Kern Fan Groundwater Storage Project

FOR CALIFORNIA'S WATER STORAGE INVESTMENT PROGRAM

August 14, 2017

Irvine Ranch
WATER DISTRICT

Rosedale-Rio Bravo
WATER STORAGE DISTRICT

The Irvine Ranch Water District and Rosedale Rio-Bravo Water Storage District have submitted the following application for the Kern Fan Groundwater Storage Project to the California Water Commission for review. The application is comprised of several components required by the Water Storage Investment Program regulations in order to be considered for Proposition 1 funding. Applications for the program are submitted online to the grants review and tracking system (GRanTS). The application is organized into eight tabs where components of the application are uploaded to the GRanTS system as either an answer to a question embedded in the GRanTS system or as an attachment that is uploaded. The 'Proposal Full View' presents the Project's application exactly as how it appears in the GRanTS system. As such, all attachments uploaded as part of the application are included after the 'Proposal Full View' section under application attachments.

Application Contents

Proposal Full View

Print

APPLICANT INFORMA TION

Irvine Ranch W ater District *	Kern Fan Groundwater Storage Project
Tax ID	952232918
Point Of Contact *	Division/Addr ess List: Irvine Ranch Water District Addr ess1: 15600 Sand Canyon Avenue; Addr ess2: City: Irvine; State: CA Zip: 92618 First Name: Kellie; Last Name: Welch Email: welch@irwd.com; Phone (Dir ect): 9494535604
Point Of Contact Position T itle *	Water Resources Manager
Pr oposal Name *	Kern Fan Groundwater Storage Project
Pr oposal Objective *	The Kern Fan Project (Project) will significantly contribute to attainment of the three objectives of the California Water Action Plan: (1) more reliable water supplies; (2) improved habitat conditions of important species, and (3) more resilient and sustainably managed water infrastructure. Specifically, the Project will cost-effectively recharge and store groundwater for subsequent recovery to address the following project objectives: - Enhance water supply reliability; - Reduce imported water demands on the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Delta) to benefit spring and winter-run Chinook salmon; - Provide water supply during drought conditions; - Provide water supply for emergency response benefits; - Establish temporary wetlands through intermittent recharge events that will attract migratory and other water birds in Kern County; - Benefit the water levels in the Kern County Groundwater Sub-basin; - Manage water in a resilient and sustainable manner; and - Be integrated into other water storage projects and storage reservoirs to provide greater statewide benefits. The Project will offer opportunities to further improve the operation of the State water system through the integration of operations with other projects funded through the Water Storage Investment Program. For example, Sites Reservoir participants could be offered the opportunity to store water in the Project under mutually beneficial terms that would avoid reservoir spills. Such integration efforts could improve the yield of the State water system, improve water supply reliability, reduce competition for water supplies during dry periods and reduce stresses on ecosystems. The Project will provide additional operating flexibility for Rosedale's existing and future programs, and will be a critical element of the IRWD water supply reliability portfolio that supports groundwater recharge and recovery for regional conjunctive use and groundwater banking partnerships.

BUDGET

Other Contribution	0
Local Contribution	85660930
Federal Contribution	0
Inkind Contribution	0
Amount Requested *	85660930
Total Proposal Cost *	171321860

GEOGRAPHIC INFORMATION

Latitude *	DD(+/-):	35	MM:	22	SS:	23
Longitude *	DD(+/-):	119	MM:	16	SS:	35
Longitude/Latitude Clarification	Center of the proposed Phase 1 Project site.		Location		Project facilities located in Kern County	
County *	Kern,Orange					
Ground Water Basin	San Joaquin Valley-Kern County					
Hydrologic Region	Tulare Lake					
Watershed	South Valley Floor					

LEGISLATIVE INFORMATION

Assembly District *	32nd Assembly District,74th Assembly District
Senate District *	14th Senate District,37th Senate District
US Congressional District *	District 21 (CA),District 45 (CA)

Project Information

PROJECT NAME: KERN FAN GROUNDWATER STORAGE PROJECT

KERN FAN GROUNDWATER STORAGE PROJECT

Implementing Organization	Irvine Ranch Water District
Secondary Implementing Organization	
Proposed Start Date	1/1/0001
Proposed End Date	1/1/0001
Scope Of Work	
Project Description	
Project Objective	

PROJECT BENEFITS INFORMATION

No records found.

BUDGET

Other Contribution	0
Local Contribution	85660930
Federal Contribution	0
Inkind Contribution	0
Amount Requested *	85660930
Total Project Cost *	171321860

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Ground Water Basin	San Joaquin Valley-Kern County						
Hydrologic Region	Tulare Lake						
Watershed	South Valley Floor						

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Senate District *	14th Senate District,37th Senate District
US Congressional District *	District 21 (CA),District 45 (CA)

Section : ELIGIBILITY AND GENERAL PROJECT INFORMATION

ELIGIBILITY AND GENERAL PROJECT INFORMATION TAB

Q.1 Applicant Type:

Specify which of the following describes the applicant:

Public agency

Q.2 Project Type:

Please identify the appropriate project type for the application:

Groundwater Storage ▼

Q.3 Public Benefits:

Please identify the public benefit categories for which Program funding is requested:

a) ☑ Ecosystem Improvements (must be included)
b) ☐ Water Quality Improvements
c) ☐ Flood Control Benefit
d) ☑ Emergency Response
e) ☐ Recreational Purposes

Q.4:

Explain why the proposed project does not adversely affect any river afforded protection pursuant to the California or Federal Wild and Scenic Rivers Act. See section 6003(a)(1)(I) of the regulations.

The Kern Fan Integrated Groundwater Storage Project (Project) will have no impact on any river that is afforded protection pursuant to the California or Federal Wild and Scenic Rivers Act. The Project is located approximately six miles west of Bakersfield in Kern County near the southernmost reach of Kern River in the alluvial fan area, where surface water seeps into the aquifer. The Project is located approximately 100 miles downstream of two reaches of the Kern River are designated as protected under the State and/or Federal Act: (1) North Fork from the Tulare-Kern County line to its headwaters in Sequoia National Park, and (2) South Fork from its headwaters in the Inyo National Forest to the southern boundary of the Domelands Wilderness in the Sequoia National Forest. Both of these protected reaches of the Kern River are upstream of Isabella Lake, which is northeast of Bakersfield. The Project is located downstream of Isabella Lake and nearly 100 miles southwest of these protected North and South Forks of the Kern River. Operation of Lake Oroville to provide ecosystem benefits by making water available for pulse flows in the Feather River during dry and critical years is not located in or have any affect on any river protected by the California or Federal Wild and Scenic Rivers Act.

Q.5:

Is the applicant an agricultural or urban water supplier as defined in section 6001 of the Program regulations? If not, enter "Not Applicable"; if so, has the applicant submitted complete Agricultural or Urban Water Management Plans to DWR? Have those plans been verified as complete by DWR? If not, explain how the applicant is working towards compliance with the requirements of Water Code section 10608.56. See section 6003(a)(1)(J) of the regulations.

The Kern Fan Groundwater Storage Project is a joint project between Rosedale-Rio Bravo Water Storage District (Rosedale) and Irvine Ranch Water District (IRWD). Rosedale is an independent special district under the provisions of the California Water Storage District Law and therefore is not required to complete an Agricultural or Urban Water Management Plan. IRWD is an urban water supplier as defined in section 6001 of the program Regulations. IRWD submitted an Urban Water Management Plan on June 30, 2016. IRWD received confirmation on August 31, 2016 that the Urban Water Management Plan was received and reviewed by DWR and that it fully addresses the requirements of Water Code section 10608.56.

Q.6:

Does the pr oposed pr oject affect gr oundwater basins, as defined by W ater Code section 10722 et seq.? If not, enter “Not Applicable”; if so, identify the affected gr oundwater basins and describe how the pr oject would be integrated with futur e GSP(s). Explain how the pr oject would r educe, eliminate, or have an effect on undesirable r esults (as defined in r egulations section 6001(a)(85)) within the affected gr oundwater basin(s). Describe how the applicant would work with GSA(s) or adjudicated participants of the basin. See r egulations section 6003(a)(1)(K).

The proposed Project is located within the Kern County Subbasin (Bulletin 118 Basin 5.22-14) ("Basin") and is anticipated to have a beneficial impact upon the groundwater basin. The California Statewide Groundwater Elevation Monitoring ("CASGEM") system has identified the Basin as having an overall basin priority of "High" as well as being subject to overdraft, subsidence, and water quality degradation. The Kern Groundwater Authority ("KGA") is the exclusive Groundwater Sustainability Agency (GSA) for the area served by Rosedale-Rio Bravo Water Storage District ("Rosedale"). The Project site is contained within the Rosedale service area. Pursuant to an agreement with the KGA, Rosedale shall prepare a Groundwater Sustainability Plan for its service area. Rosedale, in partnership with other members of the KGA, shall coordinate their respective GSP?s into one GSP for the boundary of the KGA?s GSA. The Project is a critical component of Rosedale?s GSP in that it will augment existing surface water supplies and reduce Rosedale?s dependence upon groundwater. Reduced dependence upon groundwater will address conditions of overdraft as well as subsidence within the region. Hydrologic variability between local (Kern River), state (SWP) and federal (Friant Kern) water supplies will likely present additional water management opportunities. Rosedale anticipates that the Project facilities, through development of agreements with other GSA?s within the Basin, may be used to capture and store these other water supplies with the goal of integrated regional water management and Basin wide benefits. To achieve sustainability at the Basin level, Rosedale and Irvine Ranch Water District ("Irvine") would seek to develop both state wide and local partnerships to leverage the use of the Project facilities when not needed for Project purposes. Examples include partnerships with local water interests with access to Kern River water. The Project facilities, when not used to meet the primary Project objective, could be made available for the recharge and storage of Kern River water which may have otherwise left the groundwater basin. Kern River water recharged and stored in the Project would improve and address Basin overdraft, subsidence as well as water quality conditions. Additionally, the Project facilities may be used to help reregulate other SWP supplies, such as carry-over water at risk of spill. Rosedale and Irvine may develop unbalanced exchange agreements with other SWP contractors for access to Project facilities to capture and reregulate SWP water supplies which may otherwise be lost. These unbalanced exchange agreements, typical of both Rosedale and Irvine water management, require that for every two (2) acre-feet ("AF") of water banked that only one is obligated for future return. As a result of these unbalanced exchange programs, the Basin benefits and overdraft and subsidence impacts are mitigated.

A.1 Executive Summary:

Attach the executive summary (max 20 pages). See r egulation section 6003(a)(1)(A).

Last Uploaded Attachments: Tab3-A1 Executive Summary_FINAL.pdf

A.2 Resolution:

Attach the Resolution, as r equir ed by r egulations section 6003(a)(1)(C). See Pr ogram website for an example r esolution.

Last Uploaded Attachments: A2_IRWD_SignedResolution_FINAL.pdf,A2-IRWD_RosedaleResolution of Financing.pdf

A.3 Pr oject Description:

Pr oject Description. Attach a description of the pr oject that meets the r equir ements of section 3.3 of the TR. If a full pr oject description is included in another attachment, identify the att achment name and beginning page number in this attachment.

Last Uploaded Attachments: Tab3- A3 IRWD_Project Description_FINAL.pdf

A.4 Project Description Support:

Attach maps, schematics and engineering design drawings that support the project description, if not already available in other attached documents. See section 6003(a)(1)(B) of the regulations.

Last Uploaded Attachments: Tab 3-A4_IRWD_Maps and Schematics_2017-08-09.pdf

A.5 Attestation:

Attach a statement, under penalty of perjury pursuant to the laws of the State of California, attesting that the information provided in the full application is true and correct to the best of the applicant's knowledge. Scanned uploaded documents containing a scanned signature are sufficient. See section 6003(a)(1)(Y) of the regulations.

Last Uploaded Attachments: Tab 3_A5_IRWD SignedCertification_FINAL.pdf,Tab3_A5-IRWD_Rosedale SignedCertification_FINAL.pdf

A.6 Other Application Information:

OPTIONAL: Attach any other information that would support the application which does not fit easily in another category: for example, other studies or an index of the submitted application documents.

Last Uploaded Attachments: 2017-06-05-ACWA-Integrated-Storage-Final-Report.pdf

Section : PHYSICAL PUBLIC BENEFITS

PHYSICAL PUBLIC BENEFITS

A.1 Ecosystem Benefits:

Attach completed Ecosystem Priorities worksheets. Be sure to include the general information worksheet as well as worksheets for each priority being claimed for which funds are being requested. Identify at least one Program ecosystem priority for any ecosystem public benefit quantified. See section 6003(a)(1)(Q) of the regulations.

Last Uploaded Attachments: IRWD_Tab 4_Attach 1_Priority 14_FINAL.pdf,IRWD_Tab 4_Attach 1_Priority 12_FINAL.pdf,IRWD_Tab 4_Attach 1_Priority 2_FINAL.pdf,Tab 4_A1_IRWD_Ecosystem_General Info_FINAL.pdf

A.2 Ecosystem Benefits:

Attach supporting documentation requested in Ecosystem Priorities worksheets such as maps or other information not already provided elsewhere in the application.

Last Uploaded Attachments: IRWD_Tab 4-A2-Ecosystem_CFS_TechMemo_FINAL.pdf,IRWD_Tab 4_A2_Ecosystem_Priority 14_FINAL.xlsx,IRWD_FeatherRiverMaps.pdf

A.1 Water Quality Benefits:

Attach completed Water Quality Priorities table(s). If the project is claiming water quality benefits that meet the water quality priorities, be sure to include the general application questions table as well as tables for each priority being claimed for which funds are being requested. Identify at least one Program water quality priority for any water quality public benefit quantified See section 6003(a)(1)(Q) of the regulations.

A.2 Water Quality Benefits:

Attach supporting documentation r equested in W ater Quality Priorities tables such as maps or other informatio n not alr eady pr ovided elsewher e in the application.

Q.1 Flood Contr ol Benefits: If the pr oposed pr oject is not claiming flood contr ol benefits, leave the following questions blank.

If applicable, how will the pr oject pr ovide flood contr ol benefits? If some pr oject operations will be for flood contr ol purposes, explain. Ar e the flood contr ol benefits r ealized locally and/or thr oughout the larger flood contr ol system? (TR section 4.9.2.1) Describe any negative impacts of pr oviding the flood contr ol benefit. (TR section 4.9.2.4)

Q.2 Flood Contr ol Benefits: If the pr oposed pr oject is not claiming flood contr ol benefits, leave the following questions blank.

What methods wer e used to calculate flood damage r eduction? Identify which of the following methods was used to q uantify physical flood contr ol benefits:

1. Modeling provided with feasibility study
2. New modeling using historical flood events or historical hydrology
3. New modeling using the climate change hydrology data set provided

If 1 or 2 is used, explain how benefits might be differ ent under the pr ovided futur e climate and sea levels pr ojections. Pr ovide justification for any methods not identified in section 5.4.3 o f the TR. See also r egulations section 6004(a)(1)(F).

A.1 Flood Contr ol Benefits: If the pr oposed pr oject is not claiming flood contr ol benefits, leave the following questions blank.

Attach any r elevant flood damage r eduction supporting documentation, such as hydraulic and hydr ologic modeling studies, and pr operty flood damage analysis (TR section 4.9.4). If informatio n to support this question is located in another attachment, pr ovide the location.

Q.1 Emergency Response Benefits: If the pr oposed pr oject is not claiming emergency r esponse benefits, leave the following questions blank.

If applicable, how will the pr oject be operated to pr ovide emergency r esponse benefits? Identify the types of emergency benefits the pr oposed pr oject could pr ovide. (TR section 4.1 1.1). If additional information to support this question is lo cated in another attachment, pr ovide the location.

For the proposed Kern Fan Groundwater Storage Project, project proponents IRWD, Rosedale and DRWD plan to operate the project to provide multiple benefits included Emergency Response. The Project will be operated to provide water for Emergency Response under an extended drought and for Emergency Response under a Delta Failure. Detailed information on the proposed Kern Fan Groundwater Storage Project operating plan to provide emergency response benefits for the extended drought and the Delta Failure is included under the Benefit Calculation, Monetization and Resiliency Tab, Attachment 2 of the WSIP funding application. Detailed information for the basis for the quantification of available water for the emergency response Delta Failure is included under the Feasibility and Implementation Risk Tab, Attachment 1 ? Technical Feasibility (MBK Engineers, 2017) of the WSIP funding application. Detailed information for the basis for the monetized benefits for the emergency response for the extended drought and the emergency response for the Delta Failure is included under the Benefit Calculation, Monetization and Resiliency Tab, Attachment 3 and Attachment 5 of the WSIP funding application.

A.1 Emergency Response Benefits: If the proposed project is not claiming emergency response benefits, leave the following questions blank.

Attach a description of the amount or share of stored water to be provided for the emergency benefits and define the conditions under which water would be made available. Describe how the applicant can commit to the conditions under which the emergency benefits would be made available. (TR section 4.1 1.2)

Last Uploaded Attachments: IRWD_Tab 4 A1 IRWD_Emergency Response Benefits_FINAL.pdf

Q.1 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

If applicable, how will the project be operated to provide recreation benefits? If additional information to support this question is located in another attachment, provide the location.

Q.2 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

By providing new recreation benefits, does the proposed project negatively affect any existing recreation activities either at the proposed project site, at another facility, or nearby recreation area? (TR section 4.10.1.1)

Q.3 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

Describe the proposed recreation physical benefits including the size of the facility, recreation activities allowed, recreation facilities associated with these activities, and their capacities and seasonal closures and conditions in which facilities are not usable or activities cannot occur. Any supporting analysis should be attached in A.1 below. (TR section 4.10.1.2)

A.1 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

Attach recreation visitation estimates including documentation of estimation methodology.

A.2 Recreation Benefits: If the proposed project is not claiming recreation benefits, leave the following questions blank.

Attach or provide links to any relevant recreation studies associated with the proposed project.

Section : FEASIBILITY & IMPLEMENTATION RISK

FEASIBILITY & IMPLEMENTATION RISK

A.1 Feasibility Documentation:

Attach feasibility studies or documentation that demonstrates the proposed project's technical, environmental, economic, and financial feasibility as described in TR section 3.5. See also regulations section 6003(a)(1)(O).

Last Uploaded Attachments: IRWD_Attach 1_Combined Feasibility.pdf,IRWD_Attach 1_MBK_Model_KernFan.xlsm

A.2 Permit List:

Provide a listing and status of all local, state, and federal permits, certifications, and other approval necessary for the construction and operation of the project. See section 6003(a)(1)(W) of the regulations.

Last Uploaded Attachments: Tab5-A2_IRWD_Permits_FINAL.pdf

A.3 Schedule:

Attach an estimated schedule for the proposed project until the first year of operation. If the schedule is included in another attachment, identify the location. See section 6003(a)(1)(G) of the regulations.

Last Uploaded Attachments: Tab5_A3_ IRWD_Schedule_Text_FINAL.pdf,Tab5-A3_IRWD_Schedule_FINAL.pdf

A.4 Environmental Document:

Attach the most recent publicly available environmental document for the proposed project. If the document is available on a website, provide a link to the document(s). See section 6003(a)(1)(S) of the regulations.

Last Uploaded Attachments: Tab5_A4 IRWD_Final EIR Stockdale.pdf,Tab5_A4 IRWD_ScopeforEnviro_ESA_FINAL.pdf

A.5 Impacts and Consultation:

Summarize the project's impacts on environmental or cultural resources and how the project will mitigate or minimize impacts to those resources, or identify where in the CEQA document this information can be found. If any environmental or cultural impacts will not be fully mitigated, explain. See regulations section 6003(a)(1)(T).

If applicable, identify whether Tribal consultation has been initiated for the project. If it has, provide supporting documentation, or identify the location in the CEQA document. If consultation has not been initiated, state whether consultation is expected and when consultation is expected to be initiated. See regulations section 6003(a)(1)(U).

Last Uploaded Attachments: Tab 5_A5_IRWD_Proj Impacts_FINAL.pdf

Section : BENEFIT CALCULATION, MONETIZATION, and RESILIENCY

BENEFIT CALCULATION, MONETIZATION, and RESILIENCY

Q.1:

Did the applicant use the model products and assumptions described in section 6004(a)(1) of the regulations? See regulations section 6003(a)(1)(CC). If no, provide a description of the models and assumptions used to determine the without-project future conditions for years 2030 and 2070.

The Kern Fan Groundwater Storage Project?s water supply and public benefits used the products developed by the Water Storage Investment Program (WSIP) for years 2030 (WSIP 2030) and 2070 (WSIP 2070) that were published on November 2, 2016.

A.1 Project Conditions:

Attach description and assumptions of with-project conditions for years 2030 and 2070, as defined in section 6004(a)(2) of the regulations, as well as a description of the with- and without-project current conditions. See also regulations section 6003(a)(1)(BB).

Last Uploaded Attachments: Tab 6-A1_IRWD_With and Without Project Conditions_FINAL.pdf

A.2 Preliminary Operations Plan:

Attach the preliminary operations plan for the proposed project. See regulations section 6003(a)(1)(H) for details. If the preliminary operations plan is located in another attachment, identify the attachment and provide the location.

Last Uploaded Attachments: Tab 6-A2_IRWD Preliminary Operations Plan_FINAL.pdf,Tab 6-A2_IRWD_Preliminary Operations Excel_FINAL.xlsx

A.3 Monetized Benefits Analysis:

Attach the analysis of all public and non-public monetized benefits. Identify at least one Program ecosystem or water quality priority for any ecosystem or water quality public benefit quantified. For each public and non-public benefit, describe the methods used to derive the physical and economic benefits and impacts at a level of detail that allows reviewers to verify your analysis.

Description must include:

- The physical changes that are being monetized, consistent with information requested in the Physical Public Benefits Tab, and describing linkages between physical benefits and monetized benefits. See regulations sections 6004(a)(3) and 6004(a)(4); and
- The monetization method and sources for data used. See regulations section 6004(a)(4).

Last Uploaded Attachments: Tab 6-A3_IRWD_MCubed_WSIP Project Economic Benefits Techmemo_FINAL.pdf

A.4 Mitigation and Compliance Obligation:

For each net public benefit claimed, where applicable, identify any existing environmental mitigation or compliance obligations that are accounted for in each net public benefit as of the date of the CalSim-II model product in section 6004(a)(1).

- Applicants that use the CalSim-II and DSM2 models to analyze their projects can indicate “within models” for any existing environmental mitigation and compliance obligations contained in those models.
- If applicable to their claimed net public benefit such projects shall also list and account for the non-flow related mitigation and compliance obligations of the State Water Project and Central Valley Project.

Last Uploaded Attachments: Tab 6-A4_IRWD_EnviroMitigation__FINAL.pdf

A.5 Quantification Support:

Provide additional information that supports the physical and monetary quantification of the public and non-public benefits and impacts of the project as required by subsection 6004(a)(4) of the regulations. This includes data, assumptions, analytical methods and modeling results, calculations and relevant sources of information. For reference documents or studies relied upon, applicants may provide links to an existing website in lieu of attaching those documents to the application.

Last Uploaded Attachments: Tab 6-A5 IRWD_WSIP_Econ Benefits_081117_FINAL.xlsx

A.6 Monetization Table:

Attach a table displaying each future economic benefit in 2015 dollars for each year of the planning horizon as required by section 6004(a)(4)(A) of the regulations.

Last Uploaded Attachments: Tab 6-A6_IRWD_Future Annual Economic Benefit_FINAL.pdf

A.7 Non-Monetized Benefits:

If applicable, provide a summary of public benefits that cannot be monetized. Provide the following information for each non-monetized benefit.

- Justification why benefit cannot be monetized,
- Qualitative description of importance of benefit (who is affected, how and how often),
- Evidence to show how the physical change is beneficial and important to Californians.

A.8 Total Project Cost Estimate:

Attach an estimate of the total project costs that includes construction cost, interest during construction, land acquisition, monitoring, environmental mitigation or compliance obligations, operations and maintenance, repair, and replacement costs during the planning horizon using methods described in TR section 6. If the project costs are located in another attachment, identify the location.

The project cost estimates must be reviewed, approved and signed by an engineer licensed by the California Board for Professional Engineers, Land Surveyors, and Geologists.

Last Uploaded Attachments: Tab 6-A8_IRWD_Total Project Cost_FINAL.pdf

A.9 Benefit and Cost Analysis:

Attach the benefit and cost analysis for the proposed project. If the analysis is located in another document, identify the location. See regulations section 6004(a)(6).

Last Uploaded Attachments: Tab 6-A9-A10_IRWD_Benefit-Cost_Analysis_Cost_Allocation.xlsx

A.10 Cost Allocation:

Provide a proposed allocation of total project costs to all project beneficiaries, including the Program, and an explanation of how the allocation was calculated, consistent with TR section 8 and section 6004(a)(7) of the regulations. If this information is included in another attachment, identify the location.

Last Uploaded Attachments: Tab 6-A10_IRWD_Allocation of Cost_FINAL.pdf

A.11 Physical and Economic Summary Table:

Attach the Physical and Economic Benefits Summary tables. These tables can be downloaded from the Commission website and uploaded with the application. See regulations section 6003(a)(1)(N).

Last Uploaded Attachments: Tab 6-A11_IRWD_Physical and Economic Benefits Summary Tables_FINAL.xlsx

A.12 Uncertainty Analysis:

Attach the uncertainty analysis. See regulations section 6004(a)(8).

Last Uploaded Attachments: Tab 6-A12_IRWD_Uncertainty Analysis_.FINAL.pdf

Section : PROGRAM REQUIREMENTS

PROGRAM REQUIREMENTS

Q.1:

Describe how the pr oject impr oves the operation of the state water system. See r egulations section 6003(a)(1)(M).

The Kern Fan Integrated Groundwater Storage Project (Project) will improve the operation of the State water system by storing up to 100,000 acre-feet (AF) of SWP unallocated Article 21 water during wet periods that would otherwise be lost to the ocean. The water would be stored for use during dry periods. The recharge and recovery of water from the Project would be expected to occur numerous times over the life of the Project and would improve the yield of the State water system, improve the water supply reliability of Rosedale, IRWD and DRWD and would provide ecosystem benefits at the Delta and its tributaries. Located in Kern County near the California Aqueduct, the Project will receive, recharge, and store unallocated SWP Article 21 water in the Kern County Groundwater Sub-basin west of Bakersfield. Article 21 water would be available in accordance with long-term Water Supply Contracts for State Water Contractors. Article 21 water is available when there is water in excess of SWP Table A needs. Unallocated Article 21 water will be delivered to the Project utilizing available capacity in the California Aqueduct to an existing or new turnout near the Cross Valley Canal. The turnout diversions would be to a new 500 cubic feet per second (cfs) lined canal that would be constructed as part of the Project that will provide dedicated conveyance capacity to move water from the California Aqueduct through multiple pump stations to the Project spreading basins. The lined canal would also facilitate the delivery by gravity of water recovered from Project wells back to the aqueduct. This new ten-mile long canal will convey water to approximately 1,200 acres of spreading basins with a recharge rate of up to 26,000 AF per month. During droughts or times of need when available supplies are reduced, stored groundwater will be recovered from the Project via 12 new extraction wells, each with a capacity of 5 cfs, and conveyed to points of use in DRWD, IRWD and Rosedale?s service areas. Some water recovered from the Project would be used within Rosedale?s service area and some would be delivered through the dedicated lined canal or the Cross Valley Canal to the California Aqueduct. Water deliveries to DRWD would occur via operational exchange and deliveries into IRWD?s service area would be made through the extension of existing exchange agreements between DRWD and Metropolitan Water District of Southern California. Approximately 25 percent of the stored water would be held as SWP system water that would be used for ecosystem benefits purposes. This 25 percent of the water would be made available for ecosystem benefits through 1-for-1 exchanges which would be facilitated through a Coordinated Operating Agreement that would executed between the project partners and DWR as described in Tab 7, A1. The Project offers exceptional flexibility to better manage available supplies, utilizing the groundwater basin as storage and existing infrastructure for conveyance of water, all of which supports improved operations of the State water system. The Project will support sustainable water management on a statewide basis and offer noteworthy, measurable ecosystem benefits. By banking unallocated Article 21 water, the Project will be operated to alleviate stress on the sensitive species in the Delta, while providing increased supply reliability. The Kern Fan Groundwater Storage Project will offer opportunities to further improve the operation of the State water system through the integration of operations with other projects funded through the Water Storage Investment Program. For example, Sites Reservoir participants could be offered the opportunity to store water in the Project under mutually beneficial terms that would avoid reservoir spills. Such integration efforts could improve the yield of the State water system, improve water supply reliability, reduce competition for water supplies during dry periods and reduce stresses on ecosystems.

Q.2:

Describe how the pr oject pr ovides a net impr ovement in ecosystem and water quality conditions r equir ed by W ater Code section 79750.

Analyses of the public benefits of the Kern Fan Groundwater Storage Project (Project) were conducted that show measureable ecosystem benefits for the Sacramento-San Joaquin Delta (Delta), Sacramento River, and Feather River, consistent with the requirements of Water Code Section 79750. The Project will be located in Kern County and operated to support the State Water Project (SWP). During wet years, the Project will recharge and store, using Project facilities, up to 100,000 acre-feet per year (AFY) of unallocated SWP Article 21 water into the Kern County groundwater basin. These deliveries would be made on behalf of Irvine Ranch

Water District (IRWD) as a landowner in Dudley Ridge Water District (DRWD) and Rosedale-Rio Bravo Water Storage District (Rosedale) as a sub-unit of the Kern County Water agency. Approximately 25 percent of the stored water would be held as SWP system water that would be used for public ecosystem benefits. This 25 percent of the water would be made available for ecosystem benefits through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water, that is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The SWP system water left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta. Results of water modeling (MBK Engineers) indicate that in 2030 the Project would typically recharge unallocated Article 21 water on average in about 24 of 30 years. While Project storage will vary and be dependent upon water supply, demand and operations, the average annual Project storage is estimated at 18,000 AF at the end of October. During dry and critical periods, ecosystem pulses would be released from Oroville Reservoir to provide net improvements to the Delta ecosystem and its upstream tributaries. It is anticipated that the Project would apply six ecosystem pulses of 18,000 AF over 3.75-day periods in April at 2,400 cubic feet per second (cfs) during dry or critical years. April was selected as a period of high relative abundance for downstream migration and rearing of juvenile salmon, however, the Project operation offers flexibility to accommodate DWR?s operation of Oroville Reservoir and the SWP. The ecosystem pulses will improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids. Overall for the 2030 condition, it is estimated that the spring-run of Chinook salmon would increase from 107 to 252 due to the ecosystem pulses. Winter-run Chinook salmon would also increase from 20 to 38 with the ecosystem pulses. Though April flow pulses are expected to benefit multiple fish species and life stages, the quantitative analysis focuses on assessing benefits to outmigrating juvenile spring-run and winter-run Chinook salmon. Project performance was also simulated under other projected conditions as part of the uncertainty analysis. The conclusions generally remain the same ? operation of the Project and coordination with the SWP operation will support ecosystem pulse releases from Oroville Reservoir will yield a net increase in public benefits. Lastly, the Project will optimize public benefits by providing flexible water storage and recovery facilities that will improve the State?s water system in a cost effective manner. The Project?s water banking will build upon the success of other groundwater storage/recovery projects, demonstrating that collaboration with DWR can provide many public benefits, namely environmental improvements for habitat and fish at the Delta as well as water supply during droughts and other emergency situations.

Q.3:

If applicable, summarize how the applicant is coordinating with the owners and operators of water system facilities not owned or operated by the applicant or pr oject partners that may be affected by the pr oject. See r egulations section 6003(a)(1)(P).

The Kern Fan Integrated Groundwater Storage Project (Project) will be implemented through coordination between multiple agencies. Irvine Ranch Water District (IRWD) and Rosedale-Rio Bravo Water Storage District (Rosedale), thru a partnership agreement, will have primary responsibility for implementing the Project. Deliveries of unallocated Article 21 water will be made to the project in accordance with long-term Water Supply Contracts for State Water Contractors. These deliveries would be made on behalf of Irvine Ranch Water District (IRWD) as a landowner in Dudley Ridge Water District (DRWD) and Rosedale as a sub-unit of the Kern County Water agency. During droughts or times of need when available supplies are reduced, stored groundwater will be recovered from the Project via 12 new extraction wells and conveyed to points of use in DRWD, IRWD and Rosedale?s service areas. Some water recovered from the Project would be used within Rosedale's service area and some and would be delivered through a dedicated lined canal or the Cross Valley Canal (CVC) to the California Aqueduct. Any water conveyed through the CVC would occur via standard transaction requests to the Kern County Water Agency using capacity owned by Rosedale and IRWD and unused capacity. Water deliveries to DRWD would occur via operational exchange and deliveries into IRWD's service area would be made through the extension of existing exchange agreements between DRWD and Metropolitan Water District of Southern California (Metropolitan) using aqueduct capacities available to DRWD and Metropolitan through their State Water Project Contracts. IRWD has an existing Coordinated, Operating and Exchange Agreement with Metropolitan and the Municipal Water District of Orange County

(MWDOC) that would, with Metropolitan's consent, facilitate the deliveries of water to IRWD's service area through MWDOC. Should the CWC select the Project for grant funding, IRWD would seek Metropolitan?s consent to such deliveries to allowable areas consistent with provisions of the agreement. The California Department of Water Resources State Water Project Analysis Office (SWPAO) and SWP operations staff have been consulted with respect to the proposed 1-for-1 exchanges that would make water available for the public ecosystem benefits that would be derived from pulse flows as described in Tab 7, A1. SWPAO has identified that uncertainties and contractual issues would need to be worked through with the project partners. This work would begin immediately should the CWC select the Project for funding. It is expected that the efforts would result in a Coordinated Operating Agreement that would be executed between the project partners and DWR. The Project would not require any changes in water rights or State Water Project Contracts. The storage and recovery of water stored in the Project as described above would not impact groundwater rights or entitlements. As project proponents that are submitting this application for WSIP funding, IRWD and Rosedale are expressing their willingness to be a party to the Coordinated Operating Agreement with DWR. Attached with the application is a letter from DRWD expressing its support for the project and its willingness to consider terms for participating in the project as a party to the Coordinated Operating Agreement. The Kern Fan Groundwater Storage Project will offer opportunities to further improve the operation of the State water system through the integration of operations with other projects funded through the Water Storage Investment Program. For example, Sites Reservoir participants could be offered the opportunity to store water in the Project under mutually beneficial terms that would avoid reservoir spills. Such integration efforts could improve the yield of the State water system, improve water supply reliability, reduce competition for water supplies during dry periods and reduce stresses on ecosystems.

Q.4:

Describe how the pr oject advances the long-term objectives of r estoring the ecological health and impr oving water management for beneficial uses of the Delta. See r egulations section 6003(a)(1)(R).

The Kern Fan Integrated Groundwater Storage Project (Project) will improve water management in California and benefit the environment at the Sacramento-San Joaquin Delta (Delta) and Sacramento and Feather Rivers. The Project will store up to 100,000 acre-feet (AF) of State Water Project (SWP) Article 21 water in the Kern County groundwater basin during normal-wet years. These deliveries would be made on behalf of Irvine Ranch Water District (IRWD) as a landowner in Dudley Ridge Water District (DRWD) and Rosedale-Rio Bravo Water Storage District (Rosedale) as a sub-unit of the Kern County Water agency. During dry years and critical dry years, IRWD as a land owner in DRWD, DRWD and Rosedale would rely on the stored flows to provide non-public water supply benefits that improve water supply reliability. Approximately 25 percent of the stored water would be held as SWP system water that would be used for ecosystem benefits purposes. This 25 percent of the water would be made available for ecosystem benefits through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water, that is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet DRWD and Rosedale SWP Table A demands either directly or through operational exchanges. The SWP system water left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta. The 1-for-1 exchanges would result in the water extracted from the ground and used by DRWD and Rosedale being classified as Table A water and the water left in Oroville Reservoir for use in providing ecosystem benefits being classified as SWP system water. Irvine Ranch Water District (IRWD), and its partner, Rosedale-Rio Bravo Water Storage District (Rosedale) have successfully implemented two prior water banking projects as part of Rosedale?s Conjunctive Use Program and understand the benefits of regional cooperation and integration to optimize water management. Studies have been prepared to document the operation of the Project and confirm how it will achieve the goal of improving water use at the Delta. The first three are included in the Feasibility and Implementation Tab within Attachment 1. The ACWA Study is provided in the Eligibility and General Project Tab, Attachment 6, Other Application Information.: MBK Engineers, 2017. ?Analysis of Kern Fan Groundwater Storage Project for Water Storage Investment Program? ? This technical memorandum presents modeling demonstrating how the Project will be operated to provide both public and non-public benefits by storing additional water in the aquifers in the Kern River Fan in wet years, and by providing up to 18,000 AF of water in dry years to provide both ecosystem and water supply benefits.

Q.5:

Describe how the applicant will ensur e that the pr oposed pr oject will comply with and be consistent with all applicable lo cal, state, and federal laws and r egulations, including existing envir onmental mitigation or compliance obligation r equir ements. See r egulations section 6003(a)(1)(V).

The Kern Fan Integrated Groundwater Storage Project (Project) will comply with and be consistent with all applicable local, state, and federal laws and regulations, including environmental compliance requirements. Irvine Ranch Water District (IRWD) and Rosedale-Rio Bravo Water Storage District (Rosedale) have successfully implemented two similar water banking projects in Kern County, and based on that experience, understand the regulatory requirements associated with the Project. Local permits may be required for encroachment, traffic control, and land use. The area is designated for agriculture with allowable uses of water storage and groundwater recharge sites and facilities. Kern County permits for grading, construction, and building should not be required because water facilities are considered exempt. An encroachment permit may be required for use and modification of the Cross Valley Canal. Permanent or temporary easements will be required for pipelines and the new canal. Well drilling permits will be required for construction of the extraction wells. Depending on the site, approvals may be required from the U.S. Army Corps of Engineers, California Department of Fish and Wildlife, and Regional Water Quality Control Board. The contractor will be required to obtain all permits for construction of the facilities, such as a storm water pollution prevention plan (SWPPP), and dust control per the San Joaquin Valley Air Pollution Control District. Specific permitting requirements will be evaluated in the environmental compliance documentation for the Project. In December 2015, IRWD and Rosedale certified the Stockdale Integrated Water Banking Project Final Environmental Impact Report (Final EIR) in compliance with the California Environmental Quality Act (CEQA). The Final EIR included a program-level analysis of the Stockdale East property, which will be used as the Project?s Phase I site. Phase II of the Project will add another site in this vicinity. A supplemental EIR will be prepared, adding to the Final EIR, to specifically address the Project Phase I site and appurtenance conveyance facilities. The Project?s Phase II site will be evaluated in the supplemental EIR on a program level. When the location of the Phase II site is confirmed, a second, more focused supplement EIR will be prepared. In conclusion, the Project will comply with all permit requirements and be consistent with all applicable regulations.

A.1 Delta or T ributary Measurable Impr ovement:

What measur able impr ovements t o the Delta ec osystem or tributary t o the Delta does the pr oject pr ovide? Wher e is the location of the impr ovement? If the pr oject is not within the w atershed of the Delta, w hat speciic w ater rig hts or w ater contr acts w ould be cr eat ed or amended t o ensur e public beneits t o the Delta ec osystem? Pr ovide supporting documentation of the willingness of these w at er rig ht or w ater c ontr act holders t o ent er int o such c ontr acts or amendments. Explain how these changes w ould assur e measur able impr ovements t o the Delta ec osystem. S ee r egulations section 6003(a)(1)(L).

Last Uploaded Attachments: Tab 7_A1_IRWD_Delta Improvements_FINAL.pdf,Tab 7_A1 Dudley Ridge Water District Letter.pdf

A.2 Cost Effectiveness:

Pr ovide documentation indicating the pr oposed pr oject is cost-effective. If ther e is at least one feasible alternative means of pr oviding the same amount or mor e of the total public and non-public physical benefits as pr ovided by the pr oposed pr oject, calculate, display and document the least-cost of these alternative means and just ify the pr oposed pr oject by comparison.

Last Uploaded Attachments: Tab 7_A2_IRWD_Cost-Effectiveness_FINAL.pdf

Section : EARLY FUNDING REQUEST

EARLY FUNDING RE QUEST

Q.1:

Is early funding for completing envir onmental documentation and/or permits r equested? If yes, answer the following question and pr ovide the r equested information. See r egulations section 6003(a)(1)(X).

IRWD and Rosedale are not requesting early funding.

Q.2:

What is the r equested amount?

Not Applicable

A.1 Early Funding Scope, Schedule, Budget:

Attach a schedule, scope of work, and budget.

- Keep in mind that the applicant must provide a 50 percent cost share and reimbursable costs can only go back to November 4, 2014.
- Scope of work must include an explanation of why early funding is critical to the project, the viability of the project in the absence of this funding and how the project will proceed once early funding is expended.
- The scope of work cannot include work performed prior to submittal of the application.
- The tasks in the schedule, scope of work and budget should match.

Eligibility and General Project Information Tab

Eligibility and General Project Information Tab

A.1 Executive Summary:

Attach the executive summary (max 20 pages). See regulation section 6003(a)(1)(A)

File: Tab3-A1 Executive Summary_FINAL.pdf

KERN FAN GROUNDWATER STORAGE PROJECT
EXECUTIVE SUMMARY

PROJECT OVERVIEW

The Kern Fan Groundwater Storage Project (Kern Fan Project or Project) will recharge and store up to 100,000 acre-feet (AF) of water, primarily during wet periods, in the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin for subsequent recovery and use for public and non-public benefits. Building upon a successful track record of water banking, the Project is co-sponsored by the Irvine Ranch Water District (IRWD) and Rosedale Rio-Bravo Water Storage District (Rosedale). A Project Description was prepared in support of the application submitted by IRWD and Rosedale for Proposition 1 funding under the Water Storage Investment Program (WSIP) administered by the California Water Commission (CWC). This Executive Summary is submitted in fulfillment of **Eligibility and General Project Information Tab, Attachment 1 (**Executive Summary) of the WSIP application.

IRWD and Rosedale propose to develop a regional water bank in the Kern Fan area to capture, recharge and store unallocated Article 21 water during wet year conditions and extract water when needed to provide ecosystem, emergency supply, and water supply benefits. The water would be used at a later date through use of groundwater wells and direct or exchange delivery. Operations of the Project will be coordinated with the State Water Project (SWP) through the California Department of Water Resources (DWR).

The Kern Fan Project will cost-effectively recharge and store groundwater for subsequent recovery to address the following project objectives:

- Enhance water supply reliability;
- Reduce imported water demands on the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Delta) to benefit spring and winter-run Chinook salmon;
- Provide water supply during drought conditions;
- Provide water supply for emergency response benefits;
- Establish temporary wetlands through intermittent recharge events that will attract migratory and other water birds in Kern County;
- Benefit the water levels in the Kern County Groundwater Sub-basin;
- Manage water in a resilient and sustainable manner; and
- Be integrated into other water storage projects and storage reservoirs to provide greater statewide benefits.

The Kern Fan Groundwater Storage Project will offer opportunities to further improve the operation of the State water system through the integration of operations with other projects funded through the Water Storage Investment Program. For example, Sites Reservoir participants could be offered the opportunity to store water in the Project under mutually beneficial terms that would avoid reservoir spills. Such integration efforts could improve the yield of the State water system, improve water supply reliability, reduce competition for water supplies during dry periods and reduce stresses on ecosystems.

The Kern Fan Project will provide additional operating flexibility for Rosedale's existing and future programs, and will be a critical element of the IRWD water supply reliability portfolio that supports groundwater recharge and recovery for regional partnerships involving conjunctive use and groundwater banking. The estimated capital cost of the entire Kern Fan Project is approximately $172 million. In comparison, the economic value of the benefits provided by the Project is estimated at $177.8 million.

IRWD and Rosedale will partner to implement the Kern Fan Project. As the local co-sponsor, Rosedale will be the Project operator. IRWD and Rosedale share a ten-year history of implementing successful water banking projects. The Project concept, sizing, location, features and operations are based on the experience and knowledge gained from IRWD's and Rosedale's existing water banking projects.

Irvine Ranch Water District

IRWD was established in 1961 as a California Water District pursuant to the California Water District Law (California Water Code, Division 13). IRWD provides potable and recycled water, sewage collection and treatment, and urban runoff treatment to municipal and industrial and agricultural customers within its 115,531-acre service area in Orange County, California. Since 2007, IRWD has diversified its water supply reliability by developing water banking projects in Kern County. IRWD entered into a long-term water banking partnership with Rosedale to operate IRWD's Strand Ranch and Stockdale West water banking projects. IRWD can store water in the underlying groundwater basin and recover portions of the stored water to supply its demands during critical drought conditions or water supply interruptions. Recovered water is conveyed to IRWD's service area via existing canals, the California Aqueduct, and Metropolitan Water District of Southern California (MWD) facilities. In total, IRWD has developed 126,000 AF of storage capacity, 63,600 AF of recharge capacity, and 35,100 AF of recovery capacity.

IRWD is a landowner in Dudley Ridge Water District (DRWD) and has the rights to the use of SWP Table A water. IRWD has successfully implemented unbalanced exchange agreements, with the approval of MWD and DWR that facilitates the use of portions of this water in IRWD's service area.

Rosedale Rio-Bravo Water Storage District

Rosedale was established in 1959 as an independent special district to develop a groundwater recharge program to offset overdraft conditions in the regional Kern County aquifer area. Located west of Bakersfield, the Rosedale service area encompasses 44,150 acres in Kern County, with 27,500 acres developed as irrigated agricultural use and about 7,500 acres developed for urban uses. Rosedale's service area overlies the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin. For the benefit of its landowners, Rosedale developed a Groundwater Storage, Banking, Exchange, Extraction & Conjunctive Use Program (Conjunctive Use Program) and manages more than 470,000 AF of stored groundwater in the basin, with a total storage capacity in excess of 1.7 million AF. (Sierra Scientific Services, 2009). Operation of the Kern Fan Project will be integrated with Rosedale's Conjunctive Use Program. **Figure 1** shows the locations of IRWD, Rosedale and the Kern Fan Project.

Figure 1. Map with IRWD, Rosedale and Kern Fan Groundwater Storage Project Locations

Project Implementation

The proposed Kern Fan Project would be located in western Kern County, about six miles west of the City of Bakersfield, as shown in **Figure 2**. Portions of the Kern Fan area are characterized by geologic conditions that are particularly suitable for groundwater recharge operations. Kern County is also strategically located in central California near federal, state, and local water supply conveyance facilities. The Project overlies the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin.

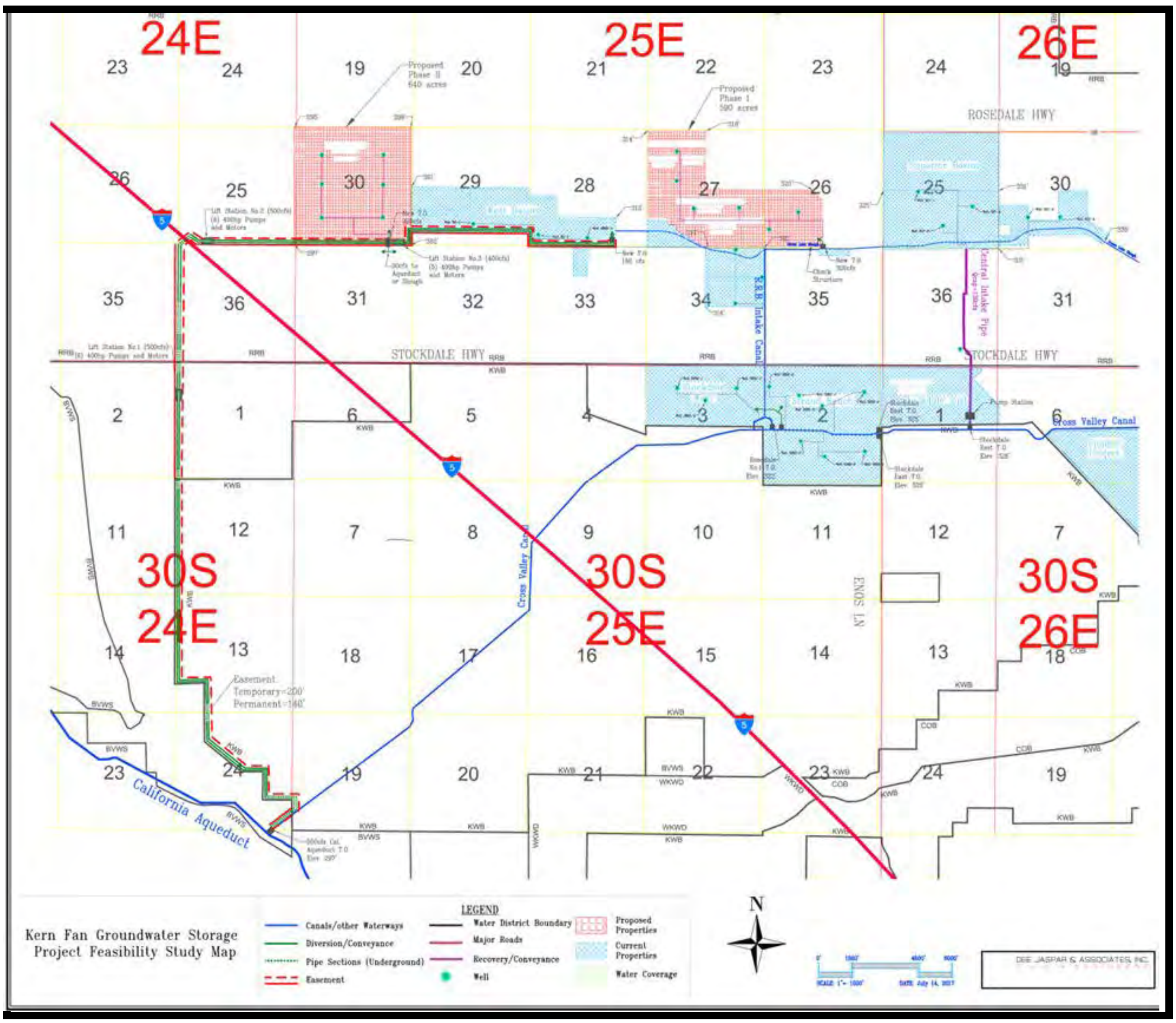

Figure 2. Kern Fan Groundwater Storage Project Location Map

The Kern Fan Project would be constructed in two phases. The Phase 1 and 2 project sites would be comprised of 640 acres each and would include construction of conveyance, recharge and recovery facilities as necessary to develop a fully functioning water banking project. The total Project would include approximately 1,200 acres of spreading basins and up to 12 new extraction wells, each with 5 to 6 cubic feet per second (cfs) of extraction capacity and associated pipelines. Water will be conveyed from the California Aqueduct to and from the Project via a newly proposed turnout at the California Aqueduct and a new conveyance canal with up to 500 cfs conveyance capacity. More detailed information on the project facilities is provided in the **Feasibility and Implementation Risk Tab, Attachment 1, Appendix A** of the WSIP funding application.

Project Costs

The estimated capital cost of the Kern Fan Project is approximately $172 million. **Table 1** shows the breakdown of the estimated project costs.

Table 1. Estimated Project Costs of the Kern Fan Project

Description	Estimated Cost ($)
Aqueduct Turnout	1,185,000
Lift Stations	11,917,500
Phase 1 Recharge & Recovery Facilities	13,861,108
Phase 2 Recharge & Recovery Facilities	14,019,608
Conveyance Facilities	56,195,000
Turnout Facilities	5,582,500
Miscellaneous	2,120,000
Subtotal	104,880,716
20% Contingency	20,976,143
Land, Easements, R/W, habitat credit purchase	36,600,000
Total Field Costs	162,456,859
Non-Contract Costs	
Engineering & Design	5,315,000
Environmental & Permitting	550,000
Construction Management	3,000,000
Subtotal	8,865,000
Total Construction Costs	**171,321,859**

Environmental Compliance

Environmental compliance, on a program-level, was completed for the Phase 1 recharge and recovery facilities of the Kern Fan Project under the Stockdale Integrated Banking Project Final Environmental Impact Report, approved in 2015. It is expected that a Supplemental EIR would be prepared at a project level for the construction and operation of the Phase 1 and Phase 2 facilities contemplated in the Kern Fan Project. More information about environmental compliance for the Project is located in **Feasibility and Implementation Risk Tab, Attachments 4 and 5** of the WSIP application.

Allocation of Water to Beneficiaries

The total storage capacity to be developed from the Project is expected to be 100,000 AF. Deliveries of unallocated Article 21 water would be made on behalf of IRWD as a landowner in DRWD and Rosedale as a member unit of Kern County Water Agency (KCWA). The Article 21 water stored in the Project would be allocated in separate accounts to derive Project benefits as follows:

- 25% would be reserved for public ecosystem benefits
- 37.5% would be reserved for IRWD/DRWD for non-public and public benefits
- 37.5% would be reserved for Rosedale for non-public and public benefits.

Beneficiaries of the Project and their locations are listed in **Table** 2.

Table 2. Beneficiaries of the Project

Beneficiary	Location of Benefits	Description of Project Benefit(s)
Public	Delta, Sacramento River, and Feather River	• Reduces demands on the Delta by recovering stored groundwater to supply local demands in lieu of exporting water from the Delta • Provides ecosystem benefits in dry and critical years by releasing pulses of water from Lake Oroville for Delta outflow • Decreases water exported from the Delta and increases river flows during critical periods to support fish spawning • Provides an emergency supply in the event of a levee failure in the Delta
Public	Kern County	• Provides temporary wetlands (recharge basins) that attract water birds
Rosedale	Kern County	• Provides greater operational flexibility by utilizing contingency groundwater storage to augment supplies during periods when other water sources may be limited or unavailable (emergency response – extended drought)
IRWD	Orange County	• Augments supplies to IRWD during periods when other supply sources may be limited or unavailable (emergency response – extended drought)
DRWD	Kings County	• Augments supplies during periods when other supply sources may be limited or unavailable (emergency response – extended drought)

Project Operations

The project would operate such that 25 percent of the stored water would be held as SWP system water that would be used for ecosystem benefit purposes. This water would be made available for the ecosystem through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water, which is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet DRWD and Rosedale's demands either directly or through operational exchanges. The SWP system water left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta.

As described in the WSIP funding application, the DWR identified that uncertainties and contractual issues would need to be worked through with respect to the proposed 1-for-1 exchanges. A coordinated operating agreement with DWR would allow the Project to integrate with Oroville operations to provide public benefits. Through the Kern Fan Project, DWR would make releases of pulse flows from Lake Oroville upstream of the Delta which would then physically improve the ecosystem habitat conditions for rearing, downstream migration of spring and winter-run Chinook salmon and other fish species in the Feather River.

Figure 3 shows a schematic of the statewide perspective of the operations of the Kern Fan Project.

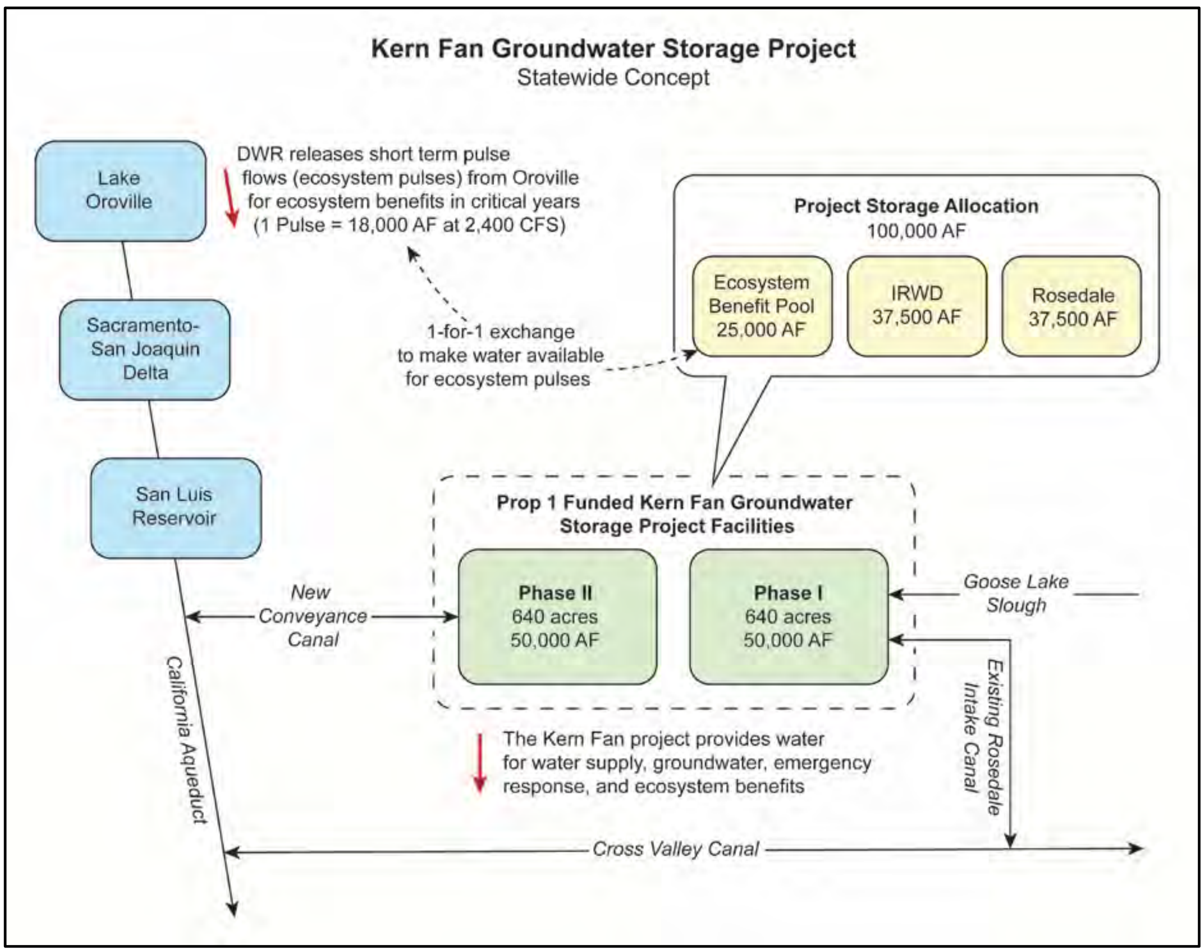

Figure 3. Kern Fan Groundwater Storage Statewide Operational Schematic

Figure 4 presents a schematic of how unallocated Article 21 water will be provided to the Project beneficiaries and how the Project would yield system water for ecosystem benefits through proposed 1-for-1 exchanges.

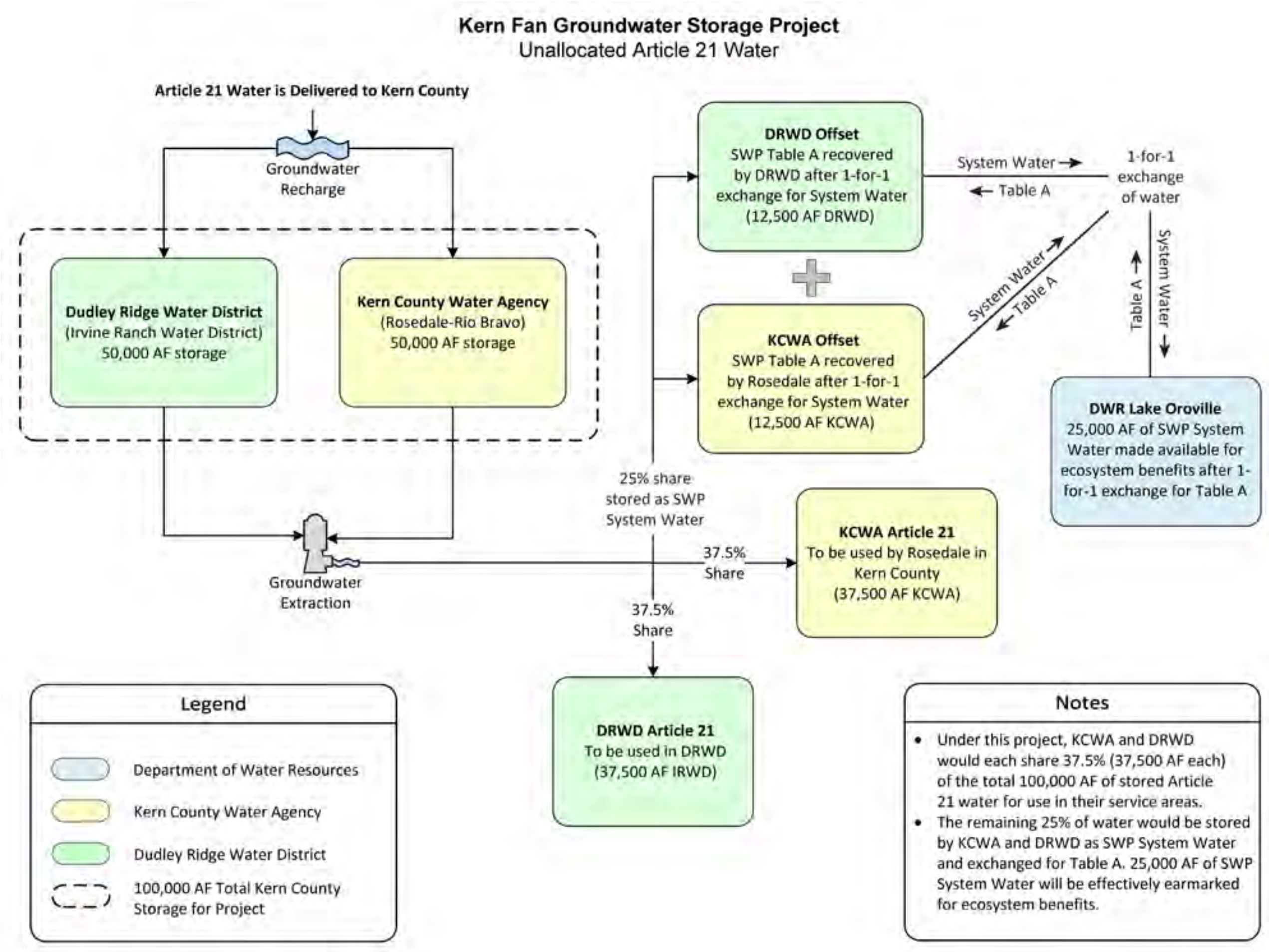

Figure 4. Project Preliminary Operations Plan

Project Performance

MBK Engineers estimated the Project yield and performance using the CalSim II model results that depict the without-Project (Baseline) scenario within a spreadsheet model (MBK Engineers, 2017). The operation of Project was then layered onto the baseline operation of the CalSim II results to simulate the with-Project scenario. Project benefits were then determined and quantified by comparison of the with-Project and without-Project scenarios. MBK Engineers analysis of the Project is included in the **Feasibility and Implementation Risk Tab, Attachment 1, Appendix B.** Cramer Fish Sciences prepared an assessment of ecosystem benefits resulting from the Kern Fan Project and this work is included in the **Physical Public Benefits Tab, Attachment 2** of the WSIP funding application.

Table 3 presents a summary of the Project performance on an average annual basis with the 2030 WISP conditions. Of the 8,000 AF available for the project diversion, approximately 6,100 AF could be conveyed in the Project for recharge on an average annual basis. This water would be stored and then extracted to provide public and non-public benefits. Actual deliveries and recharge in any one year would be substantially greater. Presenting the modeling results on an average annual basis is done for comparison purposes. Actual recharge at the Project would range from 10,000 AF to 70,000 AF per year in years when water is available under 2030 future conditions. Under 2070 conditions, recharge would range from 3,000 AF per year to 70,000 AF per year when water is available. MBK Engineers' modeling results indicate that 500,000 AF of unallocated Article 21 water would be recharged at the Project over the 82-year modeling period under 2030 conditions. A total of 25 percent of these recharged amounts would be dedicated to an ecosystem account to provide water for ecosystem benefits.

Table 3. Summary of Project Performance (WSIP 2030) on Average Annual Basis

Year Type	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
Wet	11	0	0	0	0
Above Normal	13	0	0	1	0
Below Normal	5	0	0	4	6
Dry	0	5	5	4	6
Critical	0	1	2	2	1
All Years	**6.1**	**6**	**1.3**	**2**	**2.5**

MBK Engineers also simulated project performance under other projected conditions: (1) 2070 climate change, (2) without the California WaterFix (CWF) and (3) with the CWF. While the numbers vary, the conclusions generally remain the same – operation of the Project and coordination with the SWP operation will support ecosystem pulse releases from Oroville Reservoir and will yield a net increase in adult salmon survival benefits.

Project Benefits

Based on analysis the Kern Fan Project, M. Cubed calculated that the Project is anticipated to provide a total benefit value of $177.8 million (M. Cubed, 2017). A summary of the estimated value of the non-public and public project benefits is provided in **Table 4.**

Table 4. Estimated Value of Project Benefits

Benefit Category	Benefit Type	Estimated Value (2015 $ millions)
Non-public Benefits	Water Supply Benefits	$47.7
	Groundwater	$4.3
Public Benefits	Environmental Benefits – Chinook Salmon	$21.0
	Environmental Benefits – Incidental Wetland Habitat	$39.8
	Emergency Response – Extended Drought	$5.1
	Emergency Response – Delta Failure	$59.9
	Total Benefits	**$177.8**

Conclusion

The Project will manage available surplus water supplies to serve dry year demands, for emergency response, and ecosystem benefits including improved habit conditions, enhanced access to fish spawning and rearing in the Feather River downstream of Oroville Dam. The Project's water banking facilities will build upon the success of other groundwater storage/recovery projects, demonstrating that collaboration with DWR can provide ecosystem improvements for habitat and fish at the Delta. Other public benefits from the Project will include temporary wetlands and water supply that will be available during emergency situations such as long-term drought or Delta levee failures. The estimated capital cost of the entire Kern Fan Project is approximately $172 million. In comparison, the economic value of the benefits provided by the Project is estimated at $177.8 million.

Eligibility and General Project Information Tab

A.2 Resolution:

Attach the Resolution, as required by regulations section 6003(a)(1)(C)

File: A2_IRWD_SignedResolution_FINAL.pdf

RESOLUTION NO. 2017 - 22

RESOLUTION OF THE BOARD OF DIRECTORS OF IRVINE RANCH WATER DISTRICT AUTHORIZING SUBMISSION OF A GRANT APPLICATION FOR THE WATER STORAGE INVESTMENT PROGRAM TO THE CALIFORNIA WATER COMMISSION

WHEREAS, the California Water Commission (Commission) has released a Funding Opportunity Announcement to provide grant funding under the 2017 Water Storage Investment Program pursuant to Title 23, Division 7, Chapter 1 of the California Code of Regulations; and

WHEREAS, the Commission is seeking applications from eligible agencies to cost share with the Commission on projects that provide public benefits including ecosystem improvements, water quality improvements, flood control benefits, emergency response, recreational benefits, or the improved management of water resources for beneficial use; and

WHEREAS, the Irvine Ranch Water District is eligible to submit an application for grant funding up to $86 million for its Proposition 1 grant application to the Commission with a cost share of 25 percent or more of the project capital costs.

NOW, THEREFORE, the Board of Directors of IRVINE RANCH WATER DISTRICT DOES HEREBY RESOLVE, DETERMINE and ORDER as follows:

Section 1. The General Manager of the Irvine Ranch Water District or his/her designee is hereby authorized to submit an application to the Commission for grant funding up to $86 million for the Water Storage Investment Program.

Section 2. The Board of Directors of the Irvine Ranch Water District has reviewed and supports the application for Proposition One grant funding from the Commission for the Water Storage Investment Program.

Section 3. The Irvine Ranch Water District hereby agrees and further confirms that it has the capability to provide its cost share funding as specified in the application's project funding plan.

Section 4. The General Manager or his/her designee is hereby authorized to prepare the necessary data, conduct investigations, file such applications, execute an acceptable funding agreement and any amendments thereto, and sign invoices with the Commission on behalf of the Irvine Ranch Water District.

Section 5. The General Manager or his/her designee is hereby authorized to work with the Commission to meet the established deadlines for entering into the funding agreement.

Section 6. That the Secretary is hereby authorized to certify a copy of this resolution to accompany the grant application.

ADOPTED, SIGNED AND APPROVED this 24th day of July, 2017.

President, IRVINE RANCH WATER DISTRICT
and the Board of Directors there of

Secretary, IRVINE RANCH WATER DISTRICT
and the Board of Directors there of

APPROVED AS TO FORM:
NOSSAMAN LLP
Alfred Smith, Legal Counsel

By: ____________________

56099451.v1

STATE OF CALIFORNIA)
) SS.
COUNTY OF ORANGE)

I, Leslie Bonkowski, Secretary of the Board of Directors of Irvine Ranch Water District, do hereby certify that the foregoing Resolution was duly adopted by the Board of Directors of said District at a Regular Board meeting of said Board held on the 24th day of July 2017, and that it was so adopted by the following vote:

AYES:	DIRECTORS	Reinhart, Matheis, LaMar, and Swan
NOES:	DIRECTORS	None
ABSTAIN:	DIRECTORS	None
ABSENT:	DIRECTORS	Withers

(SEAL)

Leslie Bonkowski

Secretary of Irvine Ranch Water District
and of the Board of Directors thereof

STATE OF CALIFORNIA)
) SS.
COUNTY OF ORANGE)

I, Leslie Bonkowski, Secretary of the Board of Directors of Irvine Ranch Water District, do hereby certify that the above and foregoing is a full, true and correct copy of Resolution No. 2017-22 of said Board, and that the same has not been amended or repealed.

Dated: 7/26/17

Leslie Bonkowski

Secretary of Irvine Ranch Water District
and of the Board of Directors thereof

(SEAL)

Eligibility and General Project Information Tab

A.2 Resolution:

Attach the Resolution, as required by regulations section 6003(a)(1)(C)

File: A2-IRWD_RosedaleResolution of Financing.pdf

RESOLUTION NO. 2017 - 490

RESOLUTION OF THE BOARD OF DIRECTORS OF
ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT AUTHORIZING SUBMISSION
OF
A GRANT APPLICATION FOR THE WATER STORAGE INVESTMENT PROGRAM TO
THE CALIFORNIA WATER COMMISSION

WHEREAS, the California Water Commission (Commission) has released a Funding Opportunity Announcement to provide grant funding under the 2017 Water Storage Investment Program pursuant to Title 23, Division 7, Chapter 1 of the California Code of Regulations; and

WHEREAS, the Commission is seeking applications from eligible agencies to cost share with the Commission on projects that provide public benefits including ecosystem improvements, water quality improvements, flood control benefits, emergency response, recreational benefits, or the improved management of water resources for beneficial use; and

WHEREAS, the ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT is eligible to submit an application for grant funding up to $_______________ for its Proposition 1 grant application to the Commission with a cost share of 25 percent or more of the project capital costs.

NOW, THEREFORE, the Board of Directors of ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT DOES HEREBY RESOLVE, DETERMINE and ORDER as follows:

Section 1. The General Manager of the ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT or his/her designee is hereby authorized to submit an application to the Commission for grant funding up to $_______________ for the Water Storage Investment Program.

Section 2. The Board of Directors of the ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT has reviewed and supports the application for Proposition One grant funding from the Commission for the Water Storage Investment Program.

Section 3. The ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT hereby agrees and further confirms that it has the capability to provide its cost share funding as specified in the application's project funding plan.

Section 4. The General Manager or his/her designee is hereby authorized to prepare the necessary data, conduct investigations, file such applications, execute a funding agreement and any amendments thereto, and sign invoices with the Commission on behalf of the ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT.

Section 5. The General Manager or his/her designee is hereby authorized to work with the Commission to meet the established deadlines for entering into the funding agreement.

Section 6. That the Secretary is hereby authorized to certify a copy of this resolution to accompany the grant application.

ADOPTED, SIGNED AND APPROVED this 8th day of August, 2017.

President, ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT
and the Board of Directors there of

Secretary, ROSEDALE-RIO BRAVO WATER STORAGE DISTRICT
and the Board of Directors there of

APPROVED AS TO FORM:
Dan Raytis, ~~Legal~~ Counsel
By: ______________________

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Eligibility and General Project Information Tab

A.3 Project Description:

Project Description. Attach a description of the project that meets the requirements of section 3.3 of the TR. If a full project description is included in another attachment, identify the attachment name and beginning page number in this attachment.

File: Tab3-A3 IRWD_Project Description_FINAL.pdf

KERN FAN GROUNDWATER STORAGE PROJECT
PROJECT DESCRIPTION

1. OVERVIEW

The Kern Fan Groundwater Storage Project (Kern Fan Project or Project) will recharge and store up to 100,000 acre-feet (AF) of water, primarily during wet periods, in the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin for subsequent recovery and use for public and non-public benefits. Building upon a successful track record of water banking, the Project is co-sponsored by the Irvine Ranch Water District (IRWD) and Rosedale Rio-Bravo Water Storage District (Rosedale). This Project Description is prepared in support of the application submitted by IRWD and Rosedale for Proposition 1 funding under the Water Storage Investment Program (WSIP) administered by the California Water Commission (CWC).

IRWD and Rosedale propose to develop a regional water bank in the Kern Fan area that would capture, recharge and store water during conditions when surface water is abundant and extract water when needed to provide ecosystem, emergency supply, and water supply benefits. The water would be used at a later date through use of groundwater wells and subsequent direct or exchange delivery. Operations of the project will be coordinated with the State Water Project (SWP) through the California Department of Water Resources (DWR).

The Kern Fan Project could be operated such that in wet years, IRWD and Rosedale would divert unallocated SWP Article 21 supplies to store in the Project. IRWD and Rosedale would share first priority rights to 75 percent of the water delivered into storage for use in their respective water banking and supply reliability programs. The remaining 25 percent of the stored water would be held as SWP system water that would be used for ecosystem benefits purposes. This 25 percent of the water would be made available for ecosystem benefits through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water that is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet demands either directly or through operational exchanges. The SWP system water left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta.

The Kern Fan Project will significantly contribute to attainment of the three objectives of the California Water Action Plan: (1) more reliable water supplies; (2) improved habitat conditions of important species, and (3) more resilient and sustainably managed water infrastructure.

Specifically, the Kern Fan Project will cost-effectively recharge and store groundwater for subsequent recovery to address the following project objectives:

- Enhance water supply reliability;
- Reduce imported water demands on the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Delta) to benefit spring and winter-run Chinook salmon;
- Provide water supply during drought conditions;
- Provide water supply for emergency response benefits;
- Establish temporary wetlands through intermittent recharge events that will attract migratory and other water birds in Kern County;
- Benefit the water levels in the Kern County Groundwater Sub-basin;
- Manage water in a resilient and sustainable manner; and
- Be integrated into other water storage projects and storage reservoirs to provide greater statewide benefits.

The Kern Fan Groundwater Storage Project will offer opportunities to further improve the operation of the State water system through the integration of operations with other projects funded through the Water Storage Investment Program. For example, Sites Reservoir participants could be offered the opportunity to store water in the Project under mutually beneficial terms that would avoid reservoir spills. Such integration efforts could improve the yield of the State water system, improve water supply reliability, reduce competition for water supplies during dry periods and reduce stresses on ecosystems.

The Kern Fan Project will provide additional operating flexibility for Rosedale's existing and future programs, and will be a critical element of the IRWD water supply reliability portfolio that supports groundwater recharge and recovery for regional partnerships involving conjunctive use and groundwater banking.

The estimated capital cost of the entire Kern Fan Project is approximately $172 million. A discussion of the estimated cost is presented in **Section 9**. In comparison, the economic value of the benefits provided by the Project is estimated at $177.8 million.

2. PROJECT SPONSORS

IRWD and Rosedale will partner to implement the Kern Fan Project. As the local co-sponsor, Rosedale will be the Project operator. IRWD and Rosedale share a ten-year history of implementing successful water banking projects. The Project concept, sizing, location, features and operations are based on the experience and knowledge gained from IRWD's and Rosedale's existing water banking projects. Rosedale and IRWD will share in the costs and benefits of the proposed Kern Fan Project. The Kern Fan Project will be the third water banking effort between Rosedale and IRWD.

2.1 Irvine Ranch Water District

IRWD was established in 1961 as a California Water District pursuant to the California Water District Law (California Water Code, Division 13). IRWD provides potable and recycled water, sewage collection and treatment, and urban runoff treatment to municipal and industrial (M&I) and agricultural customers within its 115,531-acre service area in Orange County, California. IRWD serves the City of Irvine and portions of the Cities of Costa Mesa, Lake Forest, Newport Beach, Tustin, Santa Ana, and Orange, and unincorporated areas of Orange County.

In the last decade IRWD has diversified its water supply reliability by developing water banking projects in Kern County. IRWD entered into a long-term water banking partnership with Rosedale to operate IRWD's Strand Ranch and Stockdale West recharge and recovery facilities. IRWD can store water in the underlying groundwater basin and recover portions of the stored water to supply its demands during critical drought conditions or water supply interruptions. Recovered water is conveyed to IRWD's service area via existing canals, the California Aqueduct, and Metropolitan Water District of Southern California (MWD) facilities. In total, IRWD has developed 126,000 AF of storage capacity, 63,600 AF of recharge capacity, and 35,100 AF of recovery capacity.

IRWD is a landowner in Dudley Ridge Water District (DRWD) and has the rights to the use of SWP Table A water. IRWD has successfully implemented unbalanced exchange agreements, with the approval of MWD and DWR that facilitates the use of portions of this water in IRWD's service area.

2.2 Rosedale Rio-Bravo Water Storage District

Rosedale was established in 1959 as an independent special district to develop a groundwater recharge program to offset overdraft conditions in the regional Kern County aquifer area. Located west of Bakersfield, the Rosedale service area encompasses 44,150 acres in Kern County, with 27,500 acres developed as irrigated agricultural use and about 7,500 acres developed for urban uses. Rosedale's service area overlies the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin.

Operation of the Kern Fan Project will be integrated with Rosedale's existing Groundwater Storage, Banking, Exchange, Extraction & Conjunctive Use Program (Conjunctive Use Program). Rosedale's Conjunctive Use Program currently manages approximately 470,000 AF of stored groundwater in the underlying basin, which has an estimated total storage capacity in excess of 1.7 million AF (Sierra Scientific Services, 2009). The Conjunctive Use Program benefits Rosedale's landowners through better management of groundwater resources, integrating and incorporating all of Rosedale's available facilities.

Rosedale has groundwater banking agreements with several participants as part of its Conjunctive Use Program requiring that all recharge must occur in advance of extraction. Water supplies for the Conjunctive Use Program are supplied by the participating water agencies and include, but are not limited to, high-flow Kern River water and supplies from the SWP and the Central Valley Project (CVP). Currently, the infrastructure for the Conjunctive Use Program includes over 1,000 acres of recharge basins and multiple recovery wells. The current Program provides for maximum annual recharge of approximately 252,000 AF per year (AFY) and maximum annual recovery of approximately 62,500 AFY.

IRWD is one of the participating agencies in Rosedale's Conjunctive Use Program through its Strand Ranch and Stockdale West Projects, which are described in **Section 10**. Fulfilling its mission of providing an adequate and reliable water supply for its service area, Rosedale has multiple water supplies that are recharged and stored in the groundwater aquifer and are then available for later extraction. Rosedale replenishes the aquifer using canals and recharge basins (ponds) to maintain groundwater levels and minimize pumping costs of recovery wells.

Rosedale's groundwater banking programs, including IRWD's integrated projects, are subject to a Memorandum of Understanding (MOU) with adjacent water districts that, among other things, specifies loss factors to be applied to gross deliveries for banking. Rosedale has groundwater banking programs with Buena Vista Water Storage District, IRWD, and Castaic Lake Water Agency for which the return obligation is equal to gross banking values less the loss factors. These programs result in increased available funds that enable Rosedale to purchase additional water supplies, which increase groundwater levels while the water is stored for the banking partners.

Figure 1 shows the locations of IRWD, Rosedale, and the proposed Kern Fan Project within California.

Figure 1. Map of California with IRWD, Rosedale, and Kern Fan Groundwater Storage Project Locations

2.3 Other Project Partners

Through existing agreements, IRWD and Rosedale will coordinate the operations of the Kern Fan Project with other agencies. Background information about these agencies is provided below.

2.3.1 Dudley Ridge Water District

DRWD is a SWP Contractor and is located in southern Kings County along Interstate 5 (I-5) and the California Aqueduct. DRWD's primary water source is SWP water; local groundwater is not used due to low yields and poor quality. The majority of the SWP water is used for agricultural irrigation, which is delivered to landowners via turnouts and canals from the California Aqueduct. In addition to SWP supplies, other water sources are available through off-site groundwater basins through banking programs and from purchases, transfers, and unbalanced exchanges from other water agencies.

DRWD and IRWD already have a working relationship that will be further enhanced for the Kern Fan Project. IRWD owns 884 acres of property within DRWD's service area that includes the associated rights to use of 1,748 AF of SWP Table A water. IRWD also receives other SWP water supplies secured by DRWD and made available to land owners when available including, but not limited to, unallocated Article 21 water and Turn-Back Pool water. IRWD has obtained approvals from DWR, DRWD, KCWA, and MWD to store its SWP water at its Strand Ranch banking project on a 2-for-1unbalanced exchange basis. Although the water belongs to IRWD, one half of all SWP supplies that are stored at the Strand Ranch are returned to and used on IRWD's lands in DRWD. A similar arrangement is envisioned for the Kern Fan Project.

2.3.2 Kern County Water Agency

Created in 1961, KCWA is a SWP State Water Contractor. KCWA manages a variety of water activities in Kern County, including groundwater operations to preserve and enhance the local water supply, flood control, and water quality.

KCWA has long-term contracts with 13 local water districts, called Member Units, and KCWA Improvement District No. 4. Rosedale, as one of the Member Units, receives SWP water for its Conjunctive Use Program through a water supply contract with KCWA. Improvement District No. 4 provides a supplemental water supply for the Bakersfield area by importing SWP water that is conveyed to the area via the CVC and used to recharge and replenish the groundwater aquifer.

Groundwater banking is an important resource in Kern County, and nearly all of the local groundwater districts operate banking projects in their service areas. Rosedale and KCWA Improvement District No. 4 operate the associated Joint Groundwater Recovery Project.

2.3.3 Metropolitan Water District of Southern California

IRWD receives imported water supplies for its service area from the MWD. Water is provided to IRWD through the Municipal Water District of Orange County (MWDOC), the regional wholesale member agency of MWD. MWD sells water under a two-tier structure. MWD's Tier 1 rate recovers its cost of developing and maintaining a reliable water supply. MWD's Tier 2 rate is set at a higher rate reflecting MWD's cost of purchasing water transfers north of the Delta. IRWD can purchase imported water as either treated potable water or untreated raw water.

MWD has also entered into the Coordinated Operating, Water Storage, Exchange and Delivery Agreement (MWD/IRWD Agreement) with IRWD and MWDOC related to IRWD's Strand Ranch and Stockdale West, which are described in **Section 10**. Under the MWD/IRWD Agreement, IRWD can take delivery of banked SWP water into IRWD's service area in Southern California with MWD's consent. Recovery of SWP water from the Kern Fan Project for delivery to IRWD's service area would be subject to MWD's consent consistent with the MWD/IRWD Agreement.

3. KERN FAN GROUNDWATER STORAGE PROJECT

Water banking is a transaction involving storing surplus water in groundwater basins that is then available for recovery at a later date. The operations of many water banks involve exchanges where water banked underground is returned to the banking party from surface supplies depending on where the banking party is located in relation to the groundwater basin. Other water banks are operated with recovery wells allowing the parties to physically extract the stored water. Some water banks require a quantity of water to be left behind as part of the recharge program for the benefit of the groundwater basin. Water banks typically factor in losses due to percolation or conveyance. The Kern County groundwater banking programs benefit overlying agricultural users and local water districts and also provide reliability benefits for water agencies throughout California. This state-wide perspective is the foundation upon which the Kern Fan Project will be constructed and operated.

The Kern Fan Project is a water banking project that will enhance water supply reliability for IRWD, DRWD and Rosedale, and manage available water resources to benefit other agencies, the public, and the environment. This Project would serve to develop a regional water bank in the Kern Fan to capture and store unallocated Article 21 SWP water during conditions when surface water is abundant. The total expected 100,000 AF storage capacity of the Project would be split between accounts for public ecosystem benefits (25,000 AF) (25% of total storage) and non-public water supply benefits (75,000 AF) (75% of the total storage). IRWD and Rosedale would share equally the 75,000 AF of storage for their respective water supply reliability programs. As water is used for public and non-public benefits from the Project, storage capacity would be freed up for future unallocated Article 21 recharge events. It is expected that water would be cycled in and out of storage in the Kern Fan Project numerous times over the life of the project.

3.1 Project Location

The proposed Kern Fan Project is located in western Kern County, about six miles west of the City of Bakersfield, as shown in **Figure 2**. Portions of the Kern Fan area are characterized by geologic conditions that are particularly suitable for groundwater recharge operations. Kern County is also strategically located in central California near federal, state, and local water supply conveyance facilities. The Kern Fan Project will recharge and bank unallocated Article 21 water for recovery either by extraction or exchange to serve the dry year demands of Rosedale, DRWD and IRWD as well as make water available to benefit ecosystems in the Delta, Sacramento and Feather Rivers, and extending as far north as Lake Oroville.

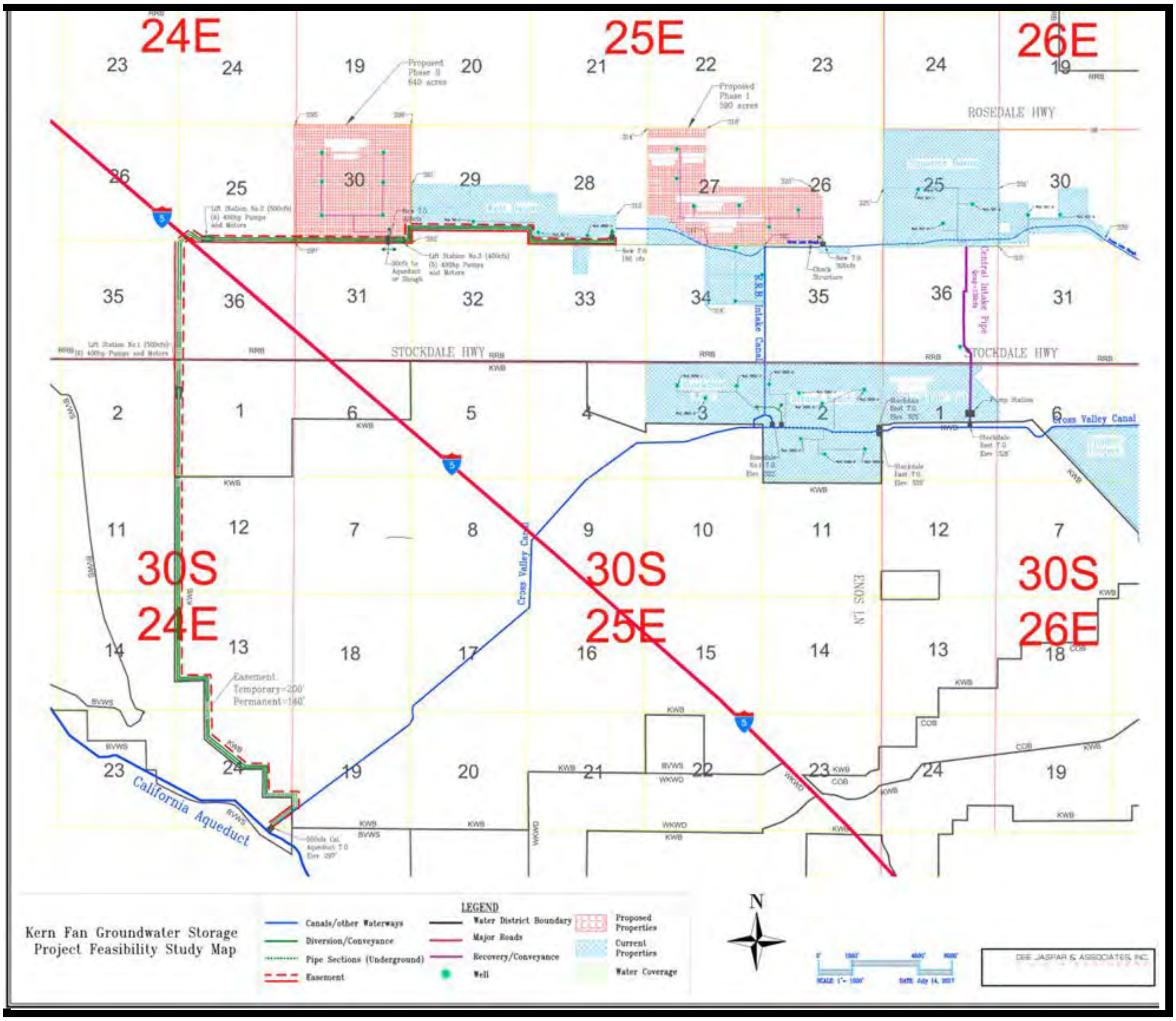

Figure 2. Kern Fan Groundwater Storage Project Location Map

3.2 Water Storage Capacity

The Project overlies the Kern County Groundwater Sub-basin of the San Joaquin Valley Groundwater Basin. This area is known as the Tulare Lake Hydrologic Region, which is the southernmost part of California's Central Valley.

The Kern Fan Project would utilize available storage capacity in the San Joaquin Valley Groundwater Basin by developing groundwater banking facilities in western Kern County. More specifically, the Project will implement water banking facilities in the Kern County Groundwater Sub-basin (DWR Basin No. 5-022.14) of the San Joaquin Valley Groundwater Basin. **Figure 3** shows the Tulare Lake Hydrologic Region and Kern County Groundwater Sub-basin. The Kern County Groundwater Sub-basin covers a surface area of approximately 1,945,000 acres (3,040 square miles) generally west of Fresno and Bakersfield.

Figure 3. Kern County Sub-basin

Summarized in **Table 1**, Rosedale's Conjunctive Use Program currently manages approximately 470,000 AF of stored groundwater in the underlying basin, which has an estimated total storage capacity in excess of 1.7 million AF (Stockdale Integrated Banking Project Final EIR, 2015). The Kern County Water Agency estimates the total water in storage to be 40,000,000 AF and dewatered aquifer storage to be 10,000,000 (California's Groundwater Bulletin 118, San Joaquin Valley Groundwater Basin, 2006).

Table 1. Total and Active Water Storage Capacity
In the Kern County Groundwater Sub-basin

	Kern County Groundwater Sub-basin (No. 5-22.14)[1]	Rosedale Conjunctive Use Program	Kern Fan Project Storage Volume
Total capacity (AF)	40,000,000	1,700,000	100,000
Active capacity (AF)		470,000[2]	100,000

[1] Groundwater Basin Number from Department of Water Resources Bulletin 118 Interim Update (DWR, 2016 --- "California's Groundwater, Working toward Sustainability", December 22, 2016)

[2] Existing Rosedale-Rio Bravo Water Storage District Conjunctive Use Program (without Stockdale Integrated Water Banking Project or Kern Fan Project) from EIR (ESA, 2015).

3.3 Proposed Project Facilities and Capacities

The Kern Fan Project would be developed in two phases. The first phase would be to develop the proposed third project site as contemplated by IRWD and Rosedale in the Environmental Impact Report for the Stockdale Integrated Water Banking Project. The Stockdale Integrated Banking Project, approved in 2015, comprises IRWD's Stockdale West property and Rosedale's Stockdale East property and a proposed third site to be located within a specified boundary. **Figure 4** shows the boundary radius within Rosedale's service area for the proposed third site in the Stockdale Integrated Banking Project.

The Kern Fan Project Phase 1 site will be located at a proposed 640-acre site within the additional Stockdale Integrated Banking Project site radius that is delineated in **Figure 4**. The Phase 2 site will be located at one or more non-contiguous properties that will comprise 640 acres within the Rosedale service area. For Phase 1 and Phase 2, IRWD and Rosedale will jointly acquire up to 1,280 acres in the Kern Fan area and will construct conveyance, recharge and recovery facilities as necessary to develop a fully functioning water banking project. The proposed project sites currently consist of agricultural land. The Project would include approximately 1,200 acres of spreading basins and up to 12 new extraction wells and associated pipelines. Water will be conveyed from the California Aqueduct to and from the sites via a newly proposed turnout at the California Aqueduct and a new conveyance canal with up to 500 cubic feet per second (cfs) conveyance capacity.

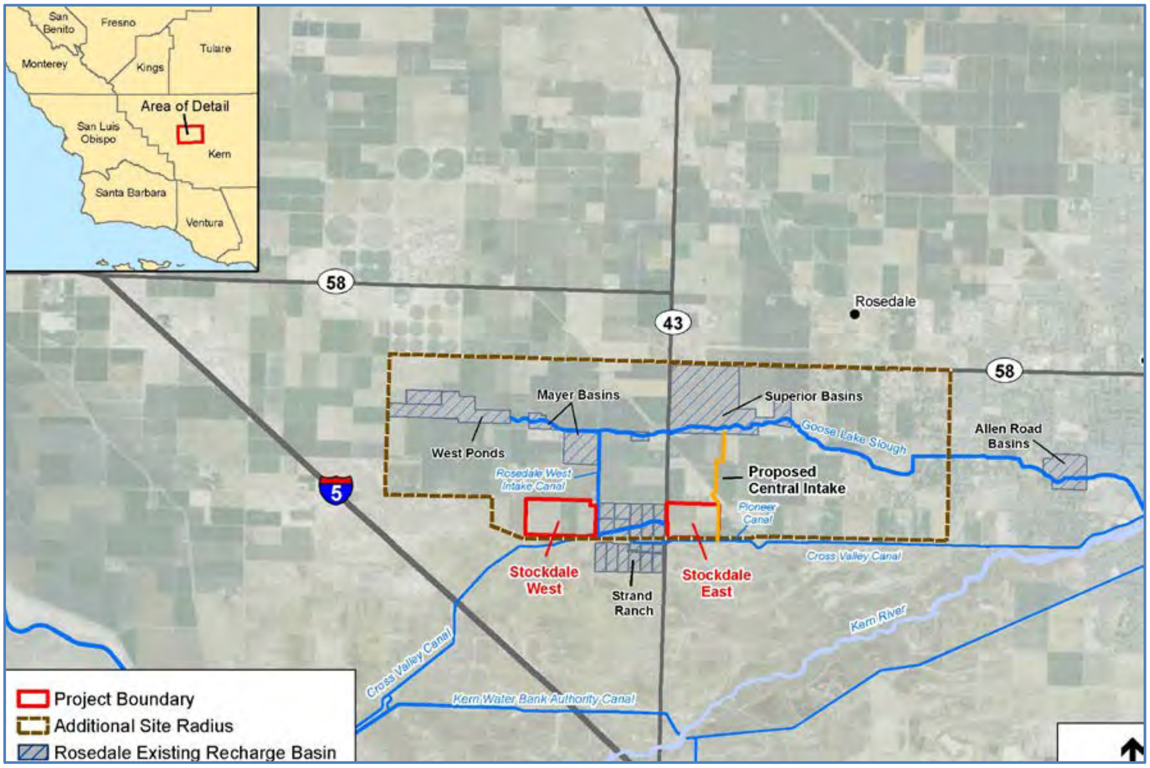

Figure 4. Stockdale Integrated Banking Project Location Map

In both Phase 1 and Phase 2 of the Project, six recovery wells will be constructed, each with an approximate capacity of 5 to 6 cfs to extract the stored groundwater as needed. The 12 wells would be 20-inches in diameter, cased to a depth of approximately 920 feet below ground surface (bgs). The wells would be equipped with vertical turbine pumps, 400 horsepower (hp) motors, discharge piping, appurtenances, electrical and controls, and site improvements. A conveyance pipeline ranging in size from 16- to 36-inches would collect extracted water from the recovery wells and return it to the California Aqueduct, Goose Lake Slough or to the CVC via the Rosedale Intake Canal.

Appurtenant facilities will include flow control gates, flow meters, access roads and other site work, as well as instrumentation and controls. The Project will install a Supervisory Control and Data Acquisition (SCADA) system to aid in the operation of the California Aqueduct turnout, canal lift stations, and turnout facilities to the Phase 1 and Phase 2 sites. This would include programmable logic controllers (PLCs), radio communications, computer station at a central headquarters, and controls software programming. For more detailed information on the project facilities see **Feasibility and Implementation Risk Tab, Attachment 1, Appendix A** of the WSIP funding application.

The recovery wells will be designed and constructed similar to the extraction wells at the IRWD-Rosedale Strand Ranch Project, which is pictured on **Figure 5.**

Figure 5. Kern Fan Project Recovery Wells will be Similar to Strand Ranch Wells

4. SOURCES OF WATER SUPPLY

The Project will receive, recharge, and store unallocated Article 21 water, which is surplus supply from the California SWP managed by DWR. Unallocated Article 21 water is available in accordance with long-term Water Supply Contracts for State Water Contractors that have signed the Monterey Agreement and is expected to be available when there is water in excess of SWP "Table A" needs. SWP Table A water is the volume of water annually allocated to be delivered to each SWP State Water Contractor based on its long-term Water Supply Contract. Absent adequate storage venues, such as that offered by the Project, the surplus supply during wet periods would otherwise be lost to the ocean.

In accordance with Article 21 of the long-term Water Supply Contracts, surplus water known as Article 21 water may be available to State Water Contractors when: (1) the San Luis Reservoir is full, (2) the Delta has a surplus, and (3) available conveyance capacity exists. This Delta surplus water can be pumped and conveyed to the Kern Fan Project. The DWR administers the Article 21 Program in years when Article 21 water is available. Deliveries of unallocated Article 21 water would be made available to the Project on behalf of IRWD as a landowner in DRWD and Rosedale as a sub-unit of the KCWA. Unallocated Article 21 water will be delivered to the Project utilizing existing capacity in the California Aqueduct to a new turnout and canal located near the CVC. During drought or for emergency response as needed, the stored groundwater will be recovered from the Project and conveyed to points of use by Rosedale, DRWD, and IRWD.

Approximately 25 percent of the stored water would be held as SWP system water that would be used for ecosystem benefit purposes. This 25 percent water would be made available for ecosystem through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water, which is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet DRWD and Rosedale's SWP Table A demands either directly or through operational exchanges. The SWP system water left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta. The 1-for-1 exchanges would result in the water extracted from the ground and used by DRWD and Rosedale being classified as Table A water and the water left in Oroville Reservoir being classified as SWP system water.

The DWR State Water Project Analysis Office (SWPAO) and SWP operations staff have been consulted with respect to the proposed 1-for-1 exchanges that would make water available for the public ecosystem benefits that would be derived from the pulse flows. SWPAO has identified that uncertainties and contractual issues would need to be worked through with the project partners. This work would begin immediately should the Project be selected by the CWC for funding under the WSIP. It is expected that these efforts would result in a Coordinated Operating Agreement that would be executed between the Project partners and DWR. Furthermore, the Project would not require any changes in water rights or SWP contracts. The storage and recovery of water stored in the Project would not impact groundwater rights or entitlements.

To achieve sustainability at the Basin level, Rosedale and IRWD would seek to develop both state wide and local partnerships to leverage the use of the Project facilities when not needed for Project purposes. Examples include partnerships with local water interests with access to Kern River water. The Project facilities, when not used to meet the primary Project objectives, could be made available for the recharge and storage of Kern River water which may have otherwise left the county. Kern River water recharged and stored in the Project would improve and address Basin overdraft, subsidence as well as water quality conditions. Additionally, the Project facilities may be used to help re-regulate other SWP supplies, such as carry-over water at risk of spill. Rosedale and IRWD may develop unbalanced exchange agreements with other SWP contractors for access to Project facilities to capture and reregulate SWP water supplies which may otherwise be lost. These unbalanced exchange agreements, typical of both Rosedale and IRWD water management programs, require that for every two (2) AF of water banked that only one is obligated for future return. As a result of these unbalanced exchange programs, the Basin benefits and overdraft and subsidence impacts are mitigated.

5. KERN FAN PROJECT CONCEPTUAL PROJECT OPERATION

Operation of the Kern Fan Project will provide flexibility in maximizing the storage of unallocated Article 21 water, managing its recovery to provide ecosystem benefits and to meet IRWD, DRWD and Rosedale's water management objectives. The Kern Fan Project would be operated such that in wet years, IRWD and Rosedale would receive surplus unallocated Article 21 supplies to store in the Project. Approximately 100,000 AF of water would be delivered in each wet period to the Project for IRWD as a landowner in DRWD and for Rosedale as a member unit of KCWA. IRWD and Rosedale would equally share 75 percent of the water delivered into storage for use in their respective water banking and exchange programs. The remaining 25 percent of the stored water would be held as SWP system water that would be used for ecosystem benefit purposes. This 25 percent of the water would be made available for ecosystem benefits through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water, which is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet DRWD and Rosedale SWP Table A demands either directly or through operational exchanges. The SWP system water left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta. A statewide perspective of the operations of the Kern Fan Groundwater Storage Project is illustrated on **Figure 6**.

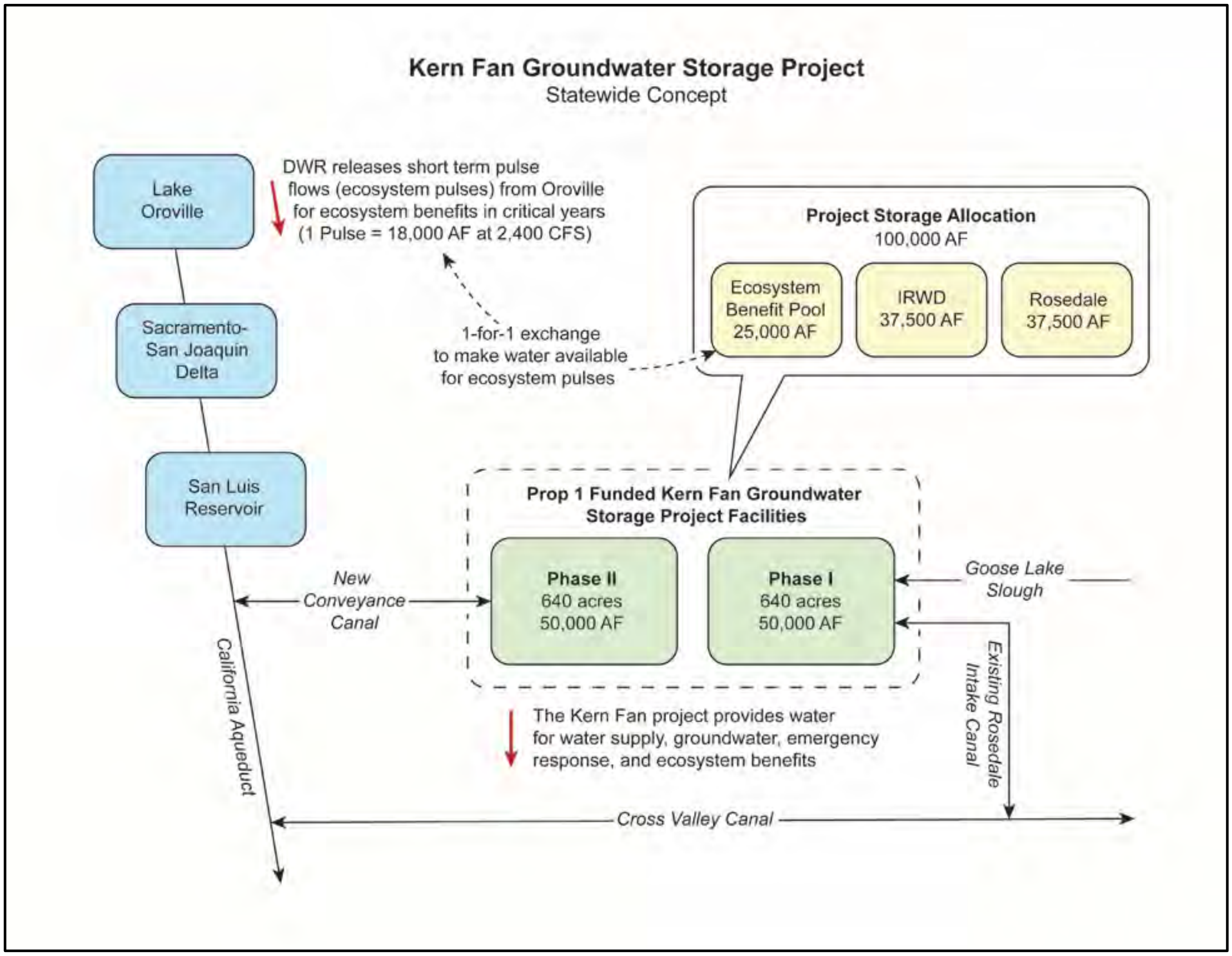

Figure 6. Kern Fan Groundwater Storage Statewide Operational Schematic

MBK Engineers prepared an analysis based on computer modeling for the Kern Fan Project operations using the CalSim II model. MBK Engineers analysis is included in the **Feasibility and Implementation Risk Tab, Attachment 1, Appendix B** of the WSIP funding application.

Figure 7 presents a conceptual diagram of how unallocated Article 21 water will be provided to the Project beneficiaries and how the Project yields system water for ecosystem benefits through 1-for-1 exchanges. The unallocated Article 21 water supplies recharged and stored in the Kern Fan Project would be allocated in separate accounts to derive Project benefits as follows:

- 25% for public ecosystem benefits
- 37.5% for IRWD/DRWD non-public and public benefits
- 37.5% for Rosedale non-public benefits

A detailed Preliminary Operations Plan for the Kern Fan Project including an overview of how the public and non-public benefits are derived from Project operations is provided under the **Benefit Calculation, Monetization and Resiliency Tab, Attachment 2**.

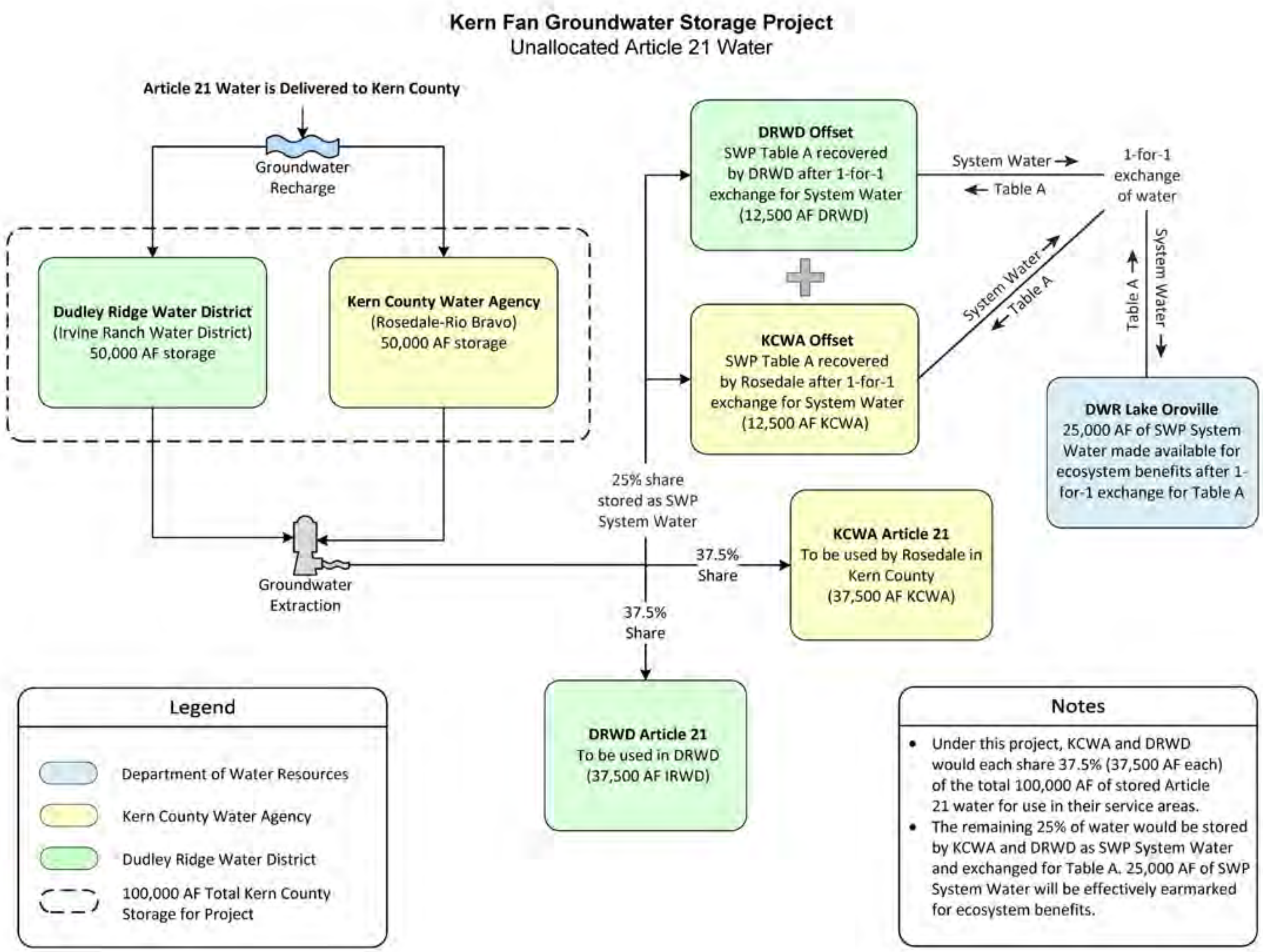

Figure 7. Project Preliminary Operations Plan

6. WATER STORAGE EVAPORATION LOSS

Minor water losses would occur during the conveyance of Article 21 water to the recharge sites. It is anticipated that losses as the water is transported from the Delta to the Project diversion on the California Aqueduct will be approximately 3%. As the water is being recharged at the spreading basins, the evaporation losses are estimated at 6%.

The modeling analysis (MBK Engineers, 2017) assumes water is stored in the Project in each of three accounts described above. Per the MOU described in Section 2.2, water stored in each account is subject to a loss percentage modeled at 10% for Rosedale, 12.5% for ecosystem, and 15% for IRWD. MBK Engineers' model accounts for these losses, such that the estimated water stored in each account is net of these losses.

7. PROJECT BENEFITS

Through the Kern Fan Project, DWR would have the flexibility to make releases of pulse flows from Lake Oroville upstream of the Delta which would then improve the ecosystem habitat condition for spring and winter-run Chinook salmon and other fish species in the Feather River. To provide the greatest benefit to ecosystem priorities, water would be released in short-term pulse flows from Oroville Reservoir, in April. This will physically improve habitat conditions for rearing, downstream migration of spring and winter-run Chinook salmon, and benefits to other fish species. **Figure 8** shows Chinook salmon in the Sacramento River.

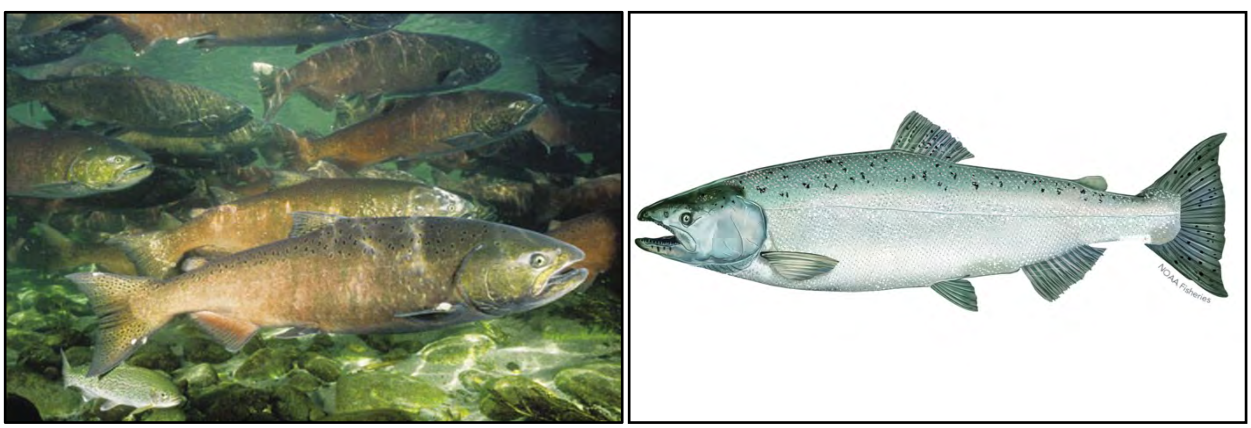

Figure 8. Sacramento River Winter-Run Chinook Salmon
(Photos from National Oceanic and Atmospheric Administration (NOAA))

Pulse flows are expected to improve conditions in the Feather River, downstream from Oroville Dan, and the Sacramento River, from the confluence with the Feather River through the Delta. Operation of the Project will be coordinated with DWR's operation of the SWP to make system water available for the pulse flows from Oroville Reservoir operations.

During dry and critical periods, ecosystem pulses would be released from Oroville Reservoir to provide net improvements in ecosystem and water quality in the Delta and its upstream tributaries. Each of the recommended releases of 18,000 AF would be made in the month of April and such pulse deliveries could occur at a rate of up to 2,400 cfs over a 3.75-day period. Modeling results by MBK Engineers, indicate that the Project could, based on 1922-2003 hydrology, provide for six April flow pulses of 18,000 AF each in dry or critically dry years (MBK Engineers, 2017) over an 82-year period. April was selected as the ideal period for the ecosystem pulses due to the high relative abundance for downstream migration and rearing of juvenile salmon. However, the Project operation also offers flexibility to accommodate DWR's operation of Oroville Reservoir and the SWP.

Figure 9 illustrates the Projects effects on Lake Oroville storage and flows in the Feather River for an example year, beginning in April when the ecosystem pulses would be made and continuing through September. No changes in Lake Oroville carryover storage would occur as a result of the coordinated operations with the Project (MBK Engineers, 2017).

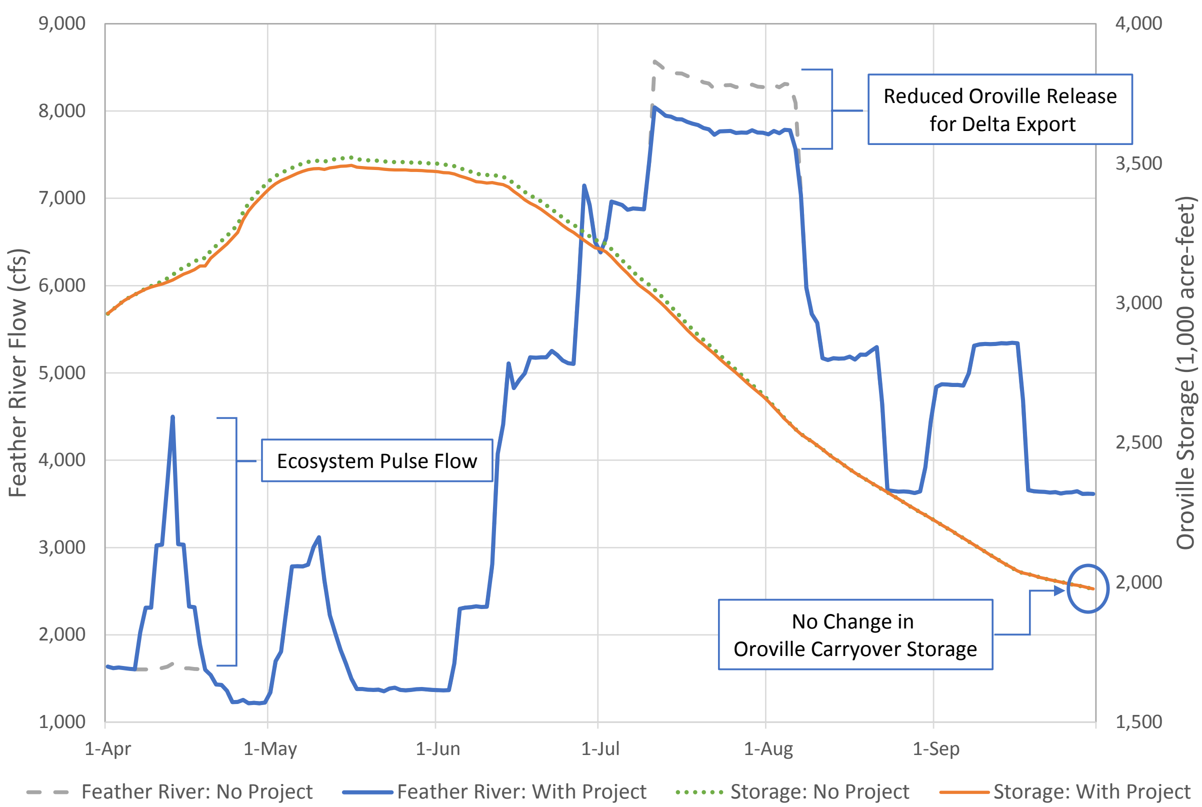

Figure 9. Example of Project Public Benefits through Integration with Lake Oroville

Though April flow pulses are expected to benefit multiple fish species and life stages, the quantitative analysis focuses on assessing benefits to out-migrating juvenile spring-run and winter-run Chinook salmon. Per Cramer Fish Sciences, over 50 years of operations with the project (2030 conditions) these April flow pulses are expected to provide a net benefit of 586 additional adult Central Valley spring-run Chinook salmon and 41 additional Adult Sacramento River winter-run

Chinook salmon. Cramer Fish Sciences' report is included in the **Physical Benefits Tab, Attachment 2** of the WSIP funding application**.**

While not analyzed in detail in this evaluation, it is estimated that other fish species may also benefit from the Project's ecosystem pulses. For example, increased flows in the Feather River may improve passage and eliminate barriers for upstream migration of adult green sturgeon. Downstream at the Delta, higher freshwater flows from the pulse releases could reduce salinity and improve conditions in the freshwater-saltwater mixing zone of the estuary, benefitting the Delta smelt during its spring spawning season.

Project performance was also simulated under other projected conditions: (1) 2070 climate change, (2) without the California WaterFix (CWF), and (3) with the CWF. While the numbers vary, the conclusions generally remain the same – operation of the Project and coordination with the SWP operation will support ecosystem pulse releases from Oroville Reservoir will yield a net increase in adult salmon survival benefits.

7.1 Public Benefit - Ecosystem Priorities

The Kern Fan Project provides benefit to three California Department of Fish and Wildlife (CDFW) ecosystem priorities as presented in the WSIP. Ecosystem Priority 2 calls for "flows to improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids". Per Cramer Fish Sciences' assessment of ecosystem benefits resulting from the Kern Fan Project, April is a period of "high" relative abundance for downstream migration and rearing of juvenile spring Chinook and juvenile steelhead in the Feather River. (Cramer Fish Sciences, August 2017). The Project also provides benefits to Ecosystem Priority 12 which calls for enhanced "access to fish spawning, rearing and holding habitat by eliminating barriers to migration". Upstream migration of adult green sturgeon in Feather Rivers is high for the month of April and upstream passage for green sturgeon appears to be positively influenced by river flow (Cramer Fish Sciences, August 2017). **Figure 10** shows the location of the ecosystem benefits, Priority 2 and Priority 12. Additional maps showing more details the location of the ecosystem benefits are provided in the **Physical Benefits Tab, Attachment 2.**

The Project also provides benefit for CDFW Ecosystem Priority 14 which calls for "water to enhance seasonal wetlands, permanent wetlands, and riparian habitat for aquatic and terrestrial species". The project will construct recharge basins over approximately 1,200 acres in the Kern Fan area which will be operated to maximize the use of available water supplies. During Project recharge activities, the recharge basins would be flooded for recharge purposes and would establish intermittent wetland habitat along the recharge basins for waterfowl, shorebirds, raptors and other native and migrating birds.

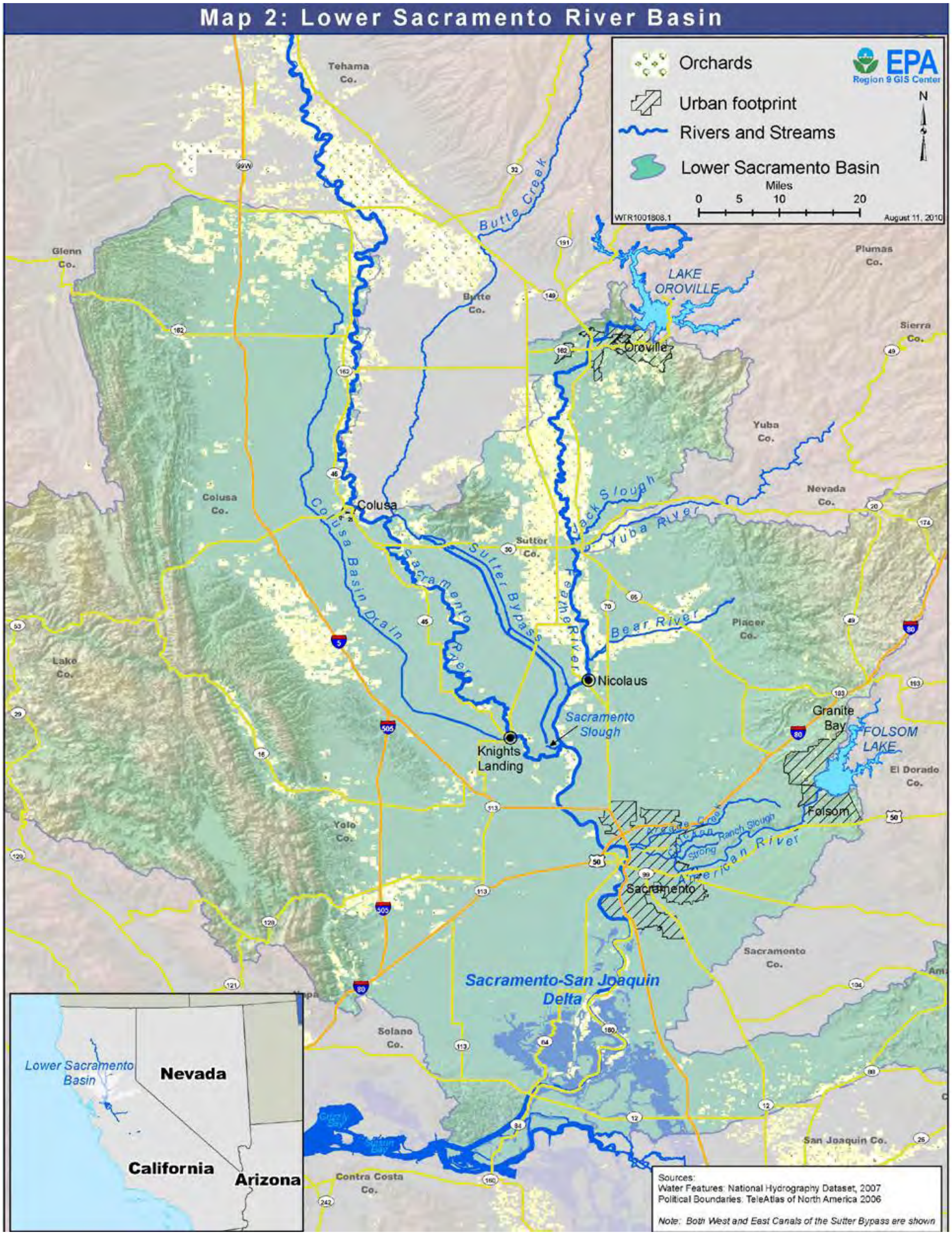

Figure 10. Location of Ecosystem Benefits

7.2 Public Benefits – Emergency Response – Extended Drought

A major benefit of the Project is that it provides water to IRWD, Rosedale, and DRWD in the event of extreme drought, when other water resources are short and are most costly. Groundwater stored as part of the Project will be available to call on during a drought emergency or as an alternative supply in the case of a local supply outage.

IRWD and Rosedale will dedicate one-third of the non-ecosystem water supply created by the Project to emergency response. The water supply that is expected to be available for emergency response in an extended drought would be 4,500 AF per year in 2030 future conditions and 4,100 AF per year in the 2070 future conditions. This water will be available for recovery after the third year or later of a multi-year drought.

7.3 Public Benefits – Emergency Response – Delta Failure

A separate emergency response benefit of the Project is that the stored water supply could be recovered from the Project in the event of levee failures in the Delta. It is expected that should an earthquake cause major levees failures in the Delta, that SWP deliveries could be curtailed for an extended period of time. The WSIP Technical Guidance explains that an emergency response to Delta failure should be assumed to occur once, 30 years into the project operations period, or 2056 for the Kern Fan Project. Per MBK Engineers' analysis, according to historical hydrology, the project is likely to have approximately 20,000 AF of water available for emergency response after 30 years of operation. IRWD, Rosedale and DRWD could use the supplies stored in the Project as an emergency response during the curtailment period.

7.4 Non-Public Benefits – Water Supply

Water supply benefits are non-public benefits that will accrue to IRWD, Rosedale and DRWD. IRWD and Rosedale estimate that approximately two-thirds of all their stored water will be used for non-emergency water supply and will be recovered in below normal, dry and critical water years.

7.5 Non-Public Benefits – Groundwater

The Project will also provide a water supply benefit to the Kern County groundwater basin. A portion of banked groundwater will accrue to losses that benefit the groundwater basin. Per the MOU discussed in Section 2.2, loss factors are applied to gross water deliveries into the Kern groundwater basin. This portion of the water will not be recovered and that will remain in the ground to bolster local groundwater levels. For the Kern Fan Project, an average 12.5% of the groundwater stored in the Project on behalf of IRWD and Rosedale will not be recovered and 60%

of that amount is estimated to be recharged, net of evaporative losses. This amount would benefit groundwater levels in the Kern County Groundwater Sub-basin.

7.6 Value of the Project Benefits

Based on analysis of the project benefits, M.Cubed calculates that the Kern Fan Project is anticipated to provide a total of $52 million in non-public benefits, and $125.8 million in public benefits, for a total benefit value of $177.8 million (M.Cubed, 2017). A summary of the estimated value of the non-public and public project benefits is provided in **Table 2.**

Table 2. Estimated Value of Project Benefits

Benefit Category	**Benefit Type**	**Estimated Value (2015 $ millions)**[1]
Non-public Benefits	Water Supply Benefits	$47.7
	Groundwater	$4.3
Public Benefits	Environmental Benefits – Chinook Salmon	$21.0
	Environmental Benefits – Incidental Wetland Habitat	$39.8
	Emergency Response – Extended Drought	$5.1
	Emergency Response – Delta Failure	$59.9
	Total Benefits	**$177.8**

7.7 Other Project Benefits

The Project will manage available surplus water supplies to serve dry year demands, for emergency response, and ecosystem benefits including improved habit conditions, enhanced access to fish spawning and rearing in the Feather River downstream of Oroville Dam. In addition to these public and non-public benefits, the Project will provide flexible water storage and recovery facilities that will improve the State's water system in a cost-effective manner. The Project will make use of existing infrastructure (canals and lift stations) and construct new conveyance facilities, recharge basins and extraction wells for an estimated capital cost of approximately $172 million. The Project's water banking facilities will build upon the success of other groundwater storage/recovery projects, demonstrating that collaboration with DWR can provide public benefits, namely environmental improvements for habitat and fish at the Delta as well as water supply during emergency situations (long-term drought or Delta failure).

The Project offers exceptional flexibility to better manage available supplies, utilizing the groundwater basin as storage and existing infrastructure for conveyance of water, all of which supports improved operations of the State water system. The Project will support sustainable water management on a statewide basis and offer noteworthy, measurable ecosystem benefits. By banking unallocated Article 21 water, the Project will be operated to alleviate stress on the sensitive species in the Delta, while providing increased supply reliability.

The Kern Fan Groundwater Storage Project will offer opportunities to further improve the operation of the State water system through the integration of operations with other projects funded through the WSIP. For example, Sites Reservoir participants could be offered the opportunity to store water in the Project under mutually beneficial terms that would avoid reservoir spills. Such integration efforts could improve the yield of the State water system, improve water supply reliability, reduce competition for water supplies during dry periods and reduce stresses on ecosystems.

8. BENEFICIARIES AND LOCATIONS OF BENEFITS

Beneficiaries of the Project and their locations are listed in **Table 3**.

Table 3. Beneficiaries of the Project

Beneficiary	Location of Benefits	Description of Project Benefit(s)
Public	Delta, Sacramento River, and Feather River	• Reduces demands on the Delta by recovering stored groundwater to supply local demands in lieu of exporting water from the Delta • Provides ecosystem benefits in dry and critical years by releasing pulses of water from Lake Oroville for Delta outflow • Decreases water exported from the Delta and increases river flows during critical periods to support fish spawning • Provides an emergency supply in the event of a levee failure in the Delta
Public	Kern County	• Provides temporary wetlands (recharge basins) that attract water birds
Rosedale	Kern County	• Provides greater operational flexibility by utilizing contingency groundwater storage to augment supplies during periods when other water sources may be limited or unavailable
IRWD	Orange County	• Augments supplies to IRWD during periods when other supply sources may be limited or unavailable.
DRWD	Kings County	• Augments supplies during periods when other supply sources may be limited or unavailable.

9. ESTIMATED PROJECT COSTS

A project concept and engineering Class 4 Feasibility Level Cost Estimate was developed for the Kern Fan Groundwater Storage Project by Dee Jaspar & Associates, Inc. (DJA). DJA's Draft Concept Study for the Kern Fan Groundwater Storage Project provides detailed information on the estimated project costs and is included in **Feasibility and Implementation Risk Tab, Attachment 1, Appendix A** of the WSIP application. The total capital costs are estimated to be $171,321,859. **Table 4** shows the breakdown of the estimated project costs.

Table 4. Estimated Cost of Kern Fan Project

Description	Estimated Cost ($)
Aqueduct Turnout	1,185,000
Lift Stations	11,917,500
Phase 1 Recharge & Recovery Facilities	13,861,108
Phase 2 Recharge & Recovery Facilities	14,019,608
Conveyance Facilities	56,195,000
Turnout Facilities	5,582,500
Miscellaneous	2,120,000
Subtotal	104,880,716
20% Contingency	20,976,143
Land, Easements, R/W, habitat credit purchase	36,600,000
Total Field Costs	162,456,859
Non-Contract Costs	
Engineering & Design	5,315,000
Environmental & Permitting	550,000
Construction Management	3,000,000
Subtotal	8,865,000
Total Construction Costs	**171,321,859**

The Draft Concept Study describes the project facilities to be constructed and the operations consistent with the Project operations plan. DJA's cost estimates are based upon previous project bid prices, actual cost of operations of other Rosedale and IRWD water banking facilities and includes direct and indirect costs such as project overhead, business overhead, profit and bonds. The cost estimates include capital construction costs, operations and maintenance costs consistent with the operations plan and replacement costs.

DJA's cost estimate also includes the expected environmental compliance costs for the project. This cost estimate was provided by environmental consultants at ESA, and a copy of ESA's scope of work, schedule and cost estimate to prepare the Project environmental review documents are included under **Feasibility and Implementation Risk Tab, Attachment 4** under Environmental Document of the WSIP funding application.

A proposed conveyance canal will be constructed as part of the project. Construction of the canal will require obtaining conveyance easement and habitat conservation plan (HCP) mitigation credit for approximately 100 acres within the Kern Water Bank Authority (KWBA) Permit Area. The cost of the mitigation credit needed for the proposed Project is included in the cost estimate.

The estimated capital, operations and maintenance and replacement costs from the Concept Study are used in the present value calculations for the Benefit Cost analysis of the Project. See **Benefit Calculation, Monetization and Resiliency Tab, Attachment 9** of the WSIP funding application.

10. RELATIONSHIPS TO EXISTING WATER PROJECT FACILITIES

The Kern Fan Project's relationship to the other existing water projects is described below. The Kern Fan Project will be operated in coordination with DWR's management of the SWP to make water available for ecosystem benefits.

The Kern Fan Project is based on the success of other water banking and conjunctive use projects implemented by IRWD and Rosedale which include the:

- Strand Ranch Integrated Banking Project, and
- Stockdale Integrated Banking Project.

10.1 Existing SWP Water Conveyance Facilities

The CVC, Kern County's primary conduit for water deliveries to and from the California Aqueduct, was originally constructed in 1975 and expanded in 2012. Shown in **Figure 11**, the CVC conveys supplemental water from the California Aqueduct to the Bakersfield area. An intertie between the Friant-Kern and increased CVC capacity have enabled CVC Contractors to move Central Valley Project water supplies from the west side of the valley to the east. The California Aqueduct will provide for delivery of banked supplies by exchange to DRWD and directly to IRWD's service area through the existing MWD system.

Figure 11. Cross Valley Canal

MWD is the State Water Contractor that imports water to IRWD's service area. MWD would access Project water from the California Aqueduct at Lake Perris where it would be conveyed to MWD's Diemer Filtration Plant located in Orange County. The two major pipelines that deliver treated, potable water to IRWD's service area are the Allen McColloch Pipeline and the East Orange County Feeder No. 2.

Imported water is provided to IRWD through MWDOC, the regional wholesale member agency of MWD. In 2011, IRWD, MWD, and MWDOC entered into the MWD/IRWD Agreement to facilitate delivery of SWP water banked at Strand Ranch to IRWD's service area. The Agreement was amended to include the Stockdale Recovery Facilities Project. Under the Agreement and with MWD's consent, IRWD will provide banked water to MWD at a Kern County delivery point into the California Aqueduct (via the CVC). In exchange, MWD would provide IRWD with an equal amount of imported SWP water in its service area and other allowed areas.

10.2 Existing Strand Ranch Project

Since 2008 IRWD, in partnership with Rosedale, has participated in Rosedale's Conjunctive Use Program through the Strand Ranch Integrated Banking Project. Strand Ranch is located in western Kern County and borders Rosedale's service area as shown in **Figure 4.**

The Strand Ranch Project includes approximately 502 acres of groundwater recharge basins, seven on-site production (recovery) wells, and off-site joint-use wells constructed by Rosedale. **Figure 12** shows the Strand Ranch recharge basins during a recharge event. With the Strand Ranch Project, IRWD has the ability to store up to 50,000 AF and recover up to 17,500 AFY in accordance with its banking project agreement with Rosedale. Recovered water is delivered to

IRWD's service area via the CVC, California Aqueduct, and MWD facilities through existing agreements with MWD.

Figure 12. Strand Ranch recharge basins during recharge

IRWD has the priority rights to use the recharge basins on the Strand Ranch when Rosedale is not recharging Kern River floodwaters and has first priority rights to the use of the recovery facilities. Rosedale has secondary priority use of Strand Ranch facilities. The water that Rosedale stores on its own behalf does not count against the 50,000 AF of storage dedicated to IRWD. Rosedale manages operation of the Strand Ranch Project on behalf of IRWD.

The Phase 1 Kern Fan Project site will be located in the vicinity of the Strand Ranch Project. The Phase 2 Kern Fan Project site will be in this same vicinity. The Kern Fan Project will be similar to the Strand Ranch Project in that both are water banking projects located in Rosedale's service area and near the CVC. Recharged water is stored in the groundwater basin for later extraction.

10.3 Existing Stockdale Integrated Banking Project

In 2011, IRWD acquired a neighboring property known as Stockdale West Ranch (Stockdale West) with the intent of expanding its water banking opportunities. The Stockdale West property is the initial component of the Stockdale Integrated Banking Project, and is located west of and adjacent to the Strand Ranch Project in western Kern County. IRWD constructed recharge basins on the 323-acre Stockdale West site, which is located north of the Pioneer Canal and the CVC.

IRWD began recharging water on the Stockdale West site in 2011. The recharge capacity of the Stockdale West site was estimated at up to 27,100 AFY based on infiltration pilot tests. IRWD has constructed three extraction wells to recover up to 11,250 AF per year of stored groundwater. The recovered groundwater is conveyed via pipelines to the existing CVC for transport to the California Aqueduct, points of use and/or exchange with partnering agencies. Rosedale is developing water banking facilities on its Stockdale East property, also a component of the Stockdale Integrated Banking Project.

Phase 1 of the Kern Fan Project will be located within the Stockdale Integrated Banking Project boundary as shown on **Figure 4.** The Phase 2 Kern Fan Project will be in this same vicinity. The IRWD-Rosedale partnership of the Strand Ranch and Stockdale Integrated Banking Projects will be expanded by the Kern Fan Project.

11. FUTURE CONDITIONS WITH AND WITHOUT THE PROJECT

The Project yield was estimated using the CalSim II model results that depict the without-Project (Baseline) scenario within a spreadsheet model (MBK Engineers, 2017). The operation of Project was then layered onto the baseline operation of the CalSim II results to simulate the with-Project scenario. Project benefits were then determined and quantified by comparison of the with-Project and without-Project scenarios. Following is a summary of the CalSim-II model's application to estimate the project yield that is described in more detail in the **Feasibility and Implementation Risk Tab, Attachment 1, Appendix B** of the WSIP application.

11.1 Baseline Scenario

The Baseline scenario for this analysis is the WSIP 2030 CalSim II model dated November 2, 2016. This model simulation is described as a without-project, 2030 future condition with projected climate and sea-level conditions for a thirty-year period centered at 2030 (WSIP 2030).

Figure 13 presents a summary of available Article 21 water supply to the Project diversion from the California Aqueduct by water year type (Sacramento Valley Year Type Index) based on WSIP 2030 CalSim II modeling results. This available supply is calculated by considering constraints on available Banks Pumping capacity, conveyance capacities in the California Aqueduct, the capacity to convey water from the California Aqueduct to the Project, and conveyance losses. On an average annual basis, available unallocated Article 21 supply at the project diversion from the California Aqueduct is 8 TAF with most of the supply available during wet years. There is no Article 21 supply during dry and critical years.

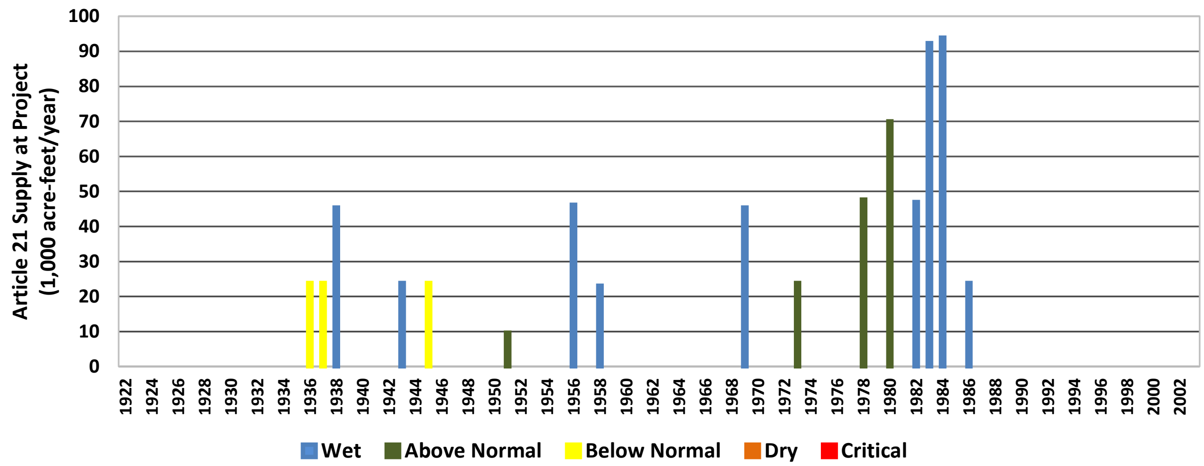

Figure 13. Article 21 Supply at Project Diversion

Table 5 presents a summary of the Project performance on an average annual basis with the 2030 WISP conditions. Of the 8 TAF available to the project diversion approximately 6.1 TAF is able to be conveyed in the project facilities for recharge on an average annual basis. This water is stored and then extracted to provide public and non-public benefits. Actual deliveries and recharge in any one year would be substantially greater. Presenting the modeling results on an average annual basis is done for comparison purposes. Actual recharge at the Project would range from 10,000 AF to 70,000 AF per year in years when water is available under 2030 future conditions. Under 2070 conditions, recharge would range from 3,000 AF per year to 70,000 AF per year when water is available. MBK Engineers' modeling results indicate that 500,000 AF of unallocated Article 21 water would be recharged at the Project, over the 82-year modeling period, under 2030 conditions. A total of 25 percent of these recharged amounts would be dedicated to an ecosystem account to provide water for ecosystem benefits.

Table 5. Summary of Project Performance (WSIP 2030) on Average Annual Basis

Year Type	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
Wet	11	0	0	0	0
Above Normal	13	0	0	1	0
Below Normal	5	0	0	4	6
Dry	0	5	5	4	6
Critical	0	1	2	2	1
All Years	**6.1**	**6**	**1.3**	**2**	**2.5**

Under 2030 conditions, the Project could provide six pulse releases from Oroville Reservoir over the 82-year period analyzed and provide an average annual ecosystem water supply of 1.3 TAF. The ecosystem supply of 1.3 TAF includes 0.84 TAF of Project release, a 23% savings in carriage losses for releases above the Delta and 0.2 TAF of reduced flood control releases. Local water supply benefits are 4.5 TAF annually, with 2.0 TAF for IRWD and 2.5 TAF for Rosedale.

11.2 Uncertainty Analysis

In addition to analyzing the project performance with the 2030 WSIP conditions an uncertainty analysis of potential future climate change and the California WaterFix was modeled. Following is a summary of the uncertainty analysis that is described in more detail in the **Feasibility and Implementation Risk Tab, Attachment 1, Appendix B** of the WSIP funding application.

11.2.1 Climate Change

The climate change analysis was performed using the WSIP 2070 dataset that reflects future climate and sea level conditions for a 30 year period centered at year 2070. As summarized in **Table 6**, the Project benefits diminish slightly due to a reduction in available water supply when the 2070 WSIP results are compared to the 2030 WSIP results. Average annual recharge is reduced by 0.4 TAF or approximately 7% as compared to 2030 conditions. The frequency of ecosystem pulses is reduced from six years under 2030 conditions, to five years under 2070 climate conditions. Water supply benefits also diminish slightly by approximately 0.3 TAF (7%) on an average annual basis. Though the Project performance is reduced with WISP 2070 climate conditions, they are similar to the WISP 2030 baseline.

Table 6. Summary of Uncertainty Analysis on Average Annual Basis

Model	Alternative	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
CalSim II (1)	WSIP 2030	6.1	6	1.3	2.0	2.5
CalSim II (1)	WSIP 2070	5.7	5	1.1	1.9	2.2
CalSim II (1)	*Change WISP 2070 -WISP 2030*	*0.4*	*1.0*	*0.2*	*0.1*	*0.3*
Calsim II ELT (2)	Without California Fix	5.2	4	0.9	1.8	1.9
Calsim II ELT (2)	With California Fix	10.7	7	1.5	3.9	3.9
Calsim II ELT (2)	*Change (With - Without California Fix)*	*5.5*	*3.0*	*0.6*	*2.1*	*2.0*

(1) Water Storage Investment Program (WSIP) CalSim II model (11/2/16)

(2) Division of Water Resources and Bureau of Reclamation for Biological Assessment with 2025 Early Long Term climate change.

11.2.2 California Water Fix

The California WaterFix (CWF) analysis was performed using the CalSim II model developed by DWR and Reclamation for the Biological Assessment for the CWF. The CWF CalSim II model includes the 2025 Early Long Term (ELT) climate change assumptions that are different from the WSIP 2030 climate change assumptions. Results, summarized in **Table 6**, indicate a substantial increase in Project yields with the CWF when compared to without the CWF. Average annual Project recharge is approximately 11 TAF with CWF, nearly 6 TAF greater than DWR ELT without CWF. Increases in the ability to recharge water with CWF increase the frequency of ecosystem pulses from four years to seven and Project yields to IRWD and Rosedale are increased by approximately 4 TAF.

12. ENVIRONMENTAL COMPLIANCE:

Environmental compliance, on a program-level, has already been completed for Phase 1 recharge and recovery facilities of the Kern Fan Project. Phase 1 of the Kern Fan Project is the proposed third site in the Stockdale Integrated Banking Project. The existing Stockdale West and Stockdale East properties plus a general area for a future third site were identified in the Final EIR for the Stockdale Integrated Banking Project. Various water banking facilities have been completed or are currently under construction on the Stockdale West and Stockdale East properties.

A Final EIR for the Stockdale Integrated Banking Project was prepared, certified and approved in compliance with the California Environmental Quality Act (CEQA) of 1970 (as amended), codified at California Public Resources Code Sections 21000 et. seq., and the State CEQA Guidelines in the Code of Regulations, Title 14, Division 6, Chapter 3. Rosedale, as lead agency, filed a Notice of Determination for the Stockdale Integrated Banking Projects with the County of Kern (ESA, 2015). IRWD, as a responsible agency, filed Notice of Determinations with the County of Orange and with the County of Kern. The Final EIR for Stockdale Integrated Banking Project is included in the **Feasibility and Implementation Risk Tab, Attachment 4** of the WSIP application.

The EIR includes a program-level analysis of impacts of a third site because the location of the site had not been identified at the time the document was prepared. The third site will be implemented as Phase 1 of the Kern Fan Project. When the Phase 1 site is identified, subsequent project-level environmental review would need to be conducted prior to implementation of project facilities. It is expected that a Supplemental EIR would be prepared for the construction and operation of the Phase 2 facilities contemplated in the Kern Fan Project.

In summary, the Kern Fan Project will be implemented in two phases. Phase 1 includes the acquisition of approximately 640 acres of land within Rosedale's boundary and within the boundaries of Stockdale Integrated Banking Project Final EIR for which environmental compliance has been completed on a programmatic basis. Groundwater recharge facilities including levees, inter-basin structures, conveyance facilities, and six groundwater recovery wells would be located on this property. Phase 1 recharge and recovery project components have a completed program-level environmental review and will require a project-level Supplemental EIR.

Another component of Phase 1 includes the construction of a new canal, three lift stations, and a reinforced concrete turnout at the California Aqueduct to convey up to 500 cfs of water in a new Project canal to the Phase 1 and 2 sites. Phase 2 includes the construction and operation of groundwater recharge and recovery facilities and the purchase of an additional 640 acres of land within the Rosedale but outside of the limits of the Stockdale Project Final EIR. Phase 2 would consist of the construction of levees, inter-basin structures, conveyance facilities and six groundwater recovery wells. Phase 2 would utilize the Phase 1 canal to convey water to and from the Phase 2 site. The Supplemental EIR would include review of the Phase 2 facilities.

More information about environmental compliance for the Kern Fan Project is located in **Feasibility and Implementation Risk Tab, Attachments 4 and 5** of the WSIP application.

13. REFERENCES

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Sierra Scientific Services, 2009. *"A Determination of Aquifer Recharge and Storage Capacities for the Rosedale-Rio Bravo Water Storage District, Bakersfield, California,"* Prepared for Rosedale-Rio Bravo Water Storage District, September 2009.

Eligibility and General Project Information Tab

A.4 Project Description Support:

Attach maps, schematics and engineering design drawings that support the project description, if not already available in other attached documents. See section 6003(a)(1)(B)

File: Tab 3-A4_IRWD_Maps and Schematics_2017-08-09.pdf

A.4. Attach maps, schematics and engineering design drawings that support the project description, if not already available in other attached documents. See section 6003(a)(1)(B) of the regulations.

All maps and schematics developed for the Kern Fan Groundwater Storage Project's (Kern Fan Project) have been included in the respective documents and tabs of the WSIP funding application. Where applicable, references to maps or schematics have been made to the specific sections or tabs in the WSIP funding application.

Eligibility and General Project Tab
Attachment 4
Maps and Schematics

Eligibility and General Project Information Tab

A.5 Attestation:

Attach a statement, under penalty of perjury to the laws of the State of California, attesting that the information provided in the full application is true and correct to the best of the applicant's knowledge. Scanned uploaded documents containing a scanned signature are sufficient. See section 6003(a)(1)(Y) of the regulations

File: Tab 3_A5_IRWD SignedCertification_FINAL.pdf

Irvine Ranch
WATER DISTRICT

August 14, 2017

Joe Yun
Executive Officer
California Water Commission
P.O. Box 942836
Sacramento, CA 94236-0001

Re: Water Storage Investment Program Grant Application

Dear Mr. Yun:

The Irvine Ranch Water District is pleased to submit its application for the Water Storage Investment Program in partnership with Rosedale Rio Bravo Water Storage District. The proposed Kern Fan Groundwater Storage Project (Project) will recharge and store up to 100,000 acre-feet (AF) of water during wet year conditions in the Kern County Sub-basin of the San Joaquin Valley Groundwater Basin and provide measureable ecosystem benefits for the Sacramento-San Joaquin Delta (Delta), Sacramento River, and Feather River. The project is designed to cost-effectively:

- Enhance water supply reliability;
- Reduce imported water demands on the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Delta) to restore important species;
- Provide water supply benefits during drought conditions;
- Provide water supply benefits during emergency conditions;
- Benefit water levels in the Kern County Sub-basin;
- Create temporary wetlands through intermittent recharge events:
- Manage water in a resilient and sustainable manner; and
- Be integrated with other water storage projects to provide greater statewide benefits.

I certify under penalty of perjury pursuant to the laws of the State of California that the information provided in the full application is true and correct to the best of my knowledge.

Sincerely,

Paul A. Cook, P.E.
General Manager

Eligibility and General Project Information Tab

A.5 Attestation:

Attach a statement, under penalty of perjury to the laws of the State of California, attesting that the information provided in the full application is true and correct to the best of the applicant's knowledge. Scanned uploaded documents containing a scanned signature are sufficient. See section 6003(a)(1)(Y) of the regulations

File: Tab3_A5-IRWD_RosedaleSignedCertification_FINAL.pdf

ROSEDALE - RIO BRAVO
WATER STORAGE DISTRICT
849 Allen Road • P.O. Box 20820 • Bakersfield, California 93390-0820 • (661) 589-6045 • FAX (661) 589-1867

August 14, 2017

Joe Yun
Executive Officer
California Water Commission
P.O. Box 942836
Sacramento, CA 94236-0001

Re: Water Storage Investment Program Grant Application

Dear Mr. Yun:

The Rosedale-Rio Bravo Water District is pleased to submit its application for the Water Storage Investment Program in partnership with Irvine Ranch Water District. The proposed Kern Fan Groundwater Storage Project (Project) will recharge and store up to 100,000 acre-feet (AF) of water during wet year conditions in the Kern County Sub-basin of the San Joaquin Valley Groundwater Basin and provide measureable ecosystem benefits for the Sacramento-San Joaquin Delta (Delta), Sacramento River, and Feather River. The project is designed to cost-effectively:

- Enhance water supply reliability;
- Reduce imported water demands on the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Delta) to restore important species;
- Provide water supply benefits during drought conditions;
- Provide water supply benefits during emergency conditions;
- Benefit water levels in the Kern County Sub-basin;
- Create temporary wetlands through intermittent recharge events:
- Manage water in a resilient and sustainable manner; and
- Be integrated with other water storage projects to provide greater statewide benefits.

I certify under penalty of perjury pursuant to the laws of the State of California that the information provided in the full application is true and correct to the best of my knowledge.

Sincerely,

Eric Averett, General Manager

Eligibility and General Project Information Tab

A.6 Other Application Information:

OPTIONAL: Attach any other information that would support the application which does not fit easily in another category: for example, other studies or an index of the submitted application documents.

File: 2017-06-05-ACWA-Integrated-Storage-Final-Report.pdf

The Storage Integration Study is too large to be included but can be found at the following link:

https://www.acwa.com/wp-content/uploads/2017/06/2017-06-05-ACWA-Integrated-Storage-Final-Report.pdf

Physical Public Benefits Tab

Physical Public Benefits Tab

A.1 Ecosystem Benefits:

Attach completed Ecosystem Priorities worksheets. Be sure to include the general information worksheet as well as worksheets for each priority being claimed for which funds are being requested. Identify at least one Program ecosystem priority for any ecosystem public benefit quantified. See section 6003(a)(1)(Q) of the regulations.

General Information Worksheet

File: Tab 4_A1_IRWD_Ecosystem_GeneralInfo_FINAL.pdf

General Info: Ecosystem Priorities and Relative Environmental Value Criteria	
Ecosystem Priorities	
P 1	Provide cold water at times and locations to increase the survival of salmonid eggs and fry.
P 2	Provide flows to improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids.
P 3	Maintain flows and appropriate ramping rates at times and locations that will minimize dewatering of salmonid redds and prevent stranding of juvenile salmonids in side channel habitat
P 4	Improve ecosystem water quality
P 5	Provide flows that increase dissolved oxygen and lower water temperatures to support anadromous fish passage
P 6	Increase attraction flows during upstream migration to reduce straying of anadromous species into non-natal tributaries
P 7	Increase Delta outflow to provide low salinity habitat for Delta smelt, longfin smelt, and other estuarine fishes in the Delta, Suisun Bay, and Suisun Marsh
P 8	Maintain or restore groundwater and surface water interconnection to support instream benefits and groundwater dependent ecosystems.
P 9	Enhance flow regimes or groundwater conditions to improve the quantity and quality of riparian and floodplain habitats for aquatic and terrestrial species.
P 10	Enhance the frequency, magnitude, and duration of floodplain inundation to enhance primary and secondary productivity and the growth and survival of fish
P 11	Enhance the temporal and spatial distribution and diversity of habitats to support all life stages of fish and wildlife species
P 12	Enhance access to fish spawning, rearing, and holding habitat by eliminating barriers to migration
P 13	Remediate unscreened or poorly screened diversions to reduce entrainment of fish
P 14	Provide water to enhance seasonal wetlands, permanent wetlands, and riparian habitat for aquatic and terrestrial species on State and Federal wildlife refuges and on other public and private lands
P 15	Develop and implement invasive species management plans utilizing techniques that are supported by best available science to enhance habitat and increase the survival of native species
P 16	Enhance habitat for native species that have commercial, recreational, scientific, or educational uses
Relative Environmental Value Criteria (REVs)	
REV 1	Number of different ecosystem priorities, for which corresponding public benefits are, provided by the project.
REV 2	Magnitude of ecosystem improvements.
REV 3	Spatial and temporal scale of ecosystem improvements.
REV 4	Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits.
REV 5	Immediacy of ecosystem improvement actions and realization of benefits
REV 6	Duration of ecosystem improvements.
REV 7	Consistency with species recovery plans and strategies, initiatives, and conservation plans
REV 8	Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values
REV 9	Efficient use of water to achieve multiple ecosystem benefits
REV 10	Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change.

Project Information

Project Name

Kern Fan Groundwater Storage Project (Kern Fan Project or Project)

Project Description (Summary)

The Kern Fan Groundwater Storage Project (Kern Fan Project or Project) will be operated to provide both public and non-public benefits by recharging and storing State Water Project (SWP) unallocated Article 21 water in the Kern County Subbasin of the San Joaquin Valley Groundwater Basin in wet years and extracting water when needed in dry years to provide ecosystem, emergency supply, and water supply benefits. The Unallocated Article 21 water supplies recharged and stored in the Kern Fan Project will be allocated to the Project beneficiaries as follows:

25% to the Public or Ecosystem account
37.5% to the IRWD/DRWD account
37.5% to the Rosedale account

MBK Engineers' analysis simulated water stored in each of the three accounts. Project recharge rates are simulated as a function of recharge in preceding months based on IRWD and Rosedale's experience and assumptions made in the Draft Concept Study (Dee Jaspar & Associates, 2017). Approximately 25 percent of the stored water would be held as SWP system water that would be used for ecosystem benefits purposes. This 25 percent of the water would be made available for ecosystem benefits through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water that is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet DRWD and Rosedale SWP Table A demands either directly or through operational exchanges. The SWP system water left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta. The 1-for-1 exchanges would result in the water extracted from the ground and used by DRWD and Rosedale being classified as Table A water and the water left in Oroville Reservoir for use in providing ecosystem benefits being classified as SWP system water.

Identify the current conditions date (i.e., year) that will be used within the application.

2030

Ecosystem improvement application instructions:

To complete the ecosystem improvement section of the Water Storage Investment Program application review the 16 ecosystem priorities listed above, determine which priorities will be addressed by your project's ecosystem improvements, and answer all questions for each priority you will address. In addition to answering the priority-specific questions, answer the general questions listed on this worksheet which apply to all priorities addressed by your project. The final relative environmental value of each project will be based on a technical review of each ecosystem priority using relative environmental criteria (REV) 2-10 and the total number of priorities claimed by a project (REV 1).

For the purpose of this application the Current Conditions date will be based on the existing conditions of an applicant's CEQA document. If specific data requested in this application is not available in the CEQA document, the applicant will use the demarcation date of the existing conditions in the CEQA document. An applicant must use the demarcation date of the existing conditions from their CEQA document consistently within the application when identifying current conditions.

REV 1: Number of ecosystem priorities targeted by the project

Briefly explain which ecosystem priorities will be met by this project.

The Kern Fan Project will meet ecosystem priorities 2, 12, and 14. Approximately 25 percent of the water stored in the Project is designated for the ecosystem account which would be held as SWP system water to be used for ecosystem benefits purposes when needed. Operation of the Project will be coordinated with that of the SWP to enable the DWR to release pulses of water from Oroville Reservoir when water is needed for fish spawning, rearing, and migration. The pulse flows (Ecosystem Pulses) will provide measurable improvements to environmental habitat in the Feather River downstream of Oroville Dam, and in the Sacramento River, from its confluence with the Feather River through the Delta thus meeting the criteria for WSIP Ecosystem Priorities 2 and 12 benefits. The Kern Fan Project is also expected to provide intermittent wetland habitat along the recharge basins where marsh-like environments are established during recharge periods and create ideal habitat for waterfowl, shorebirds, raptors, and other native and migrating birds thus meeting the criteria for WSIP Ecosystem Priority 14. These conditions are expected to exist whenever recharge activity occurs on the Project sites.

REV 4: Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers to achieve ecosystem benefits.

Describe the process through which an adaptive management and monitoring program will be developed for approval by the responsible agency.

IRWD and Rosedale will work with the CDFW to develop an adaptive management and monitoring program that meets the requirements of the program regulations.

Describe the framework you will use to develop measurable objectives, performance measures, thresholds, and triggers for your adaptive management and monitoring program.

IRWD and Rosedale will consult with the appropriate agencies to develop relevant measurable objectives for each of the three ecosystem priorities that the project will address. As suggested by Cramer Fish Sciences, a relevant performance metric for Priority 2 may be an observed flow-survival relationship consistent with the predicted flow-survival relationship described by National Marine Fisheries Service (NMFS). IRWD and Rosedale may participate in and support flow-survival studies relevant to evaluating performance of the flow pulses in achieving expected ecosystem benefits.

Performance measures associated with Priority 12 would be developed upon new information becoming available to quantify expected benefits. IRWD and Rosedale may also participate in and support monitoring programs which assess flow effects on green sturgeon passage on the Feather River. Performance measures associated with Priority 14 would be developed to be consistent with local and regional conservation plans such as the Central Valley Joint Venture Implementation Plan. Benefits associated with this priority would be monitored by conducting bird surveys during the years in which recharge activity occurs.
How will operational decisions be made if physical parameters and biological responses fall outside the range of anticipated benefits?
Should the physical parameters and biological responses fall outside the range of anticipated benefits, IRWD and Rosedale will work with the appropriate agencies to determine a solution that restores the anticipated amount of ecosystem benefits without infringing upon other expected benefits such as emergency response and water supply.
What funding sources and financial commitments do you intend to utilize for the formation and implementation of an adaptive management and monitoring program over the duration of the claimed benefits?
Should the Kern Fan Project be awarded Prop 1 WSIP funding, IRWD and Rosedale will move forward in developing an adaptive management and monitoring program that meets the requirements of the program regulations. It is expected that the development of the plan would be jointly funded through IRWD and Rosedale's respective annual operating budgets. (See under **Feasibility and Implementation Risk Tab, Attachment 1** – Financial Feasibility). The implementation of the adaptive management plan over the duration of the claimed benefits would also be funded through IRWD and Rosedale's respective annual operating budgets.
Explain what environmental uncertainties are relevant to your claimed benefit(s) and will be included in your adaptive management and monitoring program (i.e. climate change, sea level rise, earthquakes, variation in snow pack, forest fires, landslides/erosion etc.).
Environmental uncertainties relevant to the benefits provided by the Project include climate change, variation in snow pack and periods of multi-year drought because the project benefits depend on unallocated Article 21 water supply available for recharge and storage in the project. MBK Engineers performed uncertainty analyses related to the potential future (WSIP 2070) climate change, including Project performance during critical droughts and the California WaterFix. This uncertainty analysis is included in the MBK Engineers Technical Memorandum and associated model, August, 2017. (See under the **Feasibility and Implementation Risk Tab, Attachment 1** – Technical Feasibility (MBK Engineers Report 2017). Results from the uncertainty analyses would be taken into consideration upon development of the adaptive management and monitoring program for the project.
REV 9: Efficient use of water to achieve multiple ecosystem benefits
Will the same unit of water benefit multiple priorities? If so, explain which priorities will benefit, and the anticipated differences in project water availability between priorities.
Water that accrues in the ecosystem account will provide benefit for the ecosystem priority 2 and ecosystem priority 12. When water is physically recharged into the groundwater basin at the project sites it will provide a temporary wetland habitat benefit for birds (ecosystem priority 14). When an ecosystem pulse is made and a 1-for-1 exchange occurs, the water extracted from the ground and used by DRWD and Rosedale is classified as Table A water and the water left in Oroville Reservoir for use in releasing the ecosystem pulse is reclassified as SWP system water. SWP system water released as part of an ecosystem pulse then provides increased flows in the Feather River which results in benefits for ecosystem priority 2 and ecosystem priority 12.
How will hydrologic connections among priorities be measured and guaranteed?
Hydrologic connections among priorities will be measured and guaranteed through implementation of the adaptive management and monitoring plan.

Physical Public Benefits Tab

A.1 Ecosystem Benefits:

Attach completed Ecosystem Priorities worksheets. Be sure to include the general information worksheet as well as worksheets for each priority being claimed for which funds are being requested. Identify at least one Program ecosystem priority for any ecosystem public benefit quantified. See section 6003(a)(1)(Q) of the regulations.

Priority 2 Worksheet

File: IRWD_Tab 4_Attach 1_Priority 2_FINAL.pdf

Priority 2: Provide flows to improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids.
Species Information
What salmonid species are you targeting?
Juvenile Central Valley spring-run Chinook salmon are the primary target of the spring flow pulse provided by the proposed project. April represents the peak month for outmigration of juvenile spring-run Chinook from the Feather and Sacramento River basins. Winter-run Chinook juveniles in the Sacramento River downstream of Verona (the confluence with the Feather River) will also benefit from the flow pulse provided by the proposed project. Steelhead smolts emigrating from the Feather and Sacramento River basins will also benefit, but insufficient data are available to quantify these benefits.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the flow related habitat needs of each species are described.
The basis for expected flow-related benefits are described and source-referenced in the Cramer Fish Sciences Technical Memorandum (CFS 2017) See also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application. Also see NMFS (2016a) and NMFS (2017) referenced in CSF 2017 report.
REV 2: Magnitude of ecosystem improvements
What is the expected magnitude of the ecosystem improvement that will address this priority? Magnitude should be expressed as: a) the change from current conditions without the project to current conditions with the project, and b) the change from 2030 conditions without the project to 2030 conditions with the project. How did you estimate this value? If the ecosystem improvement will benefit multiple salmonid species or runs, provide the magnitude of the ecosystem improvement for each species or run separately.
In 2030 conditions, the project provides for six additional April, Feather River flow pulses over 82 years of simulated hydrology (MBK 2017). Over fifty years of operations with the project (2030 conditions) these April flow pulses are expected to provide a net benefit of 586 additional ADULT Central Valley spring-run Chinook salmon and 41 additional ADULT Sacramento River winter-run Chinook salmon. In the 2070 condition, the project provides for five additional April, Feather River flow pulses over 82 years of simulated hydrology (MBK 2017). Over fifty years of operations (2070 conditions) these April flow pulses are s expected to provide a net benefit of 428 additional ADULT Central Valley spring-run Chinook salmon and 32 additional ADULT Sacramento River winter-run Chinook salmon. Methods used to assess and quantify these methods are described in the Cramer Fish Sciences Technical Memorandum See **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the magnitude of the ecosystem improvement is described and quantified.
The basis for expected flow-related benefits are described and source-referenced in the Cramer Fish Sciences Technical Memorandum. See **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application. Also see NMFS (2016a) and NMFS (2017) referenced in CSF 2017 report.
REV 3: Spatial and temporal scale of ecosystem improvements.
What is the geographical extent (e.g. river miles, acres) of the ecosystem improvement that will address this priority?
Flow pulses associated with the project will effect approximately 60 river miles of the Feather River (from the Thermalito Afterbay Outlet to Verona) and 67 river miles of the Sacramento River (from Verona to Rio Vista).
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) where the geographical extent of the ecosystem improvement is documented or mapped.

https://www.sacramentoriver.org/sac_river_atlas.php http://www.water.ca.gov/orovillerelicensing/docs/wg_study_reports_and_docs/EWG/sp-g2_interim_report_part_c%20.pdf
When during the year will the project provide flows to improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids? How are flows likely to vary with hydrologic conditions (i.e. among water year types) a) under current conditions with and without the project, and b) in 2030 with and without the project? If the ecosystem improvement will benefit multiple salmonid species or runs, provide the timing of ecosystem improvements for each species or run separately.
The flow pulse will occur in the month of April. With 2030 conditions, over 82 years of historic hydrologies the flow pulse occurs six times. Five times in dry water years and once in an extremely dry water year. Since flow pulses occur in years with generally low river flows (without the project), greater benefits are achieved for target salmonids (the assumed flow-survival relationship is non-linear, see **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) for more information).
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the timing of ecosystem improvements that address this priority are described and quantified.
See MBK Engineer's Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and see also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.
REV 4: Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers to achieve ecosystem benefits.
Provide additional information on how this ecosystem improvement will be incorporated into the adaptive management and monitoring program. If available, provide examples of objectives, performance measures, thresholds, or triggers that could be used to manage benefits associated with this priority.
Natural resource management entities (DWR, NMFS, CDFW, USFWS, USBR) regularly conduct survival studies on outmigration of juvenile Chinook salmon and steelhead. A relevant performance metric for the proposed project would be an observed flow-survival relationships consistent with the predicted flow-survival relationships described by NMFS (2017) and utilized in the project analysis (CFS 2017). New information on the patterns of flow-survival or emigration timing for spring-run and winter-run Chinook juveniles may suggest changes in the timing or magnitude of flow pulses provided by the project. See **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application. IRWD will participate in and support flow-survival studies relevant to evaluating performance of the flow pulses in achieving expected ecosystem benefits.
REV 5: Immediacy of ecosystem improvement actions and realization of benefits
Immediacy of ecosystem improvement: Number of months from grant encumbrance until the proposed ecosystem improvement is completed (i.e. the expected timeframe until the improvement is implemented or construction is completed).
The project will require 3 years and 6 months for construction and is expected to begin storing water available for flow pulses by the year 2025. The year in which the first flow pulse will be delivered is dependent on future hydrologies and cannot be predicted in advance.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the immediacy timeframe is described and quantified.
See MBK Engineer's Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and see also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.
Realization of ecosystem improvement: Number of months from the time the ecosystem improvement is completed (i.e. project is implemented or construction is complete), until the benefit associated with this priority can be observed (i.e. when measurable improvements can be observed and quantified)
Analysis conducted by MBK indicates 6 flow pulses will occur with the project over 82 years of historic hydrologies (2030 conditions). If we assume each historic water year is an independent event, then there is 7.3% probability of a project flow pulse occurring in any year after the project is fully operated. There is a greater than 50% probability of at least one project related flow pulse occurring within ten years of the project operating. See MBK Engineer's Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report).

Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the realization timeframe is described and quantified.
See MBK Engineer's Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report),
REV 6: Duration of ecosystem improvements
How long (number of years) after realization (as calculated under REV 5 above) is the ecosystem improvement expected to address this priority? Maximum is 100 years. Explain how this value was determined and whether the magnitude of the ecosystem improvement is anticipated to change over time.
After realization, a minimum of 18,000 AF of groundwater will need to accrue in the Ecosystem Benefits account in order to make a flow pulse. Assuming historic hydrologies and each water year occurs as independent event, flow pulses associated with the project are expected to occur with an annual probability of 7.3%. The ecosystem improvement will address this priority whenever a flow pulse occurs.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the duration of the ecosystem improvement is described and quantified.
See MBK Engineer's Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report). Also see the Operations Plan located in the **Benefit Calculation, Monetization, Resiliency Tab, Attachment 2.**
REV 7: Consistency with species recovery plans and strategies, initiatives, and conservation plans
Does the ecosystem improvement meet any goals or objectives established in existing species recovery plans, initiatives, or conservation plans including but not limited to the NOAA Fisheries Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead; State Wildlife Action Plan; Central Valley Joint Venture Implementation Plan, San Joaquin County Multi-Species Habitat Conservation Plan and Open Space Plan, Draft Solano Multi-Species Habitat Conservation Plan, East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan, Draft Recovery Plan for the Giant Garter Snake, and California Water Action Plan? If so which goals, objectives, or actions will be met? Why?
Yes. Flow pulses to improve rearing and outmigration survival of winter-run Chinook salmon, spring-run Chinook salmon and steelhead are identified in the NMFS recovery plan for the species. Specifically, Actions IDs SFB-1.3, DEL-1.1, DEL-1.3, and FER-1.10 from the 2014 NMFS recovery plan. In addition, the Biological Opinion for operation the Oroville Facilities (NMFS 2016) specifically calls for evaluation of Feather River flow pulses to benefit spring-run Chinook, steelhead and green sturgeon.
Additional locations in the application, supporting documentation or attachments (page number, table number, other) where the consistency with goals, objectives, or actions from recovery plans, initiative, or conservation plans are discussed.
See Cramer Fish Sciences Report under file name IRWD_Tab 4-A2-CFS_TechMemo_Final.docx included in the **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2.**
REV 8: Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values
Provide a map that shows the extent of the ecosystem improvement that will address this priority (e.g. river miles that meet the temperature benefits). Provide additional instructions or clarification to reviewers who will be viewing this map (i.e. describe the color and/or label that identifies the spatial extent of the ecosystem improvement). If available, also submit supporting electronic files such as a .kmz file or ArcGIS layer associated with the maps provided.
The ecosystem benefits associated with the project will occur within the active channel of the Feather River. A map of the Feather River is included in under **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2,** see IRWD_FeatherRiverMap.pdf.
Explain why this location was selected. How is the location beneficial to the targeted species in the context of local environmental conditions and the target species' needs?
The Feather River was selected because of its function as a corridor of water conveyance for the State Water Project and because the Feather River hosts in-river and hatchery spawning Feather River spring-run Chinook salmon both part of the listed CV spring-run Chinook salmon ESU (NMFS 2016b). NMFS, in their most recent five-year review of CV spring-run, assigned a recovery priority for spring-run Chinook salmon in the Feather River of 5 (with 1 being the highest priority, 12 being the lowest priority) (NMFS 2016b). These determinations are based upon the evolutionary legacy the Feather River spring-run stock

represents, because the stock continues to exhibit a CV spring-run Chinook salmon migration timing, and because of habitat and management improvements required as part of the Oroville Facilities FERC Relicensing Settlement Agreement. Project flow pulses originating in the Feather River affect the Sacramento River downstream of Verona and thereby benefit spring-Chinook, winter Chinook and steelhead originating from points upstream in the Sacramento River basin. See Cramer Fish Sciences Report included in **Physical Public Benefits Tab, Ecosystem Benefits Section, Attachment 2** – CFS 2017 report for references cited above.
Is the ecosystem improvement location adjacent to, or near, other areas already being protected or managed for conservation values? Explain the proximity of the ecosystem improvement to other areas already being protected or managed for conservation values and any hydrologic connectivity that may occur between these locations.
The Feather and Sacramento River corridors are adjacent to numerous habitat features managed for conservation of anadromous salmonids and other species. For example, existing or future floodplain enhancements on the Feather and Sacramento River could benefit from project flow pulses if those flow pulses helped to extend or achieve floodplain inundation in conjunction with flow pulse events originating from other water sources. The flow pulses provided by the project are not expected to appreciably inundate floodplain features alone, but could compliment other such efforts.
Are the flows provided physically accessible by the targeted species in all year types? If not, explain barriers that may exist between the targeted species and ecosystem improvements.
Yes. The Feather and Sacramento Rivers are essential migratory corridors for juvenile salmonids in April of all water year types.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the spatial extent of the ecosystem improvement, the proximity of the ecosystem improvement to other areas already being protected or managed for conservation value, and the degree to which hydrologic connections (if any) occur between the ecosystem improvement and areas already being protected or managed for conservation value.
None that can be specifically identified and quantified.
REV 9: Efficient use of water to achieve multiple ecosystem benefits
How will water provided to address this priority be managed? Explain design efficiencies and operational strategies intended to maximize the efficiency of water allocated to ecosystem improvements that address this priority.
Ecosystem benefits for this priority are achieved when a flow pulse is released. In the years when flow pulses are released, Delta carriage water costs are reduced because project water was exported during periods of Delta surplus with no carriage water cost and stored in the export service area. The model used to calculate these benefits assumes 20 percent carriage water and the 3 percent conveyance loss can be saved when extracting water from the project for delivery within the export service area instead of meeting those demands from Oroville Reservoir.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe the design efficiencies and operational strategies used to maximize water efficiency under this priority.
For a description and details on design efficiencies and operational strategies to maximize water efficiency, see page 6 of the MBK Engineers' Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report)., and see also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.
REV 10: Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change.
Which environmental uncertainties associated with this priority were considered in the project siting, design, and operation? How were these uncertainties incorporated into project siting, design, or operation? Examples of environmental uncertainties include, but are not limited to: sea level rise, temperature changes, changes in precipitation, landslides, erosion, earthquakes, wildfires, drought events, and flooding events.
MBK Engineers (MBK) performed uncertainty analyses related to potential climate change, the California Water Fix, and the project's performance during drought. Using the results from these uncertainty analyses, CFS determined the change in winter-run and spring-run adult Chinook salmon over fifty years of project operations. Under 2070 climate change conditions, the project provided a net benefit of 428 spring-run Chinook and 32 winter-run Chinook. Under the California Water Fix future condition the project provided a net benefit of 452 spring-run Chinook and net loss of 34 winter-run Chinook. The reason for net loss of winter-run Chinook is because North Delta diversions associated with the California Water Fix more directly impact winter-run Chinook smolts than do South Delta exports. Further information on the uncertainty analyses preformed can be found in the MBK Engineers' and the CFS reports under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical

Feasibility (MBK Engineers, 2017 report) and also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the environmental uncertainties considered in the project siting, design, and operation.
See MBK Engineers and Cramer Fish Sciences reports under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.

Physical Public Benefits Tab

A.1 Ecosystem Benefits:

Attach completed Ecosystem Priorities worksheets. Be sure to include the general information worksheet as well as worksheets for each priority being claimed for which funds are being requested. Identify at least one Program ecosystem priority for any ecosystem public benefit quantified. See section 6003(a)(1)(Q) of the regulations.

Priority 12 Worksheet

File: IRWD_Tab 4_Attach 1_Priority 12_FINAL.pdf

Priority 12: Enhance access to fish spawning, rearing, and holding habitat by eliminating barriers to migration
Species Information
What species are you targeting?
With regard to Priority 12, adult green sturgeon are the target of a spring flow pulse provided by the proposed project. Per Technical Memorandum by Cramer Fish Sciences (CFS), August 4, 2017, "the upstream migration of adult green sturgeon in Feather Rivers is high for the month of April and upstream passage for green sturgeon appears to be positively influenced by river flow (National Marine Fisheries Service (NMFS), 2016a as cited in CFS 2017). See **Physical Public Benefits Tab, Attachment 2** (CFS 2017 report) in WSIP funding application.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the spawning, rearing, and holding habitat needs of this species are described and quantified.
The Biological Opinion for the Oroville Facilities relicensing describes needs and stressors for adult green sturgeon in the Feather River (see NMFS 2016a as cited in CFS 2017). See also **Physical Public Benefits Tab, Attachment 2** (CFS 2017 report) in WSIP funding application.
REV 2: Magnitude of ecosystem improvements
What is the expected magnitude of the ecosystem improvement that will address this priority? Magnitude should be expressed as: a) the change from current conditions without the project to current conditions with the project, and b) the change from 2030 conditions without the project to 2030 conditions with the project. How did you estimate this value? If the project intends to benefit multiple species, the magnitude of the ecosystem improvement for each species needs to be provided.
In 2030 conditions, the project provides for six additional April, Feather River flow pulses over 82 years of simulated hydrology (MBK Engineers, 2017). In the 2070 condition, the project provides for five additional April, Feather River flow pulses over 82 years of simulated hydrology (MBK Engineers, 2017). These flow pulses are expected to attract and enhance upstream passage of adult green sturgeon in the Feather River- particularly during low flow conditions at locations like Sunset Pumps (see NMFS 2016a). Though information to quantify these benefits is not currently available, NMFS (2016a) indicates flows within the range of the project flow pulse (additional 2,400cfs for 3.75 days) would provide for improved green sturgeon passage during dry and critically dry years. See also **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and **Physical Public Benefits Tab, Attachment 2** – CFS 2017 report.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the magnitude of the ecosystem improvement is described and quantified.
The Biological Opinion for the Oroville Facilities relicensing describes needs and stressors for adult green sturgeon in the Feather River (see NMFS 2016a as cited in CFS 2017). See also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application.
REV 3: Spatial and temporal scale of ecosystem improvements.
What is the geographical extent (e.g. river miles, acres) of the ecosystem improvement that will address this priority?
Flow pulses associated with the project will affect approximately 60 river miles of the Feather River (from the Thermalito Afterbay Outlet to Verona). Primary benefits to upstream passage are expected to occur at Sunset Pumps (River Mile 38.5) and Steep Riffle (River Mile 62). See also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) where the geographical extent of the ecosystem improvement is documented or mapped.
See NMFS 2016a as cited in CFS 2017. See also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application.
When during the year will barriers to migration be eliminated? How is access to spawning, rearing, and holding habitats likely to vary with hydrologic conditions (i.e. among water year types) a) under current conditions with and without the project, and b) in 2030 with and without the project?
The flow pulse will occur in the month of April. With 2030 conditions, over 82 years of historic hydrologies, the flow pulse occurs six times- five times in dry water years and once in an extremely dry water year. Analysis described by NMFS (2016a)

indicates that flow pulses consistent with magnitude of the proposed project would provide for improved green sturgeon passage during dry and critically dry years when it is most needed. In years where no flow pulse occurs, the project would have no affect on upstream passage of adult green sturgeon. See also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the timing of enhanced access to spawning, rearing and holding habitat are described and quantified.
NMFS (2016a) describes flow related needs for attraction and passage of adult green sturgeon into the Feather River. See also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application.
REV 4: Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers to achieve ecosystem benefits.
Provide additional information on how this ecosystem improvement will be incorporated into the adaptive management and monitoring program. If available, provide examples of objectives, performance measures, thresholds, or triggers that could be used to manage benefits associated with this priority.
Natural resource management entities (DWR, NMFS, CDFW, USFWS, USBR) conduct regular monitoring and special studies of adult green sturgeon passage and spawning success in the Feather River. As indicated previously, adult green sturgeon are expected to benefit from the proposed project, but insufficient information is currently available to quantify those expected benefits or to set performance measures associated with the action. IRWD will participate in and support monitoring programs which assess flow effects on green sturgeon passage on the Feather River. Changes in the timing and magnitude of project flow pulses to benefit green sturgeon will be considered as new information becomes available. See also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** (CFS 2017 report) in WSIP funding application.
REV 5: Immediacy of ecosystem improvement actions and realization of benefits
Immediacy of ecosystem improvement: Number of months from grant encumbrance until the proposed ecosystem improvement is completed (i.e. the expected timeframe until the improvement is implemented or construction is completed).
The project will require 3 years and 6 months to complete design and construction and is expected to begin storing water available for flow pulses by the year 2025. The year in which the first flow pulse will be delivered is dependent on future hydrologies and cannot be predicted in advance. **Feasibility and Implementation Risk Tab, Attachment 1** – Appendix A
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the immediacy timeframe is described and quantified.
See MBK Engineer's Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and see also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.
Realization of ecosystem improvement: Number of months from the time the ecosystem improvement is completed (i.e. project is implemented or construction is complete), until the benefit associated with this priority can be observed (i.e. when measurable improvements can be observed and quantified)
Analysis conducted by MBK indicates 6 flow pulses will occur with the project over 82 years of historic hydrologies (2030 conditions). If we assume each historic water year is an independent event, then there is 7.3% probability of a project flow pulse occurring in any year after the project is fully operational. There is a greater than 50% probability of at least one project related flow pulse occurring within ten years of the project operating. See also **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the realization timeframe is described and quantified.
See MBK Engineer's Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and see also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.
REV 6: Duration of ecosystem improvements

How long (number of years) after realization (as calculated under REV 5 above) is the ecosystem improvement expected to address this priority? Maximum is 100 years. Explain how this value was determined and whether the magnitude of the ecosystem improvement is anticipated to change over time.
After realization, a minimum of 18,000 AF of groundwater will need to accrue in the Ecosystem Benefits account in order to make a flow pulse. Assuming historic hydrologies and each water year occurs as an independent event, flow pulses associated with the project are expected to occur with an annual probability of 7.3%. The ecosystem improvement will address this priority whenever a flow pulse occurs.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the duration of the ecosystem improvement is described and quantified.
See MBK Engineer's Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and see also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report. Also see the Preliminary Operations Plan located in the **Benefit Calculation, Monetization, Resiliency Tab, Attachment 2.**
REV 7: Consistency with species recovery plans and strategies, initiatives, and conservation plans
Does the ecosystem improvement meet any goals or objectives established in existing species recovery plans, initiatives, or conservation plans including but not limited to the NOAA Fisheries Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead; State Wildlife Action Plan; Central Valley Joint Venture Implementation Plan, San Joaquin County Multi-Species Habitat Conservation Plan and Open Space Plan, Draft Solano Multi-Species Habitat Conservation Plan, East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan, Draft Recovery Plan for the Giant Garter Snake, and California Water Action Plan? If so which goals, objectives, or actions will be met? Why?
A recovery plan for the southern distinct population segment of green sturgeon is not currently available. However, flow pulses to provide for attraction and improved upstream passage of green sturgeon have been identified in the Oroville Facilities Biological Opinion (NMFS 2016a). Furthermore, the Feather River is considered critical habitat for green sturgeon. **Physical Public Benefits Tab, Ecosystem Benefits Section, Attachment 2** – CFS 2017 report.
Additional locations in the application, supporting documentation or attachments (page number, table number, other) where the consistency with goals, objectives, or actions from recovery plans, initiative, or conservation plans are discussed.
See NMFS 2016a and also **Physical Public Benefits Tab, Ecosystem Benefits Section, Attachment 2** – CFS 2017 report.
REV 8: Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values
Provide a map that shows the extent of the ecosystem improvement that will address this priority (e.g. river miles that meet the temperature benefits). Provide additional instructions or clarification to reviewers who will be viewing this map (i.e. describe the color and/or label that identifies the spatial extent of the ecosystem improvement). If available, also submit supporting electronic files such as a .kmz file or ArcGIS layer associated with the maps provided.
The ecosystem benefits associated with the project will occur within the active channel of the Feather River. A map of the Feather River is included in under **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2,** see IRWD_FeatherRiverMap.pdf.
Explain why the barrier proposed for elimination was selected. How is the location of the barrier proposed for elimination beneficial to the targeted species in the context of local environmental conditions and the target species' needs?
The Feather River is critical habitat for green sturgeon and flow related passage barriers have been identified in the Oroville Facilities Biological Opinion (NMFS 2016a). See also **Physical Public Benefits Tab, Ecosystem Benefits Section, Attachment 2 –** CFS 2017 report.
Is the ecosystem improvement location adjacent to, or near, other areas already being protected or managed for conservation values? Explain the proximity of the ecosystem improvement to other areas already being protected or managed for conservation values and any hydrologic connectivity that may occur between these locations.
The Feather and Sacramento River corridors are adjacent to numerous habitat features managed for conservation of anadromous salmonids and other species. For example, existing or future floodplain enhancements on the Feather and Sacramento River could benefit from Project flow pulses if those flow pulses helped to extend or achieve floodplain inundation in conjunction with flow pulse events originating from other water sources. The flow pulses provided by the project are not expected to appreciably inundate floodplain features alone, but could compliment other such efforts.

Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the spatial extent of the ecosystem improvement, the proximity of the ecosystem improvement to other areas already being protected or managed for conservation value, and the degree to which hydrologic connections (if any) occur between the ecosystem improvement and areas already being protected or managed for conservation value.
None that can be specifically identified and quantified.
REV 9: Efficient use of water to achieve multiple ecosystem benefits
If applicable, how will water provided to address this priority be managed? Explain design efficiencies and operational strategies intended to maximize the efficiency of water allocated to ecosystem improvements that address this priority.
Ecosystem benefits for priority 12 are achieved when a flow pulse is released. In the years when flow pulses are released, Delta carriage water costs are reduced because project water was exported during periods of Delta surplus with no carriage water cost and stored in the export service area. The model used to calculate these benefits assumes 20 percent carriage water and the 3 percent conveyance loss can be saved when extracting water from the project for delivery within the export service area instead of meeting those demands from Oroville Reservoir.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe the design efficiencies and operational strategies used to maximize water efficiency under this priority.
For a description and details on design efficiencies and operational strategies to maximize water efficiency, see page 6 of the MBK Engineers' Report included under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report)., and see also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.
REV 10: Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change.
Which environmental uncertainties associated with this priority were considered in the project siting, design, and operation? How were these uncertainties incorporated into project siting, design, or operation? Examples of environmental uncertainties include, but are not limited to: sea level rise, temperature changes, changes in precipitation, landslides, erosion, earthquakes, wildfires, drought events, and flooding events.
MBK Engineers performed uncertainty analyses related to potential climate change, the California Water Fix, and the project's performance during drought. Results from these uncertainty analyses show that under 2070 climate change conditions average annual supply allocated to ecosystem benefits is reduced by approximately 200 AF per year. The effects of this reduction in water supply specifically associated with this priority were not quantified. Further information on the uncertainty analyses preformed can be found in the MBK Engineers' and the CFS reports under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the environmental uncertainties considered in the project siting, design, and operation.
See MBK Engineers and Cramer Fish Sciences reports under **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report), and also **Physical Public Benefits Tab, Ecosystem Benefits, Attachment 2** – CFS 2017 report.

Physical Public Benefits Tab

A.1 Ecosystem Benefits:

Attach completed Ecosystem Priorities worksheets. Be sure to include the general information worksheet as well as worksheets for each priority being claimed for which funds are being requested. Identify at least one Program ecosystem priority for any ecosystem public benefit quantified. See section 6003(a)(1)(Q) of the regulations.

Priority 14 Worksheet

File: IRWD_Tab 4_Attach 1_Priority 14_FINAL.pdf

Priority 14: Provide water to enhance seasonal wetlands, permanent wetlands, and riparian habitat for aquatic and terrestrial species on State and Federal wildlife refuges and on other public and private lands
REV 2: Magnitude of ecosystem improvements
What is the expected magnitude of the ecosystem improvement that will address this priority? Magnitude should be expressed as: a) the change from current conditions without the project to current conditions with the project, and b) the change from 2030 conditions without the project to 2030 conditions with the project. How did you estimate this value?
In 2030 conditions over a 50 year operating period, it is expected that the project would provide temporary wetland habitat to migratory birds for an average duration of approximately 1.5 months during years in which recharge activity occurs. This incidental benefit occurs whenever water is being recharged onto the project sites. The availability of temporary habitat was then determined by the availability of water supply for the project.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the magnitude of the ecosystem improvement is described and quantified.
See 'IRWD_Priority14' file under the **Physical Public Benefits Tab, Ecosystem Benefits Section, Attachment 2.**
REV 3: Spatial and temporal scale of ecosystem improvements.
What is the geographical extent (e.g. river miles, acres) of the ecosystem improvement that will address this priority?
The project would provide water to approximately 1,200 acres of recharge ponds located on two separate project sites. The temporary wetland area would be the area of the recharge ponds.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) where the geographical extent of the ecosystem improvement is documented or mapped.
Location of the proposed project facilities that demonstrates the extent of the temporary wetland area is located in **Feasibility and Implementation Risk Tab, Attachment 1** – Appendix A (Dee Jaspar & Associates Draft Concept Study, 2017).
When during the year will water be provided for seasonal wetlands, permanent wetlands, and riparian habitat? How are seasonal wetlands, permanent wetlands, and riparian habitat likely to vary with hydrologic conditions (i.e. among water year types) a) under current conditions with and without the project, and b) in 2030 with and without the project?
Water is estimated to be recharged on the project sites and will provide temporary wetland habitat during the winter months of wet, above normal and below normal water years when recharge activity occurs. Under 2030 conditions during wet years when recharge activity occurs, the project can be expected to provide approximately 1.44 months of temporary wetland habitat. Under these conditions during above normal years approximately 2 months of temporary habitat can be expected and during below normal years approximately 1 month of temporary habitat can be expected.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the timing of water releases for seasonal wetlands, permanent wetlands, or riparian habitat improvements are described and quantified.
See 'IRWD_Priority14' file under the **Physical Public Benefits Tab, Ecosystem Benefits Section, Attachment 2**.
REV 4: Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers to achieve ecosystem benefits.
Provide additional information on how this ecosystem improvement will be incorporated into the adaptive management and monitoring program. If available, provide examples of objectives, performance measures, thresholds, or triggers that could be used to manage benefits associated with this priority.
IRWD and Rosedale will work with the CDFW to develop an adaptive management and monitoring program that meets the requirements of the program regulations. In order to measure performance of the public benefit provided by the project, IRWD and Rosedale intend to conduct bird surveys during the years in which recharge activity occurs. In addition, IRWD and Rosedale may coordinate monitoring programs with other local agencies near the project site that currently manage wetland habitats.
REV 5: Immediacy of ecosystem improvement actions and realization of benefits
Immediacy of ecosystem improvement: Number of months from grant encumbrance until the proposed ecosystem improvement is completed (i.e. the expected timeframe until the improvement is implemented or construction is completed).
The project will require approximately 3 years and 6 months for construction to be completed and is expected to be able to begin to store water by the year 2025. The year in which the unallocated Article 21 water is first delivered to the recharge ponds is dependent upon future hydrologies and cannot be predicted in advance.

Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the immediacy timeframe is described and quantified.
Project schedule is located in the **Feasibility and Implementation Tab, Attachment 3.**
Realization of ecosystem improvement: Number of months from the time the ecosystem improvement is completed (i.e. project is implemented or construction is complete), until the benefit associated with this priority can be observed (i.e. when measurable improvements can be observed and quantified)
Construction of the project is expected to be completed in 2025. Water will be recharged into the ponds as soon as unallocated Article 21 water supply becomes available for the project. The temporary wetland habitat will be available for migratory birds and other water fowl when water is recharged into the ponds.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the realization timeframe is described and quantified.
Project schedule is located in the **Feasibility and Implementation Tab, Attachment 3**.
REV 6: Duration of ecosystem improvements
How long (number of years) after realization (as calculated under REV 5 above) is the ecosystem improvement expected to address this priority? Maximum is 100 years. Explain how this value was determined and whether the magnitude of the ecosystem improvement is anticipated to change over time.
After realization of this improvement, the project is expected to provide temporary wetland habitat to migratory birds whenever recharge activity occurs on the project sites. Over an 82 year simulation period using historical hydrology, the project was expected to have a total of 23 months of recharge under 2030 conditions. Using historical hydrology, it was determined that the project would have 1 to 3 months of temporary habitat during years in which recharge activity occurs depending on the year type. Duration of recharge was determined using the approximate area of recharge basins (1,200 acres), recharge rate of land (0.7 ft/day), and amount of water recharged per event.
Additional locations in the application, supporting documentation or attachments (document name, page number, table number, other) where the duration of the ecosystem improvement is described and quantified.
See 'IRWD_Priority14' file under the **Physical Public Benefits Tab, Ecosystem Benefits Section, Attachment 2.**
REV 7: Consistency with species recovery plans and strategies, initiatives, and conservation plans
Does the ecosystem improvement meet any goals or objectives established in existing species recovery plans, initiatives, or conservation plans including but not limited to the NOAA Fisheries Recovery Plan for Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead; State Wildlife Action Plan; Central Valley Joint Venture Implementation Plan, San Joaquin County Multi-Species Habitat Conservation Plan and Open Space Plan, Draft Solano Multi-Species Habitat Conservation Plan, East Contra Costa County Habitat Conservation Plan/Natural Community Conservation Plan, Draft Recovery Plan for the Giant Garter Snake, and California Water Action Plan? If so which goals, objectives, or actions will be met? Why?
As identified in the Stockdale Integrated Banking Project Final EIR, the tricolored blackbird is considered to have a high potential to occur near the project site. The open water canals and agricultural fields on and near the proposed project sites can support the species. The tricolored blackbird is not a focal species in the Central Valley Joint Venture Implementation Plan however the Central Valley Joint Venture Implementation Plan states that it is a partner in the conservation of the tricolored blackbird species. In addition, the tricolored blackbirds are the focus of conservation efforts supported by partners of the Central Valley Joint Venture.
Additional locations in the application, supporting documentation or attachments (page number, table number, other) where the consistency with goals, objectives, or actions from recovery plans, initiative, or conservation plans are discussed.
Further information can be found in the Environmental Setting section of the Stockdale Integrated Banking Project Final EIR. See link to Final EIR located in the **Feasibility and Implementation Risk Tab, Attachment 4.**
REV 8: Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values
Provide a map that shows the extent of the ecosystem improvement that will address this priority (e.g. river miles that meet the temperature benefits). Provide additional instructions or clarification to reviewers who will be viewing this map (i.e. describe the color and/or label that identifies the spatial extent of the ecosystem improvement). If available, also submit supporting electronic files such as a .kmz file or ArcGIS layer associated with the maps provided.

The temporary wetland habitat expected to be made available from the project will be within the recharge basins that will be constructed on two project sites, totally approximately 1,200 acres. A map showing the location of the proposed project sites is located in the **Feasibility and Implementation Risk Tab, Attachment 1** – Appendix A (Dee Jaspar & Associates Draft Concept Study, 2017).
Explain why this location was selected. How does this location enhance seasonal wetlands, permanent wetlands, and riparian habitat for aquatic and terrestrial species in the context of local environmental conditions?
The temporary wetland habitat expected to be made available from the project is an incidental benefit that occurs as result of normal project recharge operations during wet, above normal, and below normal water years. The two project sites were selected due to their soils properties and expected infiltration rates. The two project sites are also ideal within proximity to current water banking projects owned by IRWD and Rosedale as well as located within the additional site radius boundary identified in the Stockdale Project Final EIR (located in the **Feasibility and Implementation Risk Tab, Attachment 4**). The project's location is in the vicinity of properties managed by the Kern Water Bank Authority where several species of birds have been surveyed. The temporary habitat provided by the project would augment existing habitat to these birds.
Is the ecosystem improvement location adjacent to, within, or near, other areas already being protected or managed for conservation values? Explain the proximity of the ecosystem improvement to other areas already being protected or managed for conservation values and any hydrologic connectivity that may occur between these locations.
The proposed properties for the project are located within approximately 2 miles of the northern boundary of the Kern Water Bank. The Kern Water Bank property is a State and Federally designated habitat for sensitive and endangered native plant and animal species. 3,267 acres of the Kern Water Bank are designated as a Conservation Bank for projects located within the Kern Water Bank Authority Permit Area in the southern San Joaquin Valley. The Kern Fan project will recharge water through shallow ponds into the same underground aquifer that the Kern Water Bank recharges water into.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the spatial extent of the ecosystem improvement, the proximity of the ecosystem improvement to other areas already being protected or managed for conservation value, and the degree to which hydrologic connections (if any) occur between the ecosystem improvement and areas already being protected or managed for conservation value.
A map showing the vicinity of the project to the Kern Water Bank is shown as Figure 3.4-2 in the Stockdale Project Final EIR. A link to the Final EIR is located in the **Feasibility and Implementation Risk Tab, Attachment 4.**
REV 9: Efficient use of water to achieve multiple ecosystem benefits
How will water provided to address this priority be managed? Explain design efficiencies and operational strategies intended to maximize the efficiency of water allocated to ecosystem improvements that address this priority.
Unallocated Article 21 water is the supply anticipated for this project and provides an incidental benefit when recharged into the filtration ponds located on the project properties. Therefore any water supply acquired for this project will not only provide water supply benefits, emergency supply benefits, and benefits to winter and spring-run chinook salmon but will at the same time provide temporary habitat to migratory bird species when being recharged.
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe the design efficiencies and operational strategies used to maximize water efficiency under this priority.
Further information on how the project will be operated is located in the **Benefit Calculation, Monetization, Resiliency Tab, Attachment 2** (Preliminary Operations Plan).
REV 10: Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change.
Which environmental uncertainties associated with this priority were considered in the project siting, design, and operation? How were these uncertainties incorporated into project siting, design, or operation? Examples of environmental uncertainties include, but are not limited to: sea level rise, temperature changes, changes in precipitation, landslides, erosion, earthquakes, wildfires, drought events, and flooding events.
The availability of temporary wetland habitat provided by the project is directly related to the amount of water recharged onto the project site. Therefore any uncertainty associated with providing this ecosystem improvement is a result of decrease in the project's overall water supply. MBK Engineers performed uncertainty analyses related to potential climate change, the California Water Fix, and the project's performance during drought. MBK Engineers determined that under 2070 climate change conditions the project's average annual recharge is reduced by 400 AF. The availability of temporary habitat over fifty years of

project operations then decreases by approximately 1 month. However with the California Water Fix, MBK determined the project's average annual recharge increases by 5,500 AF thereby significantly increasing the availability of temporary habitat. See **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report),
Additional locations in the application, supporting documentation or attachments (document name, page number, figure name or number, other) that describe and quantify the environmental uncertainties considered in the project siting, design, and operation.
More information on uncertainty analyses performed for the project can be found in the **Feasibility and Implementation Risk Tab, Attachment 1 -** Technical Feasibility (MBK Engineers, 2017 report).

Physical Public Benefits Tab

A.2 Ecosystem Benefits:

Attach supporting documentation requested in Ecosystem priorities worksheets such as maps or other information not already provided elsewhere in the application.

Cramer Fish Sciences Technical Memorandum

File: IRWD_Tab 4-A2-Ecosystem_CFS_TechMemo_FINAL.pdf

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August 4th, 2017

TECHNICAL MEMORANDUM

Subject: Ecosystem Benefits from Kern Fan Groundwater Storage Project

Prepared for: Irvine Ranch Water District

Prepared by: Brad Cavallo, Dr. Steven Zeug and Dr. Myfanwy Johnston.

This technical memorandum provides a description of methodology, assumptions and results for an assessment of fishery ecosystem benefits resulting from the Kern Fan Groundwater Storage Project (Project).

1. Project operations for ecosystem benefits

The WSIP identifies sixteen priorities for ecosystem benefits. Cramer Fish Sciences (CFS) consulted with MBK Engineers and Irvine Ranch Water District to recommend how 18 thousand acre-feet (TAF) of additional water supply made available by proposed Project could be used to provide the greatest benefit to ecosystem priorities and relative environmental value criteria (Revs). CFS recommended a pulse released from Lake Oroville in the month of April. CALSIM analysis provided by MBK Engineers indicated the project could, with 1922-2003 hydrology, provide for six April flow pulses (of 18 TAF) in dry or critically dry years.

CFS recommended and assumed the 18TAF would be applied as a 3.75 day, 2,400cfs increase in Feather River flows released from the Thermalito Afterbay Outlet (TAO). Releasing this water from the TAO is important because the Feather River downstream of TAO has no ramping criteria for flows greater than 2,500 cfs (NMFS 2016a).

2. Methods for quantifying ecosystem benefits

Two ecosystem priorities are the primary beneficiaries of an April flow pulse on the Feather River. Ecosystem Priority 2 (P2) calls for "flows to improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids. April is a period of "high" relative abundance for downstream migration and rearing of juvenile spring Chinook and juvenile steelhead in the Feather River and in the Sacramento downstream of Verona (NMFS 2016a). Also in April, juvenile winter-run Chinook are at "low" abundance in the Sacramento River downstream of Verona (NMFS 2016a).

Ecosystem Priority 12 (P12) calls for enhanced "access to fish spawning, rearing, and holding habitat by eliminating barriers to migration". Upstream migration of adult green sturgeon in Feather Rivers is "high" for the month of April and upstream passage for green sturgeon appears to be positively influenced by river flow (NMFS 2016a).

Though April flow pulses are expected to benefit multiple fish species and life stages, our quantitative analysis focuses on assessing benefits (or impacts) to outmigrating juvenile spring-run Chinook and winter-run Chinook salmon. The Feather River hosts natural and hatchery origin spring-run Chinook. NMFS considers both in-river and hatchery spawning Feather River spring-run Chinook salmon to be part of the listed CV spring-run Chinook salmon ESU (NMFS 2016b). NMFS, in their most recent five-year review of CV spring-run, assigned a recovery priority for spring-run Chinook salmon in the Feather River of 5 (with 1 being the highest priority, 12 being the lowest priority) (NMFS 2016b). These determinations are based upon the evolutionary legacy the Feather River spring-run stock represents, because the stock continues to exhibit a CV spring-run Chinook salmon migration timing, and because of habitat and management improvements required as part of the Oroville Facilities FERC Relicensing Settlement Agreement.

Name	Value	Description	Source
SmH	2 million	Annual spring-run hatchery smolts released	FRH Spring Chinook HGMP
SmN	2 million	Annual natural origin spring-run smolt production from the Feather River (estimated from spawning escapement, fecundity, egg-fry survival data)	CDFW GrandTab; Zeug et al. (2012), Bradford (1995)
MIGm	Figure 1	Fraction of natural smolt emigration by month	Figure 1. Delta Passage Model (Available: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/CAWaterFix/app_5.d_methods.pdf)
MIGp	0.125	Fraction of days in month with flow pulse	Duratiion of flow pulse (3.75 days) divided by 30
rel	0.5	Fraction of FRH smolts released in April	FRH Spring Chinook HGMP
relf	0.5	Fraction of FRH smolt release which be coordinated to coincide with flow pulse	Ryon Kurth (CDWR), personal communication
B0	-2.1	Smolt survial in the Feather River (untransformed value)	NMFS (2016a), Figure 2-30
B1	1.47	Flow survival effect (untransformed value)	NMFS (2017), Table B1
Qm	variable	Standardized Feather River flow by month	CALSIM ouput
SmS	3.2 million	Annual natural origin spring-run smolts from the Sacramento River basin (estimated from spawning escapement, fecundity, egg-fry survival data)	CDFW GrandTab; Zeug et al. (2012), Bradford (1995)
SmW	2.1 million	Annual winter-run smolts from the Sacramento River (estimated from spawning escapement, fecundity, egg-fry survival data)	CDFW GrandTab; Zeug et al. (2012), Bradford (1995)
Sa	0.01	Survival rate for smolts to return as adults	Araujo et al. (2015)

Table 1. Values, descriptions and sources for inputs and parameters used for the quantification of project ecosystem benefits.

Data and sources used to evaluate effects of the proposed project on the survival of Feather River spring-run Chinook salmon are summarized in Table 1. The monthly number of hatchery origin spring-run smolts entering the Sacramento River (Sm_{FRH}) from the Feather River is estimated by

$$Sm_H * rel_m * relf * surv_m$$

and the monthly number of natural origin spring-run smolts entering the Sacramento River from the Feather River (Sm_{FRW})is estimated by

$$Sm_N * MIG_m * MIG_p * surv_m.$$

Survival for both hatchery and natural origin smolts are modeled as a function of monthly Feather River flows

$$logit(surv_m) = B0 + B1 * Q_m$$

where B0 and B1 are model parameters (Table 1), and Qm is monthly Feather River flows standardized relative to all monthly Feather River flow observations provided by CALSIM. Monthly flow data (1922 through 2003) representing four future conditions (WISP 2030, WISP 2030, WF_Base and WF) and two scenarios (project and no project) were provided by MBK Engineers (see MBK 2017). A total of eight different CALSIM scenarios were analyzed.

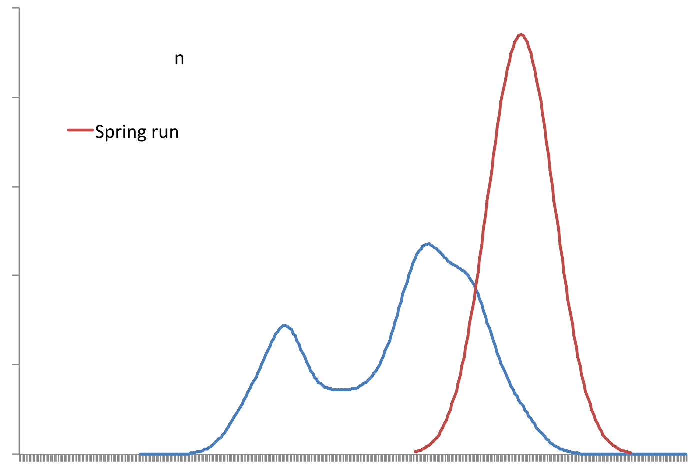

Figure 1. Smolt migration distributions used for analyses of survival from the Feather River through the Delta. Source: CWF (2016).

Survival rates for migrating juvenile Chinook salmon from Verona (Sacramento River) to San Francisco Bay was estimated using the Delta Passage Model (CWF 2016). The Delta Passage Model (DPM) was developed by Cramer Fish Sciences to integrate empirical study findings related to how water project operations influence the survival of juvenile Chinook salmon. Although the DPM is based primarily on studies of winter-run Chinook salmon smolt surrogates (late fall–run Chinook salmon), it is applied here for winter-run and spring-run Chinook salmon by adjusting emigration timing (Figure 1) and assuming that all migrating Chinook salmon smolts will respond similarly to Delta conditions. The DPM has undergone substantial revisions based on comments received through Cal Water Fix (previously BDCP) anadromous team meetings and in particular through feedback received during a workshop held on August 24, 2010, a 2-day workshop held June 23–24, 2011, and since then from various meetings of a workgroup consisting of agency biologists and consultants. The DPM analysis used for here has not been revised since September 2015 and is the same version used to analyze effects for Cal Water Fix (CWF 2016).

The DPM is based on a detailed accounting of migratory pathways and reach-specific mortality as Chinook salmon smolts travel through a simplified network of reaches and junctions (CWF 2016, Figure 5.D-40). The biological functionality of the DPM is based on the foundation provided by Perry et al. (2010) as well as other acoustic tagging–based studies (Holbrook et al. 2009) and coded wire tag (CWT)–based studies (Newman and Brandes 2010; Newman 2008).

The major model functions in the DPM are as follows.

1. Delta Entry Timing, which models the temporal distribution of smolts entering the Delta for each race of Chinook salmon.
2. Fish Behavior at Junctions, which models fish routing as they reach channel junctions.
3. Migration Speed, which models reach-specific smolt migration speed and travel time.
4. Route-Specific Survival, which models route-specific survival response to non-flow factors.
5. Flow-Dependent Survival, which models reach-specific survival response to flow.
6. Export-Dependent Survival, which models survival response to water export levels in the Interior Delta reach (CWF 2016, Table 5.D-35).

Functional relationships used in the DPM are described in detail in CWF (2016) Section 5.D.1.2.2.2.5, Model Functions.

Monthly CALSIM flow data for key Sacramento River, the Feather River and Delta water diversions were provided as inputs to the DPM (see CWF 2016 for details). The DPM produced annual survival rates weighted by monthly emigration timing for spring-run and winter-run Chinook salmon (Figure 1).

Sm_{FRH} and Sm_{FRW} provided inputs to the Delta Passage Model (DPM) representing Feather River Hatchery origin spring-run Chinook and Feather River natural origin spring-run Chinook, respectively. The number of spring-run (Sm_{SSRC}) and winter-run (Sm_{SWRC}) Chinook smolts entering from the Sacramento River basin are indicated in Table 1.

Total annual adult returns of spring-run Chinook salmon were calculated as

$$(Sm_{FRH}+Sm_{FRW}+Sm_{SSRC})*S_{DPM\_SRC} * S_a$$

and total annual adult returns of winter-run Chinook salmon were calculated as

$$Sm_{SWRC}*S_{DPM\_WRC} * S_a$$

Where…
S_{DPM_SRC} is the DPM-based estimate of survival for spring-run Chinook smolts to Delta exit;

S_{DPM_WRC} is the DPM-based estimate of survival for winter-run Chinook smolts to Delta exit; and where S_a is survival rate for smolts exiting the Delta to return as adults.

3. Results from quantitative analysis

MBK (2017) describes water project operations, river flows and water supply results associated with the project. Using these same simulated flows and water project operations, our analysis shows substantial net benefits to spring-run and winter-run Chinook (Table 2).

Table 2. Estimated net change in adult Chinook salmon resulting from 50 years of proposed project operations under four future conditions.

	Change in Adult Chinook Salmon Abundance from 50 years with Project	
Future Condition	Spring-run	Winter-run
2030	586	41
2070	428	32
WF_Base	516	24
WF	452	-34

As expected, benefits for Chinook salmon occur in years when the project allows for a Feather River flow pulse. In most years, Chinook salmon are not effected positively or negatively by the project. For spring-run Chinook, benefits equaling 107 to 252 additional adult Chinook occur in six years for the 2030 condition, and five years for the 2070 condition (Figure 2). Reductions in estimated annual adult Chinook occur in some years as a result of increased Delta diversions associated with the project, but these losses are outweighed by much larger benefits which accumulate across all years (Table 2).

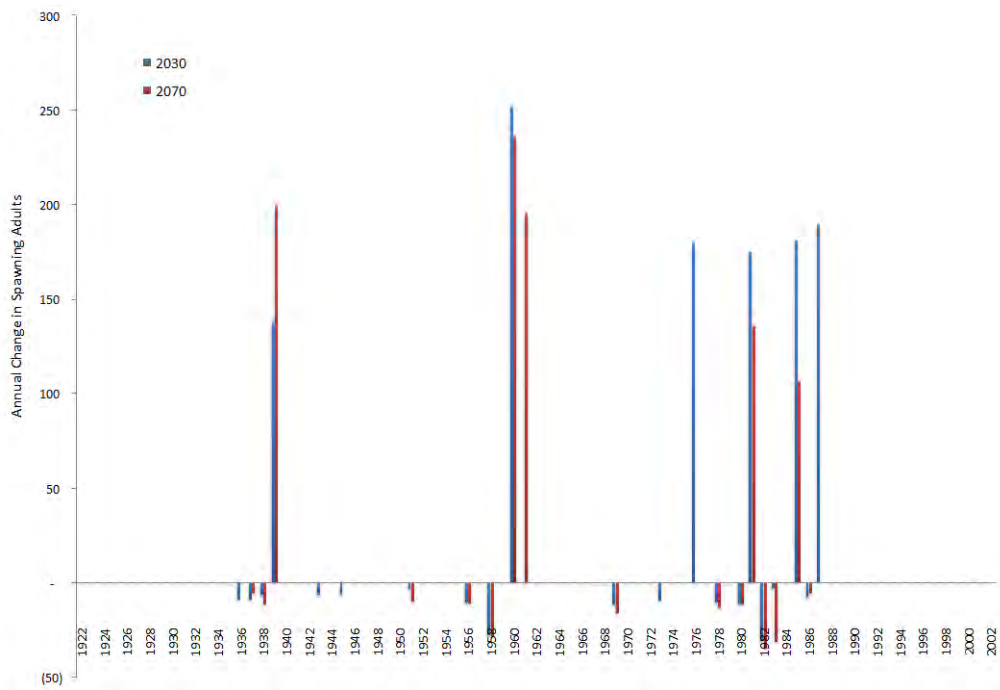

Figure 2. Annual change in adult spring-run Chinook spawners returns associated with the project under 2030 and 2070 future conditions.

Benefits from the project are also apparent for winter-run Chinook salmon. Though winter-run Chinook salmon are not present in the Feather River, the flow pulse originating from the Feather River reaches the Sacramento River and provides benefits from Verona to Delta exit. In most years, winter-run Chinook salmon are not effected positively or negatively by the project. Benefits ranging from 20 to 38 additional adult Chinook winter-run occur in six years for the 2030 condition, and five years for the 2070 condition (Figure 3). Most winter-run Chinook smolts emigrate through Delta prior to April and are thus sometimes exposed to increased winter exports sometimes associated with the project (MBK 2017). As with spring-run Chinook, Delta losses occur but are outweighed by larger benefits which accumulate across all years except for the WF future condition (Table 2). The WF future condition shows a net loss of winter Chinook because North Delta diversions associated with Cal Water Fix more directly impact winter-run Chinook smolts than do South Delta exports.

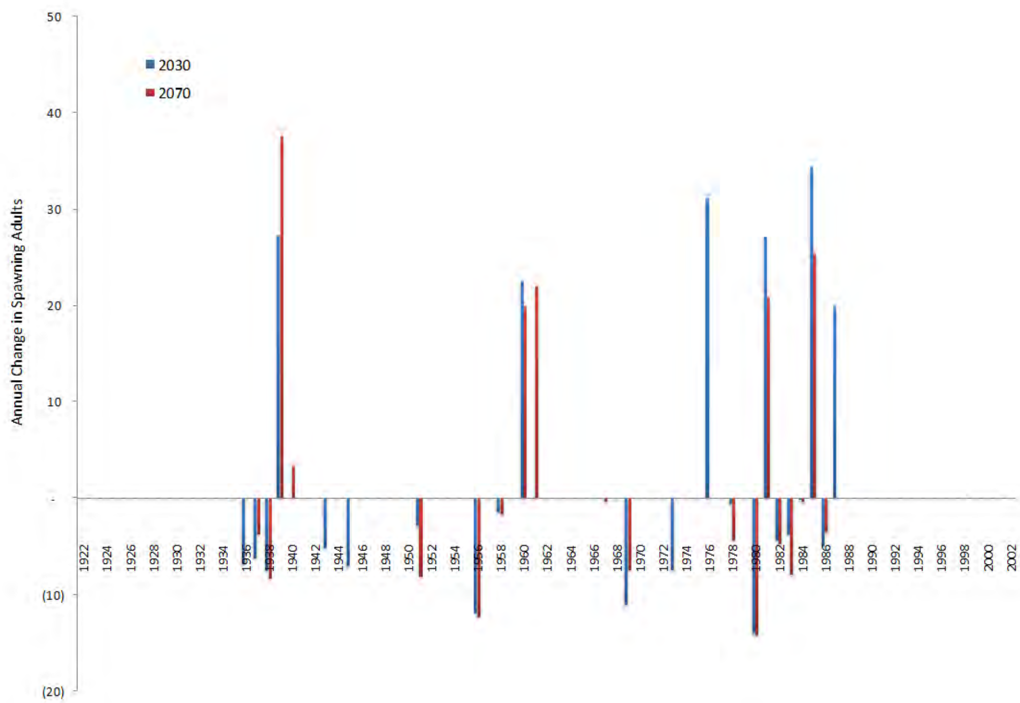

Figure 3. Annual change in adult winter-run Chinook spawning returns associated with the project under 2030 and 2070 future conditions.

Literature cited

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National Marine Fisheries Service (NMFS). 2016b. 5-Year Review: Summary and Evaluation of Central Valley Spring-run Chinook Salmon Evolutionarily Significant Unit. National Marine Fisheries Service, West Coast Region.

Newman, K. B. 2008. An evaluation of four Sacramento-San Joaquin River Delta juvenile salmon survival studies. US Fish and Wildlife Service, Stockton, CA.

Newman, K. B., and P. L. Brandes. 2010. Hierarchical modeling of juvenile Chinook salmon survival as a function of Sacramento-San Joaquin Delta water exports. North American Journal of Fisheries Management 30:157–169.

Perry, R. W. 2010. Survival and Migration Dynamics of Juvenile Chinook Salmon (Oncorhynchus tshawytscha) in the Sacramento-San Joaquin River Delta. Ph.D. Dissertation. University of Washington, Seattle, WA.

Zeug, S.C., P.S. Bergman, B.J. Cavallo, and K.S. Jones. 2012. Application of a life cycle simulation model to evaluate impacts of water management and conservation actions on an endangered population of Chinook salmon. Environmental Modeling and Assessment. 13 p.

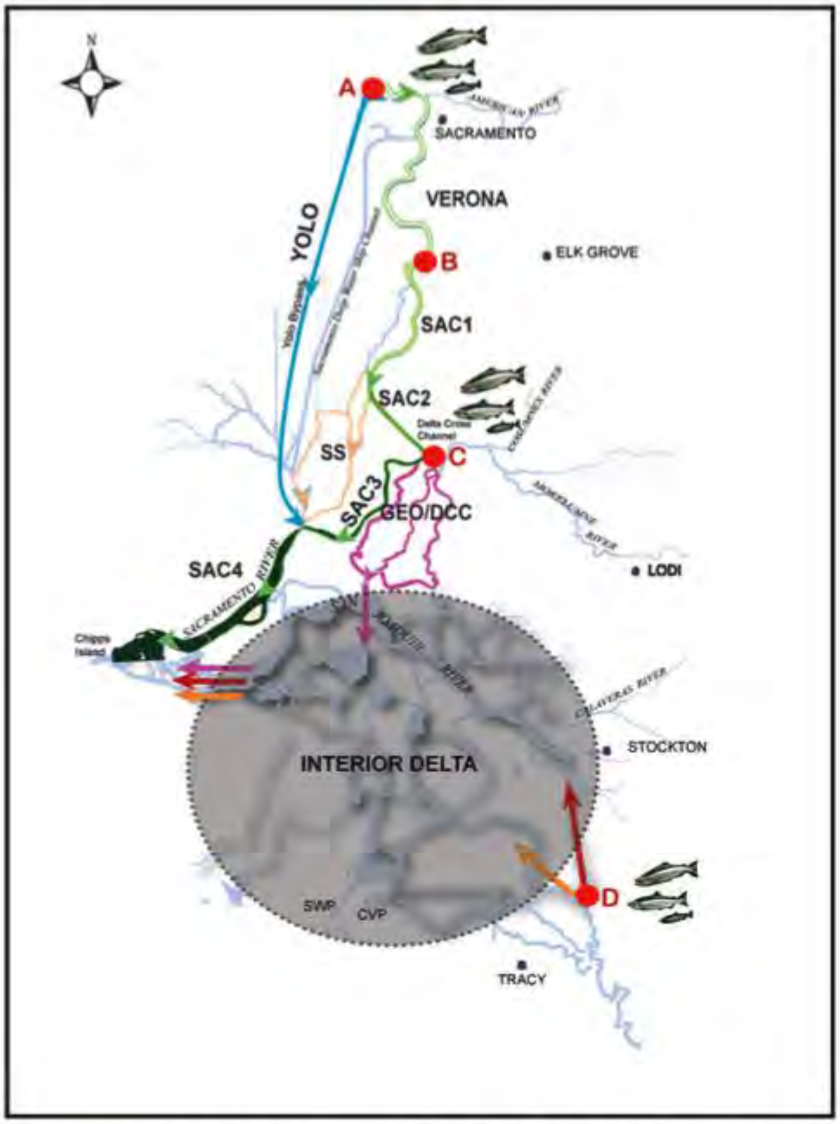
Physical Public Benefits Tab

A.2 Ecosystem Benefits:

Attach supporting documentation requested in Ecosystem priorities worksheets such as maps or other information not already provided elsewhere in the application.

Feather River Maps

File: IRWD_FeatherRiverMaps.pdf



Bold headings label modeled reaches, and red circles indicate model junctions. Salmonid icons indicate locations where smolts enter the Delta in the DPM. Smolts enter the Interior Delta from the Geo/DCC reach or from Junction D via Old River or from the San Joaquin River. Because of the lack of data informing specific routes through the Interior Delta, and tributary-specific survival, the entire Interior Delta region is treated as a single model reach but survival varies within the Interior Delta depending upon whether fish enter from the Sacramento River, Mokelumne River, the San Joaquin River, or Old River.

Figure 5.D-40. Map of the Sacramento–San Joaquin River Delta Showing the Modeled Reaches and Junctions of the Delta Applied in the Delta Passage Model

The Delta map is from documentation for the Delta Passage Model which CFS used to analyze project effects in the Sacramento River from Verona through the Delta

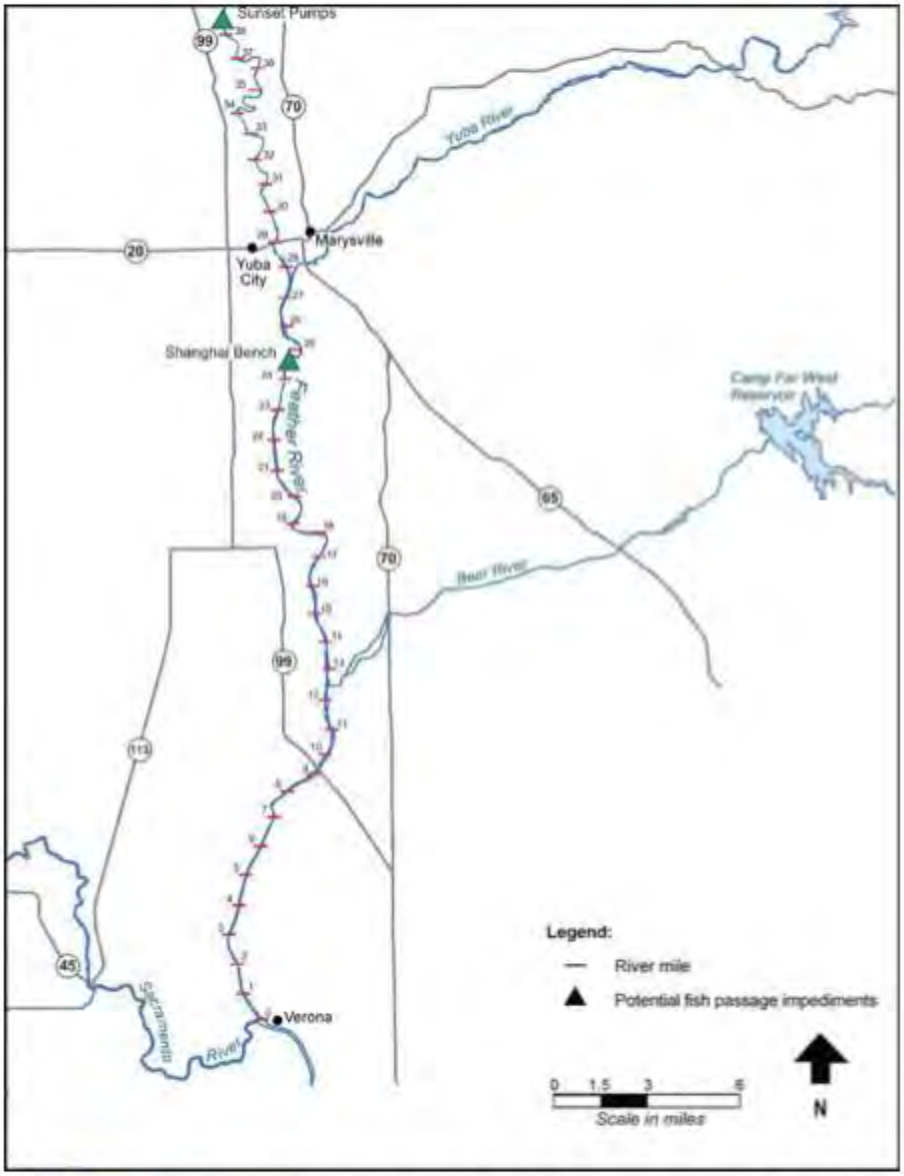


Figure 1-5. Map of the Feather River Upstream from the Sacramento River Verona Confluence

The above figure, taken from the Oroville Facilities BiOp, indicates a specific location on the Feather River where the project is expected to provide flow pulses that would benefit upstream passage for adult green sturgeon.

Figure 2-41. Map of the Lower Feather River Depicting the LFC and HFC

National Marine Fisheries Service (NMFS). 2016a. Endangered species act section 7(a)(2) Biological Opinion and Magnuson-Stevens Fisheries Conservation and Management Act essential fish habitat response and Fish and Wildlife Coordination Act recommendations for relicensing the Oroville Facilities Hydroelectric Project, Butte County, CA. National Marine Fisheries Service, West Coast Region.

Physical Public Benefits Tab

A.2 Ecosystem Benefits:

Attach supporting documentation requested in Ecosystem priorities worksheets such as maps or other information not already provided elsewhere in the application.

Priority 14 Data Used

File: IRWD_Tab 4-A2-Ecosystem_Priority 14_FINAL.pdf

Summary

	Year Type Occurance (Years)	Number of Recharge Events for Year Type (Years)	Avg Recharge Time during Years that Recharge Events Occur (Months)
Wet Year	26	9	1.44
Above Normal	12	4	2
Below Normal	14	3	1
Dry	18	0	0
Critical	12	0	0

Assumptions	
Recharge Ponds (acres):	1200
Rate- Month 1 (ft/day)	0.70
Rate- Month 2 (ft/day)	0.65
Rate- Month 3 (ft/day)	0.60

		WSIP 2030		WSIP 2070		
Sacramento Valley Year Type	Water Year	Water Recharged (TAF)	Approximate Recharge Time (Months)	Water Recharged (TAF)	Approximate Recharge Time (Months)	
Above Normal	1980	70	3	70	3	70
Above Normal	1978	48	2	49	2	
Above Normal	1973	24	1	0		
Above Normal	1951	10	1	24	1	
Above Normal	1922	0		0		
Above Normal	1928	0		0		
Above Normal	1940	0		0		
Above Normal	1954	0		0		
Above Normal	1957	0		0		
Above Normal	1993	0		0		
Above Normal	2000	0		0		
Above Normal	2003	0		0		
Below Normal	1936	24	1	0		
Below Normal	1937	24	1	19	1	
Below Normal	1945	24	1	0		
Below Normal	1923	0		0		
Below Normal	1935	0		0		
Below Normal	1946	0		0		
Below Normal	1948	0		0		
Below Normal	1950	0		0		
Below Normal	1959	0		0		
Below Normal	1962	0		0		
Below Normal	1966	0		0		
Below Normal	1968	0		0		
Below Normal	1972	0		0		
Below Normal	1979	0		0		
Critical	1924	0		0		
Critical	1929	0		0		
Critical	1931	0		0		
Critical	1933	0		0		
Critical	1934	0		0		
Critical	1976	0		0		
Critical	1977	0		0		
Critical	1988	0		0		
Critical	1990	0		0		
Critical	1991	0		0		
Critical	1992	0		0		
Critical	1994	0		0		
Dry	1925	0		0		
Dry	1926	0		0		
Dry	1930	0		0		
Dry	1932	0		0		
Dry	1939	0		0		
Dry	1944	0		0		
Dry	1947	0		0		
Dry	1949	0		0		
Dry	1955	0		0		
Dry	1960	0		0		
Dry	1961	0		0		
Dry	1964	0		0		
Dry	1981	0		0		
Dry	1985	0		0		
Dry	1987	0		0		
Dry	1989	0		0		
Dry	2001	0		0		
Dry	2002	0		0		
Wet	1982	47	2	47	2	
Wet	1956	46	2	46	2	
Wet	1938	45	2	69	3	
Wet	1969	45	2	48	2	
Wet	1943	24	1	0		
Wet	1986	24	1	19	1	
Wet	1958	23	1	23	1	
Wet	1983	22	1	47	2	
Wet	1984	0.32	1	3	1	
Wet	1927	0		0		
Wet	1941	0		0		
Wet	1942	0		0		
Wet	1952	0		0		
Wet	1953	0		0		
Wet	1963	0		0		
Wet	1965	0		0		
Wet	1967	0		4	1	
Wet	1970	0		0		
Wet	1971	0		0		
Wet	1974	0		0		
Wet	1975	0		0		
Wet	1995	0		0		
Wet	1996	0		0		
Wet	1998	0		0		
Wet	1999	0		0		
Wet	1997	0		0		

Physical Public Benefits Tab

A.1 Emergency Response Benefits:

Attach a description of the amount or share of stored water to be provided for the emergency response benefits and define conditions under which water would be made available. Describe how the applicant can commit to the conditions under which the emergency benefits would be made available (TR section 4.11.2)

File: IRWD_Tab 4-A1 IRWD_Emergecy Response Benefits_FINAL.pdf

EMERGENCY RESPONSE BENEFITS

Attach a description of the amount or share of water to be provided. Define conditions under which water would be made available. Define conditions under which water would be made available. Describe how applicant can commit to conditions when benefit will be available.

For the proposed Kern Fan Groundwater Storage Project, project proponents IRWD, Rosedale and DRWD plan to operate the project to provide multiple benefits included Emergency Response. The Project will be operated to provide water for Emergency Response under an extended drought and for Emergency Response under a Delta Failure.

<u>Emergency Response under an Extended Drought</u>:

A major benefit of the Project is that it will provide supplemental water to IRWD, Rosedale, and DRWD in the event of extreme drought, when other water resources are at their most expensive or may be limited. Groundwater stored as part of the project will be available to call on during a drought emergency or as an alternative supply in the case of a local supply outage. According to the WSIP Technical Guidance an emergency is defined as a critical year that occurs in the 3rd or later year of consecutive drought.

Per MBK's model, IRWD and Rosedale's accounts would receive 4,500 AF per year of water on an average annual basis under 2030 future conditions and 4,100 AF per year would be received on an average annual basis during 2070 future conditions. One-third of the water in the IRWD and Rosedale storage accounts will be dedicated to Emergency Response during extended droughts and two-thirds will be dedicated for water supply during other dry year conditions. The water used for Emergency Response purposes will be physically extracted from the Project utilizing the Phase 1 and Phase 2 recovery wells at the 3rd or later year of a multi-year drought. The Project recovery wells will have sufficient capacity to recover this emergency response drought water.

For detailed information see:
Feasibility and Implementation Risk Tab, Attachment 1 – Technical Feasibility (MBK Engineers, 2017)
Benefit Calculation, Monetization and Resiliency Tab, Attachment 2 (Preliminary Operations Plan)
Benefit Calculation, Monetization and Resiliency Tab, Attachment 3 and Attachment 5 (M.Cubed, 2017)

Emergency Response under a Delta Failure:

A separate emergency response benefit of the Project is the water supply that the Project could provide in the event of a levee failure in the Delta that curtails water project deliveries. The WSIP Technical Guidance explains that an emergency response to Delta Failure should be assumed to occur once, 30 years into the project operation period—2056 for this project.

According to MBK's analysis, under historical hydrologic conditions, the Project can provide Emergency Response benefits during a Delta levee failure by storing water south of the Delta that can be extracted and made available after a failure event. The probability of water being stored in the Project in any year is one measure of potential Emergency Response benefit. MBK found that the Project is likely to have 20,000 AF of water available for Emergency Response after 30 years of operation. MBK Engineering also explored how using the 20,000 acre-feet of water 30 years into the project life would affect other Project benefits. MBK found that the ecosystem pulse flows north of the Delta could affected. To be conservative in the analysis of these affects, the availability of pulse flows north of the Delta were assumed to be reduced in the economic benefit analysis due to the need for water for Emergency Response.

For detailed information see:
Feasibility and Implementation Risk Tab, Attachment 1 – Technical Feasibility (MBK Engineers, 2017)
Benefit Calculation, Monetization and Resiliency Tab, Attachment 2 (Preliminary Operations Plan)
Benefit Calculation, Monetization and Resiliency Tab, Attachment 3 and Attachment 5 (M.Cubed, 2017)

Feasibility and Implementation Risk Tab

Feasibility and Implementation Risk Tab

A.1 Feasibility Documentation:

Attach feasibility studies or documentation that demonstrates the proposed project's technical, environmental, economic, and financial feasibility as described in TR section 3.5. See also regulations section 6003(a)(1)(O)

File: IRWD_Attach 1_Combined Feasibility.pdf

Irvine Ranch Water District and Rosedale Rio-Bravo Water Storage District

Kern Fan Groundwater Storage Project

Draft Feasibility Studies

August 2017

Presented in this document are the following components required by the Water Storage Improvement Program Application to demonstrate the project's feasibility:

- Project Objectives
- Project Description
- Project Costs
- Project benefits
- Cost Allocation
- Technical Feasibility
- Environmental Feasibility
- Economic Feasibility
- Financial Feasibility
- Constructability

Please note that these components are drafts and a completed project feasibility study will be completed by the January 1, 2022 deadline.

Table of Contents

Project Objectives

The applicant must identify the project objectives, including all public and non-public benefits the proposed project is designed to provide.

The Kern Fan Project (Project) will significantly contribute to attainment of the three objectives of the California Water Action Plan: (1) more reliable water supplies; (2) improved habitat conditions of important species, and (3) more resilient and sustainably managed water infrastructure.

Specifically, the Project will cost-effectively recharge and store groundwater for subsequent recovery to address the following project objectives:

- Enhance water supply reliability;
- Reduce imported water demands on the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Delta) to benefit spring and winter-run Chinook salmon;
- Provide water supply during drought conditions;
- Provide water supply for emergency response benefits;
- Establish temporary wetlands through intermittent recharge events that will attract migratory and other water birds in Kern County;
- Benefit the water levels in the Kern County Groundwater Sub-basin;
- Manage water in a resilient and sustainable manner; and
- Be integrated into other water storage projects and storage reservoirs to provide greater statewide benefits.

The Project will offer opportunities to further improve the operation of the State water system through the integration of operations with other projects funded through the Water Storage Investment Program. For example, Sites Reservoir participants could be offered the opportunity to store water in the Project under mutually beneficial terms that would avoid reservoir spills. Such integration efforts could improve the yield of the State water system, improve water supply reliability, reduce competition for water supplies during dry periods and reduce stresses on ecosystems.

The Project will provide additional operating flexibility for Rosedale's existing and future programs, and will be a critical element of the IRWD water supply reliability portfolio that supports groundwater recharge and recovery for regional conjunctive use and groundwater banking partnerships.

Project Description

The applicant must describe the proposed project, including facilities, operations, and relationships with existing facilities and operations.

For a full project description of the Kern Fan Groundwater Storage Project please see the **Eligibility and General Project Information Tab**, **Attachment 3**.

Project Costs

An applicant must identify and describe all project costs, including construction costs, interest during construction, replacement costs, operations and maintenance costs consistent with the operations plan, and costs of mitigation for adverse environmental consequences identified in the draft environmental documentation.

A project concept and engineering Class 4 Feasibility Level Cost Estimate was developed for the Kern Fan Groundwater Storage Project by Dee Jaspar & Associates, Inc. (DJA). The Draft Concept Study for the Kern Fan Groundwater Storage Project, dated August 10, 2017, is presented in **Appendix A** – Dee Jaspar & Associates, Inc. Draft Concept Study.

The Draft Concept Study describes the project facilities to be constructed and the operations consistent with the Project operations plan. DJA's cost estimates are based upon previous project bid prices, actual cost of operations of other Rosedale and IRWD water banking facilities and includes direct and indirect costs such as project overhead, business overhead, profit and bonds. The cost estimates include capital construction costs, operations and maintenance costs consistent with the operations plan and replacement costs.

DJA's cost estimate also includes the cost for environmental compliance for the project. This cost estimate was provided by environmental consultants, ESA, and a copy of the scope of work, schedule and cost estimate is included under "Feasibility and Implementation Risk" Tab, Attachment 1 under Environmental Feasibility.

A proposed conveyance canal will be constructed as part of the project. This will require obtaining conveyance easement and habitat conservation plan mitigation credit for approximately 100 acres within the Kern Water Bank Authority Permit Area. The cost of the mitigation credit needed for the proposed Project is included in the cost estimate.

The estimated capital, operations and maintenance and replacement costs from the Concept Study are used in the present value calculations for the Benefit Cost analysis. The interest used during construction is 3.5%.

Project Benefits

The applicant must describe and quantify all proposed project benefits, consistent with the operations plan. Public benefits and non-public benefits shall be quantified using physical measures and, where possible, monetary measures. Proposed project benefits must be displayed as expected average annual values for each year of the planning horizon. For benefits that vary according to hydrologic condition, applicants must display that variability using, for example specific water year types (such as dry and critical), or exceedance probabilities.

The Kern Fan Project will be operated to provide public and non-public benefits including water supply, groundwater improvement, environmental benefits, and emergency response benefits. Anticipated environmental benefits will meet Ecosystem Priorities 2, 12, and 14 and emergency response benefits will address extended drought and delta failure scenarios.

Project benefits were determined based on results from MBK's water supply and operations modeling. Further information on how MBK estimated the project yield can be found in their report located in Appendix B at the end of this document. Using the results provided by MBK, Cramer Fish Sciences (CFS) prepared a quantitative analysis and assessment of the project's operations for ecosystem benefits. The CFS report documenting data and methods used is located in the **Physical Public Benefits Tab, Attachment 2** as file IRWD_Tab2-A2-CFS_TechMemo_Final.docx

Project benefits quantified by MBK and CFS were then monetized by M.Cubed. The methodological approach for monetizing the project's benefits is documented in the M.Cubed technical memorandum located in **the Benefit Calculation Monetization, and Resiliency Tab** under **Attachment 3**. The data and calculations are presented in an excel file located in the **Benefit Calculation Monetization, and Resiliency Tab** under **Attachment 5**.

Cost Allocation

The applicant must conduct a benefits-based cost allocation to determine the costs to be assigned to the project beneficiaries.

Costs were allocated to beneficiaries in a manner that demonstrates financial and economic feasibility, and that supports the WSIP funds requested for the Kern Fan Groundwater Storage Project. Public benefit cost shares were allocated to the State of California and private benefit cost shares were allocated equally to IRWD and Rosedale. The public benefit cost share allocated to the WSIP for the Kern Fan Groundwater Storage project meets the following requirements:

- Considers the share of the public benefit received by Californians
- Does not exceed 50% of the capital costs
- Allocates at least 50% of the public benefit cost share for ecosystem improvements
- Is not associated with environmental mitigation or compliance obligations

A simplified allocation method was used that allocates project costs among the benefit categories in proportion to the monetized benefits. The relative proportion of public benefit cost share for ecosystem and emergency response benefits was further adjusted to ensure that 50% of the public benefit cost share addressed ecosystem improvements.

An allocation of all costs to the project beneficiaries is provided in **Benefit, Calculation, Monetization and Resiliency Tab, Attachments 9, 10 and 11** of the WSIP funding application. IRWD and Rosedale each receive 50% of the Project's non-public benefits. The State of California receives 100% of the public benefits, with 50% allocated for ecosystem improvements.

It should be noted that the calculated benefit to cost share ratio for IRWD and Rosedale is below 1.0. IRWD and Rosedale would seek to develop both state wide and local partnerships to leverage the use of the Project facilities when not needed for Project purposes, which would result in an increased benefit to IRWD and Rosedale in excess of the benefits demonstrated for the Kern Fan Groundwater Storage Project, as discussed in **Eligibility/ General Project Tab, Question 6**. Since IRWD and Rosedale expect additional future benefits, the current cost allocation is still economically feasible and supports the investments in the project at the levels shown for both of these participants.

Technical Feasibility

The applicant must demonstrate that the project is technically feasible consistent with the operations plan, including a description of data and analytical methods, the hydrologic period, development conditions, hydrologic time step, and water balance analysis showing, for the with – and without-project condition, all flows and water supplies relevant to the benefits analysis.

A description of data and analytical methods used as the basis to develop project operations is described in MBK Engineers' Technical Memorandum included as Appendix B. The associated excel file model is included under the **Feasibility and Implementation Risk Tab, Attachment 1** as IRWD_Attach1_MBK_Model_KernFan.xlsm. For a description of how the ecosystem benefits were evaluated using MBK's modeling results see the **Physical Public Benefits Tab, Attachment 2** for file IRWD_Tab2-A2-CFS_TechMemo_Final.docx.

Environmental Feasibility

The applicant must demonstrate that the project is environmentally feasible. The applicant must describe how significant environmental issues will be mitigated or indicate if the Lead Agency has or will file a Statement of Overriding Considerations.

The Kern Fan Groundwater Storage Project (Kern Fan Project or Project) is subject to the environmental review process established in the California Environmental Quality Act (CEQA) to be considered for state funding. To date, programmatic environmental review work has been completed for Phase 1 of the Kern Fan Project. Program-level analysis allows a public agency to evaluate the effects of a series of actions that are related geographically and as logical parts in a chain of contemplated actions. The advantages of a program-level analysis include providing more comprehensive consideration of alternatives and cumulative impacts than would be possible for individual actions, and avoiding duplicative reconsideration of basic policy considerations, while also reducing paperwork.

A Final Environmental Impact Report (EIR) was prepared, certified, and approved in December 2015 for the Stockdale Integrated Banking Project (Stockdale Project). A link to the Stockdale Project Final EIR is included under “Feasibility and Implementation Risk” Tab Attachment 4. The EIR includes a program-level analysis of impacts in accordance with *CEQA Guidelines* Section 15168 of a third project site yet to be identified. The third project site accounted for in the Stockdale Project Final EIR is now designated to be Phase 1 of the Kern Fan Groundwater Storage Project. As such, Phase 1 of the Kern Fan Project is referred to as the third project site in the Stockdale Project Final EIR. The Phase 1 project site will be within the additional project site perimeter identified in the figure below, also found in Chapter 2 of the Stockdale Project Final EIR. When the Phase 1 project site is identified, subsequent project-level environmental review will be conducted pursuant to *CEQA Guidelines* Section 15168(c). The Stockdale EIR will provide the basis for the anticipated project-level CEQA analysis for Phase 1 of the Project (CEQA Guidelines Section 15168(d)). For purposes of CEQA, Phase 2 of the Kern Fan Project is considered a fourth site in the vicinity of the Stockdale Project. Environmental review for the Kern Fan Project will therefore be completed as a Supplemental EIR (SEIR) to the Stockdale Project Final EIR. The SEIR will be completed such that the third site is specifically identified along with appurtenant conveyance facilities to be evaluated at a project-level and a fourth site added to be evaluated at a program-level. All environmental review for the Kern Fan Project will be completed prior to the implementation of Project facilities.

Program-Level Analysis Completed to Date

The Stockdale Project Final EIR, located in the Feasibility and Implementation Risk Tab of the application under Attachment 4, documents the program-level analysis completed for the third project site or Phase 1 of the Kern Fan Project. The Stockdale Project Final EIR assumes that similar species and impacts would occur at most potential sites within the additional site perimeter. Impacts identified would occur during the construction and operation of the project. Most construction impacts would be short term and are either considered less than significant or are reduced to less than significant levels with appropriate mitigation measures. Operation of the proposed project would primarily affect hydrology and groundwater, in particular changes in groundwater levels during recharge and recovery operations. Operational impacts either are considered less than significant or are reduced to less than significant levels with appropriate mitigation measures. The Stockdale Project Final EIR concludes that the project, which includes Phase 1 of the Kern Fan Project, would not result in any significant and unavoidable impacts. IRWD and Rosedale anticipate that upon further project-level analysis, the Kern Fan Project will not result in significant or unavoidable impacts.

A summary of potential impacts and mitigation for the proposed Project is included under **"Feasibility and Implementation Risk" Tab, Attachment 5**.

Project Level Analysis

In July 2017, environmental consulting firm, Environmental Science Associates (ESA) prepared a scope of work for environmental documentation pursuant to CEQA for the Kern Fan Project. The ESA scope of work includes an estimated schedule to complete environmental review under a proposed Supplemental EIR and the estimated cost. The scope of work is included **"Feasibility and Implementation Risk" Tab, Attachment 4**. .

Economic Feasibility

The applicant must demonstrate that the expected benefits of the project equal or exceed the expected costs, considering all benefits and costs related to or caused by the project.

Summary

This document outlines the data and the methodological approach for calculating the economic feasibility of Irvine Ranch Water District's and Rosedale-Rio Bravo Water District's proposed Kern Fan Groundwater Storage Project in support of a grant application for the Water Storage Investment Program (WSIP).

Based on the guidelines provided in the California Water Commission's WSIP Technical Reference and project information provided by Cramer Fish Sciences, Dee Jaspar & Associates, MBK Engineers, and M. Cubed, a comparison of project costs and economic benefits was developed. Estimates of the net present value (NPV) of project costs and benefits, as well as the benefit-cost and public benefit ratios are provided in the **Benefit Calculation, Monetization and Resiliency Tab, Attachment 9**. The calculated public benefit ratio and benefit-cost ratio for the proposed project are 1.47 and 1.49, respectively.

In consideration of all benefits and costs related to or caused by the project, it has been determined that the project is economically feasible.

Project Costs

A project concept and engineering Class 4 Feasibility Level Cost Estimate (Draft Concept Study) was developed for the Kern Fan Groundwater Storage Project by Dee Jaspar & Associates, Inc. (DJA). The Draft Concept Study describes the project facilities to be constructed and the operations consistent with the project Operations Plan. DJA's cost estimates are based upon 2015 project bid prices for the construction of IRWD's Stockdale West water banking project facilities and the actual cost of operations of other Rosedale and IRWD water banking facilities. The costs include direct and indirect costs such as project overhead, business overhead, profit and bonds. The cost estimates include the capital construction cost, operations and maintenance (O&M) costs consistent with the Operations Plan and replacement costs.

The costs identified in the Draft Concept Study were utilized in the Benefit and Cost Analysis (BCA) presented in the **Benefit Calculation, Monetization and Resiliency Tab, Attachment 9**. In the analysis, the project capital, land, and other non-contract costs were expected to begin in 2019, with subsequent operations, maintenance, and replacement costs beginning in 2026, the first year of project operations. The O&M and replacement costs continue throughout the 50-year life of the project to year 2075. Since the capital cost of the project would be spread over various times during the six-year construction period, a net present value of capital costs was calculated at the start of construction in 2019. The net present value of the O&M and replacement costs was calculated from the start of project operations in 2026. The net present value calculations utilized as part of the BCA use a discount rate of 3.5%, as directed in the WSIP Technical Reference.

Residual Value of Land and Site Improvements

In consultation with IRWD's property appraiser in Kern County, it was determined that the 1,280 acres of land utilized for the project would have significant residual value at the end of operations in 2075. As part of the BCA, the value of land was escalated at 4.5% starting at the time of acquisition in 2019 through the end of operations in 2075. The net present value of the land at year 2019 was deducted from the net present value of project capital costs to give a more accurate representation of true project costs.

In addition to the consideration of residual property value for the project, it was determined that a portion of the site improvements of the project would have residual value at the end of project operations. As part of the BCA, the net present value of the project aqueduct, earthwork, and inter-basin structures was calculated at year 2026. This value was also deducted from the net present value of project capital costs. As shown in the BCA, the present value of capital cost, less residual land and site facility values, is $90,355,204. This value was used as a basis for determining the benefit-cost ratio for the project.

Project Benefit Ratios

The present values of monetized benefits calculated by M.Cubed, as shown in **Benefit Calculation, Monetization and Resiliency Tab, Attachment 5**, were incorporated into the BCA in order to calculate both the public benefit ratio and benefit-cost ratio. The calculated public benefit ratio and benefit-cost ratio was determined to be 1.47 and 1.49, respectively. Both of these ratios demonstrate that the expected benefits of the project exceed the expected costs. As a result, the project has been determined to be economically feasible.

Financial Feasibility

The applicant must demonstrate that sufficient funds will be available from public (including the funds requested in the application) and non-public sources to cover the construction and operation and maintenance of the project over the planning horizon.

Proposed Funding of Project Capital Costs

IRWD and Rosedale are the local project sponsors of the proposed Kern Fan Groundwater Storage Project.

Due to the importance of the project with respect to managing water supplies, IRWD and Rosedale have planned to construct water banking facilities on a third site within its approved Stockdale Integrated Banking Project. This proposed third site effectively is Phase 1 of the proposed Kern Fan Groundwater Storage Project. The estimated capital costs for the project in 2015 dollars is $171,321,859. IRWD and Rosedale expect that a portion of the project capital costs will be funded through state grant funding and local funding. State funding will potentially be through California Water Commission's Water Storage Investment Program up to $85,660,930.

If awarded grant funding through the Water Storage Investment Program, IRWD and Rosedale, as project sponsors, understand each agency is responsible for providing the difference between the grant amount and the total project cost to ensure a fully funded project. IRWD and Rosedale are committed to jointly identifying and acquiring the property necessary to construct the water banking facilities each paying for its share of capital costs and the full operation, maintenance and replacement costs for the proposed Kern Fan Groundwater Storage Project over the planning horizon.

Table 1 below shows the expected cost estimates for the project components and the respective sources of funding. Details of the project cost estimates are included in **Feasibility and Implementation Risk Tab, Attachment 1** of the WSIP funding application. Project costs are estimated in 2015 dollars.

Estimated Projected Construction Costs and Sources of Funding

(in millions)	Kern Fan Groundwater Banking Project	% Cost Share	Total Cost Share
Project Cost	$171,321,859		
Funding Sources			
Prop 1 WSIP Grant Funding		50%	$85,660,930
IRWD Funding		25%	$42,830,465
Rosedale Funding		25%	$42,830,465
Total		100%	$171,321,859

Irvine Ranch Water District Funding Plan for Capital Costs

Each year, the IRWD Board of Directors reviews IRWD's long term capital program that extends out to final development to identify infrastructure requirements for new development, enhancement and replacement projects. The capital budget that is approved represents those facilities that will begin construction during the current fiscal year. The objectives of the long term capital program are to enhance reliability, provide sufficient redundancy, and reduce operating costs by utilizing industry-leading forecasting modules that update water, sewer and recycled master plans.

In addition, the District reviews the funding requirements necessary to meet the identified capital needs. The District's policy shares the cost of new development equally between the developer and the homeowner through connection fees and property taxes. Connection fees, general obligation (GO) property taxes, and one percent property taxes are considered the primary funding sources for new capital. The connection fees and GO property tax rates are reviewed and set annually to meet ultimate water and recycled water demands for the District's current and future customer base. This includes:

- Water and recycled water capacity
- Sewer treatment capacity
- Natural treatment system facilities
- Water and sewer system enhancements

Current construction and capital funds will provide immediate funding for the Project. The District usually funds the construction of major projects and then issues bonds that reimburse the capital funds.

IRWD’s regional facilities are ultimately funded through the sale of bonds and the District uses three primary sources of revenue to pay the debt service. These sources are the District's allocation of one percent property tax revenue, connection fees that are funded from new development and GO property taxes that are paid by the homeowners for the sole purpose of funding District debt service.

Each year IRWD publishes its Comprehensive Annual Financial Report, with the most recent for fiscal year ended June 30, 2016, a copy of which is available upon request.

Irvine Ranch Water District Funding Plan for Operation, Maintenance and Replacement Costs

Each year, the IRWD Board of Directors approves an annual operating budget. The goal of the District’s operating budget process is to appropriately fund the resources required to provide excellent service to IRWD customers as cost-efficiently as possible.

IRWD’s user rates and charges are primarily used for funding IRWD’s operation and maintenance expenses. IRWD separates the cost of constructing water and sewer infrastructure from the cost of daily operations and maintenance. User rates are billed to customers on a monthly basis and include a component for the inevitable replacement of existing infrastructure.

Rosedale’s Proposed Project Funding Plan for Capital Costs

Each year, the Rosedale Board of Directors reviews Rosedale’s short and long-term budgets, including the Rosedale long term capital program that identifies and estimates the acquisition and /or construction of new capital facilities as well as the rehabilitation and/or replacement of existing. The capital budget that is approved represents those facilities that will begin construction during the current fiscal year. The objectives of the long term capital program are to ensure continuing Rosedale operational capacity, anticipate and address swings in revenues as required to address both operational and capital cash-flow variability, and to ensure the reliability of Rosedale water supply reliability.

In addition, Rosedale annually reviews the funding requirements necessary to meet the identified capital needs. Rosedale has adopted a Financial Plan which provides for the escalation of revenues through cost recovery of its various water management programs, adjustments to user fees to reflect value of service provided and a landowner assessment, collected through property taxes. One principle source of revenue for Rosedale is through user fees levied on water management programs with third parties. The other primary source of revenues for Rosedale are the collection of assessments on each acre of land within Rosedale, collected through the property tax rolls.

Funding for the Project will occur through a revenue bonds. Rosedale uses two primary sources of revenue to pay the debt service. These sources are the Rosedale’s user fees and the landowner assessments, collected through the property tax rolls.

Each year Rosedale publishes its Annual Audit, with the most recent for fiscal year ended December 31, 2016, a copy of which is available upon request.

Rosedale's Funding Plan for Operation, Maintenance and Replacement costs

Each year, the Rosedale Board of Directors approves an annual operating budget. The goal of the operating budget process is to appropriately fund the resources required to acquire and manage the water supplies necessary to maintain groundwater levels within the Rosedale service area. Revenues from user fees are established by Agreement with various third parties and are adjusted annually based upon an agreed upon escalation factor. Rosedale seeks to minimize fluctuations in its user charges through the establishment of a reserve fund. The reserve fund is drawn upon to address variations in annual expenditures, which are primarily driven by the variability in hydrology.

Rosedale will adjust its user charges and the reserve fund to address any adjustments to annual operating costs as a result of the Project.

Constructability

The applicant must demonstrate that the project can be constructed with existing technology and availability of construction materials, work force and equipment.

The proposed Kern Fan Groundwater Storage Project's (Kern Fan Project) will be constructed using existing, well-established, efficient and reliable engineering techniques. The construction of the Project facilities will be similar to previous water banking projects constructed by the Project proponents that include Rosedale's Allen Basins, Rosedale's West Basins, Rosedale's Superior Basins, Rosedale's Drought Relief Project, IRWD's Strand Ranch Project and IRWD's Stockdale West Project, a component of the joint Stockdale Integrated Banking Project. Rosedale and IRWD have significant prior experience designing and constructing water banking projects. Experience includes environmental review, design of well construction, well equipping, recharge basins, conveyance pipelines, and turnout structures. Project facilities are designed, located and constructed to minimize potential impacts as will the proposed Project.

An engineering Draft Concept Study of the Project provides a description of the proposed Project facilities, how the Project facilities would be integrated with existing water banking facilities, capital and operations cost estimates, and replacement cost estimates (Dee Jaspar & Associates, Inc. August 9, 2017). This study provides additional detail on the Project facilities design and construction materials and is included under "Feasibility and Implementation Risk" Tab, Attachment 1. The primary Project water banking components include recharge facilities, recovery facilities and conveyance facilities which are described below.

<u>Recharge Facilities</u>:

It is expected that recharge basin facilities would be constructed over approximately 82% of acquired property for the Project, or about 1,050 acres. The construction activities related to the Project's recharge facilities include site clearing and demolition; excavation and stockpiling; construction of earthen berm levees and basins, cut-off walls, conveyance and transfer channels, riprap protection, pipelines and site restoration. The site clearing and demolition phase would include removal of existing irrigation piping systems onsite, as necessary. Up to twenty workers would be required on-site at one time to implement each construction phase. The staging areas, including construction parking, would be located on-site within the boundaries of the Project partners.

Recharge basins will be constructed by excavating and contouring each basin to a depth of approximately five feet. The excavated soils would be used to form earthen berm levees to contain each basin. The basins would be connected by welded steel or concrete transfer structures with 24- to 72-inch diameter pipe culverts. Supply channels would be constructed by excavating below existing ground surface. Any necessary supply channels would be earthen or lined channels, and turnout structures between the supply channels and recharge basins would consist of 24- to 72-inch culverts.

The recharge basins and supply channels would be designed in an effort to balance earthwork on site such that all excavated soils are redistributed and utilized to construct the project facilities. If excess soils were produced, they would be either sold or transported to an appropriate location. Demolition and construction debris would be removed from the project site and transported to an appropriate landfill facility that accepts construction waste material.

Recovery Facilities

Twelve new recovery wells would be constructed; six within the Phase 1 lands and six within the Phase 2 lands. On-site materials would be used to construct earthen well pads. Wells would be drilled and constructed using a standard reverse rotary drill rig. The aboveground wellheads, motor control centers and pump houses would be installed and connected to transformers installed on the project sites. The recovery wells would be connected to a conveyance system of underground pipelines to deliver pumped groundwater to the CVC to California Aqueduct. Installation of the recovery well conveyance system would require trenching to a depth of about seven feet below existing ground surface. Construction staging would be located on-site within the boundaries of the Project partners

Conveyance Facilities

The Phase 1 and Phase 2 Canals would be constructed using typical open trench construction methods. Minor highways will be crossed using open cut construction with appropriate traffic control. Major highway and railroad crossings will utilize jack and bore methods to minimize impacts on traffic. Jack and bore construction will require excavation pits up to 12 feet in depth. Excess soils would either be sold or transported to an appropriate location for disposal or reuse. Construction staging would be located on-site within the boundaries of the Project partners existing facilities.

The proposed Phase 1 Canal will utilize existing connections to the CVC for both diversion and recovery. Therefore, no new right-of-way permits or approval by the Kern County Water Agency is anticipated. The proposed Phase 2 Canal will connect to the California Aqueduct for both diversion and recovery. Therefore, a new right-of-way approval from the Department of Water Resources will be obtained. To avoid disruptions to the aqueduct operations, a cofferdam would be required during turnout and discharge construction. A cofferdam is a temporary watertight structure that would allow for a portion of the aqueduct to be dewatered during construction while allowing flows to continue passing through the channel.

Appendix A- Dee Jaspar & Associates, Inc. Draft Concept Study

KERN FAN GROUNDWATER STORAGE PROJECT

DRAFT CONCEPT STUDY

Prepared For:
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

DATE: AUGUST 10, 2017

Prepared by:

DEE JASPAR & ASSOCIATES, INC.
CIVIL ENGINEERS
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8-10-17

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Introduction

The District has evaluated a conceptual Kern Fan Groundwater Storage Project (Kern Fan Project). This project would serve to develop a regional water bank in the Kern Fan to capture and store Article 21 water via the State Water Project (SWP) during conditions when surface water is abundant. A two-phased approach would be taken to the development of the Kern Fan Project. The first phase would be to develop the proposed third project site as contemplated in the Stockdale Integrated Water Banking Project which would include the purchase of approximately 640 acres of land in the Kern Fan area. The first phase would also include constructing conveyance facilities, recharge facilities, and recovery facilities as necessary to develop a fully functioning water banking project. The second phase of the Kern Fan project would involve acquiring an additional 640 acres of land for expansion of the water banking facilities and developing the associated recharge and recovery facilities. Appendix A presents a map of the major facilities associated with the project concept study.

The objective of this Draft Concept Study is to further develop the project concept and provide a Class 4 Feasibility Level Cost Estimate for the project. The costs estimates are based upon previous project bid prices and include direct and indirect costs such as project overheads, business overheads, profit, and bonds. For this level cost estimate, a construction contingency of twenty percent (20%) has been utilized to account for project uncertainties.

Project Description

The first phase of the project involves purchasing approximately 640 acres of land within the Rosedale Rio Bravo Water Storage District (RRBWSD) boundary and within the limits of the Stockdale Integrated Banking Project Environmental Impact Report (EIR). Water would be conveyed to this property for recharge from the Friant-Kern Canal or the Kern River by exchange via the Goose Lake Slough or from the Cross Valley Canal (CVC) via the RRBWSD Intake Canal. An interconnection pipeline would be constructed from the RRBWSD Intake Canal to the proposed property to connect the two. A new check structure would be required in the Goose Lake Slough with a reinforced concrete turnout structure constructed behind it to convey water from the Goose Lake Slough to the proposed property. This turnout structure would include a lift station with four 60 cfs pumps each equipped with 300 hp vertical motors to lift the water up to the proposed property for recharge and include discharge piping, metering, appurtenances, lighting, electrical, controls, and SCADA communication. The anticipated recharge at this proposed property would initially be 230 cfs (0.7 ac-ft/d) and then drop to an approximate maintenance rate of 115 cfs (0.35 ac-ft/d).

The proposed Phase 1 property would be developed for recharging ground water including site clearing and grubbing, installation of site fencing and gates, construction of earthen levees, construction of interbasin structures and conveyance facilities, rip-rap, and existing well abandonments. In addition the proposed property would be equipped with six recovery wells with an approximate capacity of 5 to 6 cfs each. These would be 20-inch diameter wells cased to approximately 920-ft. The wells would be equipped with vertical turbine pumps, 400 hp vertical hollowshaft motors, discharge piping, appurtenances, electrical and controls, and site improvements. The underground well conveyance piping would be C905 PVC pipe ranging in size from 16-inch to 36-inch diameter. The recovery wells will return water through a conveyance pipeline that crosses the Goose Lake Slough and discharges into the RRBWSD Intake Canal whereby the water is returned to the Cross Valley Canal (CVC) for delivery or exchange to the California aqueduct.

In addition, in order to have capacity in the Goose Lake Slough to recharge water to the Phase 1 property it is proposed to supply water to the existing RRBWSD West Basins by an alternate means. Due to limited capacity in the Goose Lake Slough and the CVC it is proposed to construct a new reinforced concrete turnout at the California Aqueduct and convey 500 cfs approximately ten miles to the easterly end of the RRBWSD West Basins. The 500 cfs capacity would account for initial recharge to the West Basins of approximately 120 cfs, initial recharge to the Phase 2 Property of approximately 230 cfs, and potential in lieu recharge water to District farmlands. The approximate elevation at the California Aqueduct is 297-ft. The approximate elevation at the east end of the West Basins is 312-ft therefore requiring an approximate 15-ft lift. It is proposed to convey this water supply in a new canal with the approximate dimensions of a 20-ft wide bottom, 8-ft depth, and 1.5:1 side slopes. A habitat conservation plan (HCP) and mitigation credit for the conveyance easement across the Kern Water Bank equal to approximately 100 acres is included. The canal would be concrete lined and have siphon crossings at the following major locations:

- East Side Canal
- Kern Water Bank Main Canal
- West Kern Water District 36” DIP Transmission Main
- Stockdale Hwy
- Kosareff Storage Yard & Residence

- Interstate 5 Fwy

The canal would have three lift stations along the alignment to lift water to the recharge basins. It is estimated that the first two lift stations would consist of a reinforced concrete pump station, six 83 cfs low lift pumps with 400 hp vertical motors, discharge piping and appurtenances, electrical and controls in order to convey 500 cfs to the east side of the I-5 Freeway. The third lift station would consist of a reinforced concrete pump station, six 67 cfs low lift pumps with 300 hp vertical motors, discharge piping and appurtenances, electrical and controls in order to convey 400 cfs to the West Basins and the Goose Lake Slough. Each lift station would also include a gravity bypass line with slide gate into the lift station structure for the reverse flow of recovery water back to the California Aqueduct.

A reinforced concrete turnout structure for approximately 400 cfs would be constructed at the east end of the West Basins to convey recharge water to the West Basins and to the Goose Lake Slough if necessary. This structure would be equipped such that recovery water from the WB wells could be returned through the canal conveyance facility to the California Aqueduct.

The second phase of the project involves purchasing approximately 640 acres of land within the Rosedale Rio Bravo Water Storage District boundary but outside of the limits of the Stockdale Integrated Banking Project EIR. Water would be conveyed to this property from the California Aqueduct.

The proposed Phase 2 property would be developed for the recharge and recovery of ground water. The anticipated recharge at this proposed property would initially be 230 cfs (0.7 ac-ft/d) and then drop to an approximate maintenance rate of 115 cfs (0.35 ac-ft/d). The scope of work includes site clearing and grubbing, installation of site fencing and gates, construction of earthen levees, construction of interbasin structures and conveyance facilities, rip-rap, and existing well abandonments. In addition the proposed property would be equipped with six recovery wells with an approximate capacity of 5 to 6 cfs each. These would be 20-inch diameter wells cased to approximately 920-ft. The wells would be equipped with vertical turbine pumps, 400 hp vertical hollowshaft motors, discharge piping, appurtenances, electrical and controls, and site improvements. The underground well conveyance piping would be C905 PVC pipe ranging in size from 16-inch to 36-inch diameter. The recovery wells will pump water through conveyance pipelines back to the new canal and reverse flow water in the canal by gravity to return water to the California Aqueduct.

The proposed project would also include the construction of a SCADA system to aid in the operations of the aqueduct turnout, the canal lift stations, and the turnout facilities to the Phase 1 and 2 properties. This would include PLC's, radio communication, computer station at a central headquarters, and control programming.

Project Cost Estimate

A detailed feasibility level cost estimate is attached in Appendix B and summarized in Table 1 below. The cost estimate is based upon project costs as of 2015. The contract cost is intended to represent the estimated cost of the contract at the time of project award and equates to $104,880,716.

The contract costs can be grouped as follows:

Table 1 – Contract Cost Breakdown

Description	Cost	Item No. of Cost Estimate
Aqueduct Turnout	$1,185,000	Item 2 - 10
Conveyance Facilities	$56,195,000	Items 11-22
Conveyance Lift Stations	$11,917,500	Items 23-34
West Basins Turnout	$920,000	Items 35-41
Phase 1 Turnout & Lift Station & Check Structure	$3,962,500	Items 55-71
Phase 1 Recharge & Recovery	$13,861,108	Items 72-78
Phase 2 Turnout	$700,000	Items 42-48
Phase 2 Recharge & Recovery	$14,019,608	Items 49-54
Miscellaneous	$2,120,000	Items 1 & 79
Subtotal:	$104,880,716	

The field cost is an estimate of the contract cost plus a twenty-percent (20%) contingency and the land acquisition costs, easement procurement costs, and HCP fees. The field cost equates to $162,456,859.20 (see Table 2 below).

Table 2 – Field Cost Breakdown

Description	Cost	Item No. of Cost Estimate
Contract Cost	$104,880,716	
20% Contingency	$20,976,143	
Land Purchase, Easements, & R/W	$38,808,750	
Field Cost:	$162,456,859	

The non-contract costs include design and engineering, permitting, environmental work, labor compliance, PG&E electrical service, bid advertisement, legal, construction staking, and construction management and inspection and equate to $8,865,000.00 or approximately 8.5% of the contract cost (see Table 3 below).

Table 3 – Non-Contract Cost Breakdown

Description	Cost	Item No. of Cost Estimate
Engineering & Design	$2,500,000	
Environmental	$300,000	
Permitting	$250,000	
Labor Compliance	$615,000	
PG&E Service	$1,750,000	
Bid Advertisement & Legal	$50,000	
Construction Staking	$400,000	
Construction Management & Inspection	$3,000,000	
Non-Contract Cost:	$8,865,000	

The total construction cost consists of the field cost and the non-contract costs. The total construction cost estimate for this project is $171,321,859.20 (see Table 4 below).

Table 4 – Total Project Cost Breakdown

Description	Cost	Item No. of Cost Estimate
Field Cost	$162,456,859	
Non-Contract Costs	$8,865,000	
Total Construction Cost:	$171,321,859	

Approximately $136,874,023 of this total cost is associated with Phase 1 and approximately $34,447,837 is associated with Phase 2. The Phase 1 project includes the conveyance facilities from the California Aqueduct to the RRBWSD West Basins in order to free up capacity in the Goose Lake Slough for the proposed Phase 1 property.

Other preliminary alternatives were considered such as a canal conveyance facility parallel and adjacent to the CVC as well as an expansion of the existing CVC. The expansion of the CVC would involve widening the existing CVC to increase the capacity and constructing new parallel lift stations. This alternative could be made attractive to the CVC participants by constructing the expansion with additional capacity on their behalf. The total construction costs of the alternatives considered ranged from approximately $150M to $172M.

The preparation of cost estimates at the feasibility level require many assumptions to be made. Below is a list of several of the assumptions made for purposes of this cost estimate.

1. Phase I Property is estimated to be in Section 26 and 27 of T29S, R25E on the McCaslin Property based on conversations with Mike Ming of Alliance Appraisal. Appraisal value estimated between $25K to $28K per acre.

2. Phase II Property is estimated to be in Section 30 of T29S, R25E on the Tracy Ranch Property based on conversations with Mike Ming of Alliance Appraisal. Appraisal value estimated between $20K to $23K per acre.

3. Permanent and Temporary easements based on a 140-ft width for permanent and 200-ft width for temporary and appraisal values recommended by Mike Ming of Alliance Appraisal.

4. Habitat Conservation Plan (HCP) fees based on 4-miles across KWB for 200-ft width equating to approximately 100 acres. Assumed 2:1 ratio for HCP.

5. Conveyance alignment from California Aqueduct to the easterly end of RRBWSD West Basins assumed to be as shown on the attached feasibility study map in Appendix A. Lift station locations are merely conceptual.

6. Conveyance facilities from California Aqueduct to east side of I-5 Freeway to have a capacity of 500 cfs and then a 400 cfs capacity to the Goose Lake Slough and West Basins. Capacity to serve Phase 2 Property, West Basins, and potential in lieu District farmlands.

Project Schedule

A preliminary project schedule has been prepared and is attached in Appendix C. The project has been assumed to begin in January 2019 and has an estimated completion date of March 2025 or approximately six years. The design phase is estimated to involve approximately two years from January 2019 to January 2021. The bid phase is estimated as 8 months from January 2021 through September 2021 as the project is advertised and contractors pre-qualified. The construction phase is estimated as being 3-1/2 years long from September 2021 through March 2025.

Project Operation and Maintenance Costs

Preliminary project operation, maintenance, and replacement costs have been prepared for the project described herein. The operation and maintenance cost estimate is attached in Appendix D. This cost estimate approximates the operation and maintenance (O&M) costs for a typical dry year when recovering water, a typical wet year when recharging water, and an idle year. It is further broken down into those costs associated with the Phase I Recharge and Recovery property, the Phase II Recharge and Recovery property, the Phase I Canal Conveyance with three Lift Stations, and the Phase I Goose Lake Slough Turnout and one Lift Station.

The recovery operations and maintenance costs (dry year) have been based on operating approximately twelve months out of the year. The average estimated monthly cost is $317,944.44. This equates to an annual cost of approximately $3,815,333.33. Based on returning approximately 50,000 ac-ft per year equates to an average cost of $76.31 per ac-ft.

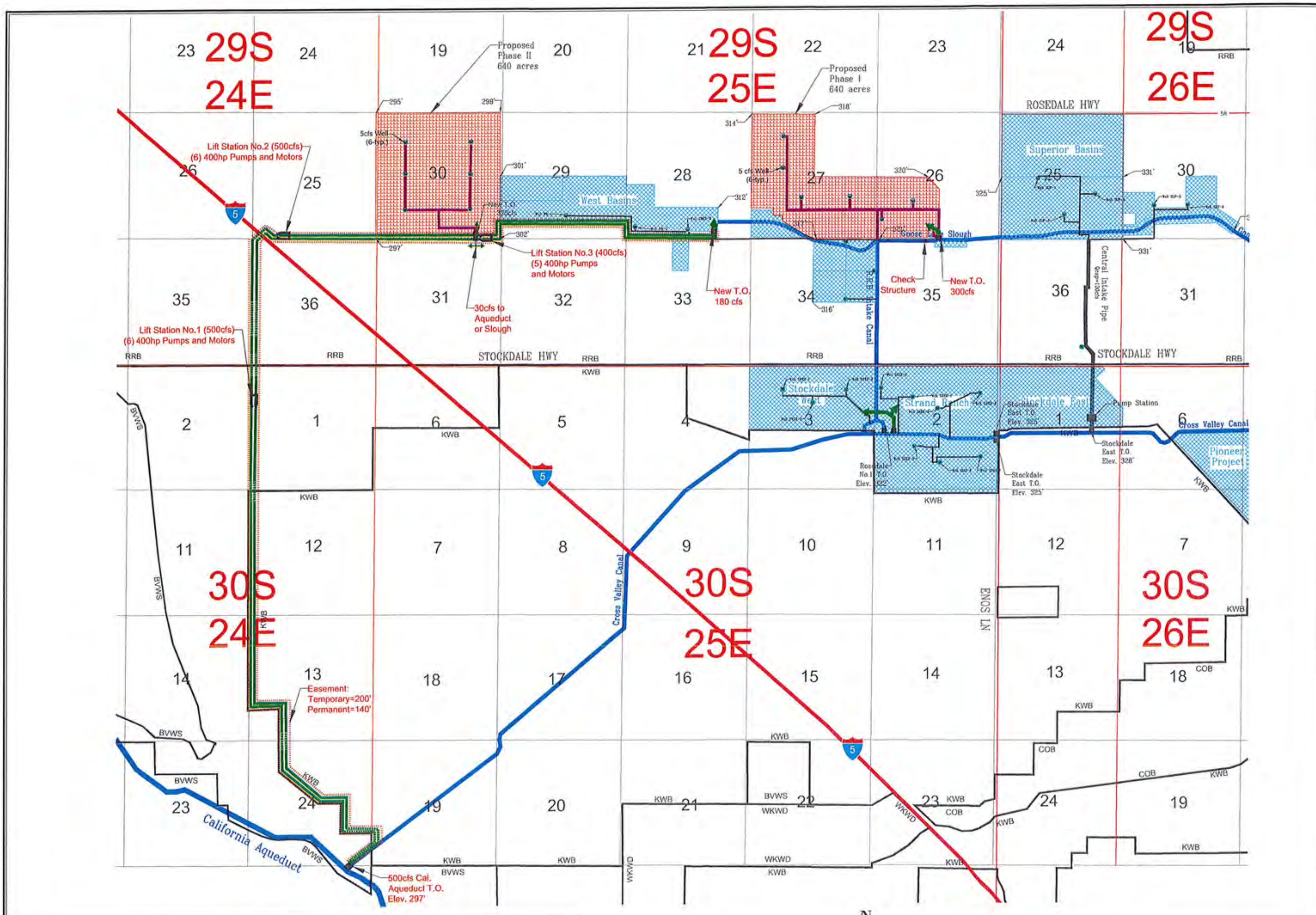
The recharge operations and maintenance costs (wet year) have been based on recharging water for approximately 3.5 months out of the year. The remaining 8.5 months of the year were considered using the costs of an idle operation (not recharging or recovering water). The average monthly cost during actual recharge operations is approximately $754,384.01. The average estimated monthly cost over a twelve month period is $233,447.65. This equates to an annual cost of approximately $2,801,371.83. Based on recharging 112,500 ac-ft per year equates to an average cost of $24.90 per ac-ft.

The replacement cost estimate is attached in Appendix E. This cost estimate is evaluating the future replacement of critical project components based upon the useful life of the component, the frequency of replacement over a fifty year period, the unit cost of material and labor, and the extended cost based upon 2015 costs. These costs have been separated into the Phase I Recovery Wells, the Phase II Recovery Wells, the Phase I Canal, the Phase I Canal Lift Stations, the Aqueduct Turnout, the Phase II Property Turnout, the West Basin Turnout, and the Goose Lake Slough Turnout and Lift Station.

Appendix A

Kern Fan Groundwater Storage Project

Project Concept Map



Kern Fan Groundwater Storage Project Feasibility Study Map

Appendix B

Class 4 Feasibility Level

Cost Estimate

Irvine Ranch Water District

Feasibility Level Cost Estimate (Class 4)

Canal Alignment along KWB to West Basins

Item No.	Item Description	Unit	Quantity		Unit Cost		Extended Cost	Phase
1	Mobilization, Demobilization, & Cleanup	LS	1	$	1,820,000.00	$	1,820,000.00	1
2	Aqueduct Cofferdam & Dewatering	LS	1	$	250,000.00	$	250,000.00	1
3	Aqueduct Turnout Excavation	LS	1	$	55,000.00	$	55,000.00	1
4	Aqueduct Reinforced Concrete Structure	LS	1	$	200,000.00	$	200,000.00	1
5	Aqueduct Backfill and Compaction	LS	1	$	50,000.00	$	50,000.00	1
6	Aqueduct Miscellaneous Steel	LS	1	$	55,000.00	$	55,000.00	1
7	Aqueduct Metering	EA	2	$	90,000.00	$	180,000.00	1
8	Aqueduct Slide Gate & Actuator	EA	2	$	37,500.00	$	75,000.00	1
9	Aqueduct Electrical, Controls, & Lighting	LS	1	$	300,000.00	$	300,000.00	1
10	Aqueduct Liner Repair	LS	1	$	20,000.00	$	20,000.00	1
11	Canal Earthwork	CY	1,650,000	$	10.00	$	16,500,000.00	1
12	Concrete Canal Lining	SF	2,640,000	$	6.00	$	15,840,000.00	1
13	Canal Appurtenances	LS	1	$	250,000.00	$	250,000.00	1
14	Canal Fencing	LF	110,000	$	7.50	$	825,000.00	1
15	Levee Road Aggregate Base Ground Cover	LS	1	$	650,000.00	$	650,000.00	1
16	East Canal Crossing Siphon & Appurtenances	LS	1	$	1,000,000.00	$	1,000,000.00	1
17	Main Canal Crossing Siphon & Appurtenances	LS	1	$	500,000.00	$	500,000.00	1
18	WKWD Pipeline Crossing Siphon & Appurtenances	LS	1	$	250,000.00	$	250,000.00	1
19	Stockdale Hwy Crossing Siphon & Appurtenances	LS	1	$	1,000,000.00	$	1,000,000.00	1
20	I-5 Crossing Siphon & Appurtenances	LS	1	$	1,500,000.00	$	1,500,000.00	1
21	Farm Road Siphon & Appurtenances	EA	3	$	600,000.00	$	1,800,000.00	1
22	84" Siphon Piping	LF	10,720	$	1,500.00	$	16,080,000.00	1
23	Lift Station Excavation	LS	3	$	60,000.00	$	180,000.00	1
24	Lift Station Reinforced Concrete Structure	LS	3	$	650,000.00	$	1,950,000.00	1
25	Lift Station Pumps - 67 cfs to 83 cfs	EA	18	$	150,000.00	$	2,700,000.00	1
26	Lift Station Motors - 300 hp to 400 hp	EA	18	$	95,000.00	$	1,710,000.00	1
27	Lift Station Discharge Piping & Appurtenances	LS	3	$	750,000.00	$	2,250,000.00	1
28	Lift Station VFD's	EA	18	$	50,000.00	$	900,000.00	1
29	Lift Station Electrical, Controls, & Lighting	LS	3	$	500,000.00	$	1,500,000.00	1
30	Lift Station Backfill & Compaction	LS	3	$	65,000.00	$	195,000.00	1
31	Lift Station Slide Gates	EA	3	$	37,500.00	$	112,500.00	1
32	Lift Station Miscellaneous Steel	LS	3	$	80,000.00	$	240,000.00	1
33	Lift Station Site Fencing	LS	1	$	135,000.00	$	135,000.00	1
34	Lift Station Ground Cover	LS	1	$	45,000.00	$	45,000.00	1
35	West Basins Turnout Structure Excavation	LS	1	$	50,000.00	$	50,000.00	1
36	West Basins Turnout Reinforced Concrete Structure	LS	1	$	200,000.00	$	200,000.00	1
37	West Basins Structure Backfill & Compaction	LS	1	$	50,000.00	$	50,000.00	1
38	West Basins Turnout Miscellaneous Steel	LS	1	$	35,000.00	$	35,000.00	1
39	West Basins Metering	EA	3	$	90,000.00	$	270,000.00	1
40	West Basins Turnout Slide Gate	EA	3	$	55,000.00	$	165,000.00	1
41	West Basins Turnout Electrical	LS	1	$	150,000.00	$	150,000.00	1
42	Phase II 640 Acres Turnout Structure Excavation	LS	1	$	55,000.00	$	55,000.00	2
43	Phase II 640 Acres Turnout Reinforced Concrete Structure	LS	1	$	150,000.00	$	150,000.00	2
44	Phase II 640 Acres Structure Backfill & Compaction	LS	1	$	50,000.00	$	50,000.00	2
45	Phase II 640 Acres Turnout Miscellaneous Steel	LS	1	$	40,000.00	$	40,000.00	2
46	Phase II 640 Acres Metering	EA	2	$	90,000.00	$	180,000.00	2
47	Phase II 640 Acres Turnout Slide Gate	EA	2	$	37,500.00	$	75,000.00	2
48	Phase II 640 Acres Turnout Electrical	LS	1	$	150,000.00	$	150,000.00	2
49	Phase II 640 Acres Earthwork and Interbasin Structures	LS	1	$	2,895,200.00	$	2,895,200.00	2
50	Phase II 640 Acres Well Drilling, Construction, & Development	EA	6	$	798,901.00	$	4,793,406.00	2
51	Phase II 640 Acres Well Equipping with Pumps, Motors, Discharge Piping, & Electrical	EA	6	$	777,333.67	$	4,664,002.00	2
52	Phase II 640 Acres Well Recovery Pipeline - 16" C905 PVC	LF	2800	$	70.00	$	196,000.00	2
53	Phase II 640 Acres Well Recovery Pipeline - 24" C905 PVC	LF	5500	$	130.00	$	715,000.00	2
54	Phase II 640 Acres Well Recovery Pipeline - 36" C905 PVC	LF	4200	$	180.00	$	756,000.00	2
55	Goose Lake Slough Turnout Structure Excavation	LS	1	$	60,000.00	$	60,000.00	1
56	Goose Lake Slough Turnout Reinforced Concrete Structure	LS	1	$	650,000.00	$	650,000.00	1
57	Goose Lake Slough Turnout Backfill & Compaction	LS	1	$	60,000.00	$	60,000.00	1
58	Goose Lake Slough Turnout Miscellaneous Steel	LS	1	$	80,000.00	$	80,000.00	1
59	Goose Lake Slough Lift Station Pumps - 60 cfs	EA	4	$	140,000.00	$	560,000.00	1
60	Goose Lake Slough Lift Station Motors - 300 hp	EA	4	$	85,000.00	$	340,000.00	1
61	Goose Lake Slough Lift Station Discharge Piping & Appurtenances	LS	1	$	600,000.00	$	600,000.00	1
62	Goose Lake Slough Metering	EA	2	$	90,000.00	$	180,000.00	1
63	Goose Lake Slough Turnout Slide Gate	EA	1	$	37,500.00	$	37,500.00	1
64	Goose Lake Slough Turnout Electrical	LS	1	$	500,000.00	$	500,000.00	1
65	Phase 1 640 Acres Conveyance Pipelines	LF	200	$	1,500.00	$	300,000.00	1
66	Phase 1 640 Acres Discharge Structure	LS	1	$	55,000.00	$	55,000.00	1
67	Goose Lake Slough Check Structure - Earthwork	LS	1	$	35,000.00	$	35,000.00	1
68	Goose Lake Slough Check Structure - Reinforced Concrete	LS	1	$	200,000.00	$	200,000.00	1
69	Goose Lake Slough Check Structure - Rip-Rap	LS	1	$	30,000.00	$	30,000.00	1
70	Goose Lake Slough Check Structure - Appurtenances, Weir Boards	LS	1	$	25,000.00	$	25,000.00	1
71	RRB Intake Canal Interconnection	LS	1	$	250,000.00	$	250,000.00	1
72	Phase 1 640 Acres Earthwork and Interbasin Structures	LS	1	$	2,895,200.00	$	2,895,200.00	1
73	Phase 1 640 Acres Well Drilling, Construction, & Development	EA	6	$	798,901.00	$	4,793,406.00	1
74	Phase 1 640 Acres Well Equipping with Pumps, Motors, Discharge Piping, & Electrical	EA	6	$	777,333.67	$	4,664,002.00	1
75	Phase 1 640 Acres Well Recovery Pipeline - 16" C905 PVC	LF	1350	$	70.00	$	94,500.00	1
76	Phase 1 640 Acres Well Recovery Pipeline - 24" C905 PVC	LF	4200	$	130.00	$	546,000.00	1
77	Phase 1 640 Acres Well Recovery Pipeline - 30" C905 PVC	LF	2800	$	130.00	$	364,000.00	1
78	Phase 1 640 Acres Well Recovery Pipeline - 36" C905 PVC	LF	2800	$	180.00	$	504,000.00	1
79	SCADA Communication & Appurtenances	LS	1	$	300,000.00	$	300,000.00	1
	Contract Cost:					*$*	*104,880,716.00*	
	20% Construction Contingency:					*$*	*20,976,143.20*	
	Property Acquisition - 640 acres	*AC*	*640*	*$*	*26,500.00*	*$*	*16,960,000.00*	
	Property Acquisition - 640 acres	*AC*	*640*	*$*	*21,500.00*	*$*	*13,760,000.00*	
	Temporary Easement	*AC*	*235*	*$*	*3,750.00*	*$*	*881,250.00*	
	Permanent Easement	*AC*	*165*	*$*	*10,750.00*	*$*	*1,773,750.00*	
	Aqueduct R/W & Compliance	*LS*	*1*	*$*	*25,000.00*	*$*	*25,000.00*	
	Habitat Credit Purchase	*AC*	*200*	*$*	*16,000.00*	*$*	*3,200,000.00*	
	Field Cost:					*$*	*162,456,859.20*	
	Non-Contract Costs:					*$*	*8,865,000.00*	
	Total Construction Cost:					***$***	***171,321,859.20***	

Curtis M. Skaggs 8-10-17

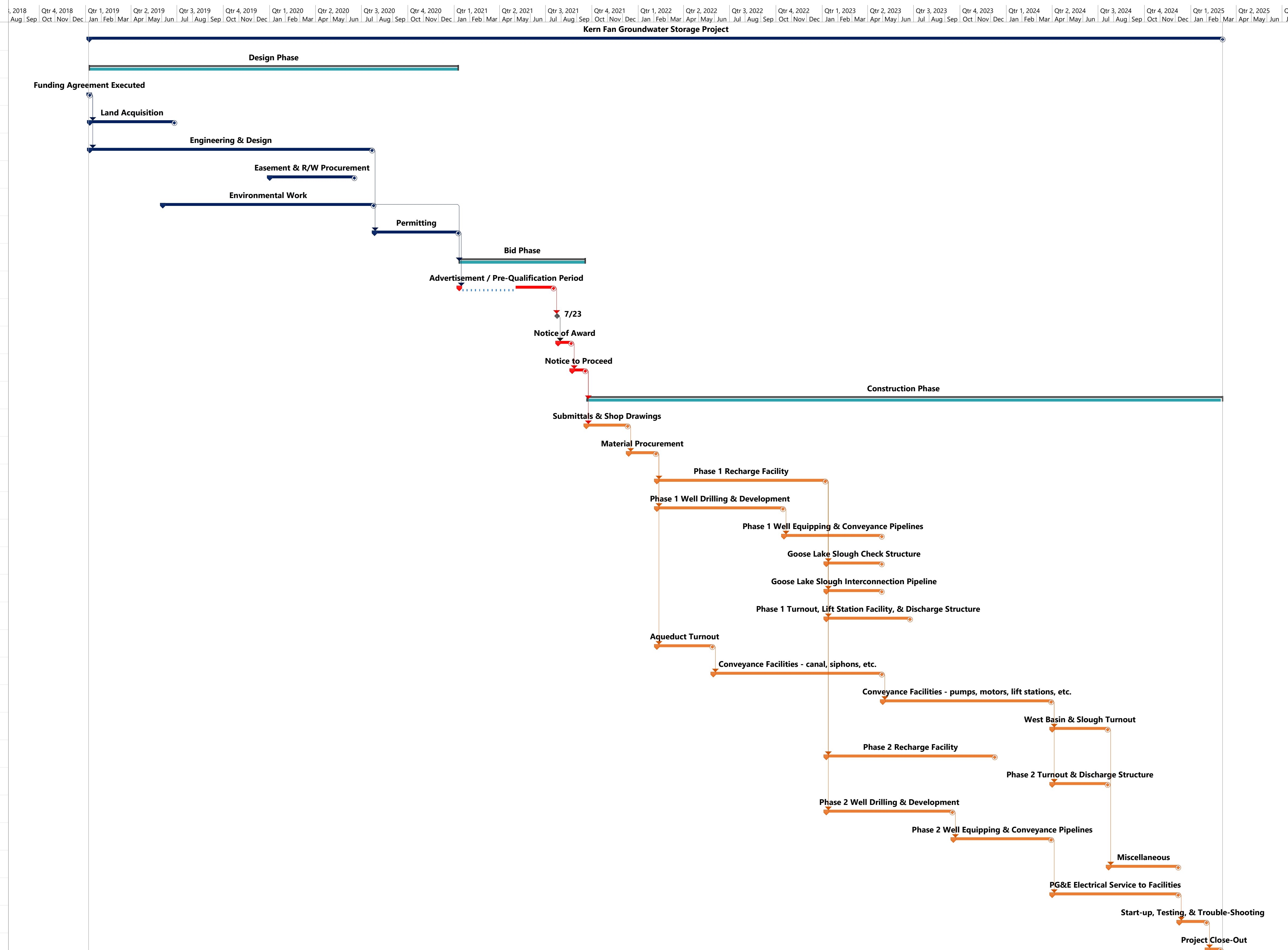
Curtis M. Skaggs, P.E. RCE 60960 Exp. 12-31-18 Date

REGISTERED PROFESSIONAL ENGINEER
CURTIS M. SKAGGS
No. C60960
Exp. 12-31-18
CIVIL
STATE OF CALIFORNIA

Appendix C

Project Schedule

ID	Task Mode	Task Name	Duration	Start	Finish
0		Kern Fan Groundwater Storage Project	1606 days	1/8/2019	3/4/2025
1		**Design Phase**	**524 days**	**1/8/2019**	**1/8/2021**
2		Funding Agreement Executed	1 day?	1/8/2019	1/8/2019
3		Land Acquisition	6 mons	1/9/2019	6/25/2019
4		Engineering & Design	20 mons	1/9/2019	7/21/2020
5		Easement & R/W Procurement	6 mons	1/1/2020	6/16/2020
6		Environmental Work	15 mons	6/3/2019	7/24/2020
7		Permitting	6 mons	7/27/2020	1/8/2021
8		**Bid Phase**	**180 days**	**1/11/2021**	**9/17/2021**
9		Advertisement / Pre-Qualification Period	3 mons	1/11/2021	7/16/2021
10		Bids Due	5 days	7/19/2021	7/23/2021
11		Notice of Award	1 mon	7/26/2021	8/20/2021
12		Notice to Proceed	1 mon	8/23/2021	9/17/2021
13		**Construction Phase**	**900 days**	**9/22/2021**	**3/4/2025**
14		Submittals & Shop Drawings	3 mons	9/20/2021	12/10/2021
15		Material Procurement	2 mons	12/13/2021	2/4/2022
16		Phase 1 Recharge Facility	12 mons	2/7/2022	1/6/2023
17		Phase 1 Well Drilling & Development	9 mons	2/7/2022	10/14/2022
18		Phase 1 Well Equipping & Conveyance Pipelines	7 mons	10/17/2022	4/28/2023
19		Goose Lake Slough Check Structure	4 mons	1/9/2023	4/28/2023
20		Goose Lake Slough Interconnection Pipeline	4 mons	1/9/2023	4/28/2023
21		Phase 1 Turnout, Lift Station Facility, & Discharge Structure	6 mons	1/9/2023	6/23/2023
22		Aqueduct Turnout	4 mons	2/7/2022	5/27/2022
23		Conveyance Facilities - canal, siphons, etc.	12 mons	5/30/2022	4/28/2023
24		Conveyance Facilities - pumps, motors, lift stations, etc.	12 mons	5/1/2023	3/29/2024
25		West Basin & Slough Turnout	4 mons	4/1/2024	7/19/2024
26		Phase 2 Recharge Facility	12 mons	1/9/2023	12/8/2023
27		Phase 2 Turnout & Discharge Structure	4 mons	4/1/2024	7/19/2024
28		Phase 2 Well Drilling & Development	9 mons	1/9/2023	9/15/2023
29		Phase 2 Well Equipping & Conveyance Pipelines	7 mons	9/18/2023	3/29/2024
30		Miscellaneous	5 mons	7/22/2024	12/6/2024
31		PG&E Electrical Service to Facilities	9 mons	4/1/2024	12/6/2024
32		Start-up, Testing, & Trouble-Shooting	2 mons	12/9/2024	1/31/2025
33		Project Close-Out	1 mon	2/3/2025	2/28/2025



Project: Kern Fan Groundwater
Date: 8/1/2017

Task | Milestone | Project Summary | Inactive Milestone | Manual Task | Manual Summary Rollup | Start-only | External Tasks | Deadline | Manual Progress
Split | Summary | Inactive Task | Inactive Summary | Duration-only | Manual Summary | Finish-only | External Milestone | Progress

Appendix D

Operation and Maintenance

Cost Estimate

Irvine Ranch Water District
Operation & Maintenance Cost Estimate
Phase I Well Field Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	DWR Monthly Conveyance Cost	Total Monthly Cost[5]	Total Annual Cost if Utilized for 12 Months[6]	Average Cost per Ac-Ft[7]
Dry Year (Pumping Wells)	$ 8,000.00	$ 144,900.00	$ 316.67	$ -	$ 153,216.67	$ 1,838,600.00	$ 73.54
Wet Year (Recharging Water)	$ 9,000.00	$ 1,500.00	$ 316.67	$ -	$ 10,816.67	$ 88,150.00	$ 1.57
Idle Year	$ 4,100.00	$ 1,500.00	$ 316.67	$ -	$ 5,916.67	$ 71,000.00	

1. Operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent control cost, and estimated overhead.
2. Cost includes one additional piece of equipment for property maintenance
3. Monthly PG&E cost to operate (6) 400 hp wells
4. Average monthly cost for cellular service to (6) Mission Units
5. Assumed 35 cfs flow rate for a 30 day month for a total of 2,083 ac-ft of water recovered per month or 25,000 ac-ft/yr
6. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 3.5 months of recharging up to 56,250 ac-ft and 8.5 months at idle costs.
7. Dry year pumping 25,000 ac-ft and a wet year recharging 56,250 ac-ft.

Phase I Canal Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	DWR Conveyance Cost[5]	Total Monthly Cost	Total Annual Cost[6]	Average Cost per Ac-Ft[7]
Dry Year (Returning water to Aqueduct)	$ 8,000.00	$ 1,500.00	$ 158.33	$ -	$ 9,658.33	$ 115,900.00	$ 4.64
Wet Year (Conveying water for Recharge)	$ 9,000.00	$ 197,486.00	$ 158.33	$ 462,053.57	$ 668,697.90	$ 2,389,388.50	$ 21.24
Idle Year	$ 4,100.00	$ 1,500.00	$ 158.33	$ -	$ 5,758.33	$ 69,100.00	

1. Operation cost includes canal maintenance, field staff time, equipment cost, weed control cost, rodent control cost, and overhead cost.
2. Cost includes one additional piece of equipment for canal maintenance
3. Monthly PG&E cost to operate (18) 300 hp lift pumps moving 500 cfs, Total 112,500 ac-ft / year
4. Average monthly cost for cellular service to (3) Mission Units
5. Article 21 water cost estimated at $23.00/AF for 112,500 ac-ft, however IRWD's share (37.5%) is paid through agreement with Metropolitan Water District.
Therefore the estimated monthly water costs include $23/AF for 70,312.5 ac-ft.
6. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 3.5 months of conveying up to 112,500 ac-ft and 8.5 months at idle costs.
7. Dry year conveying 25,000 ac-ft to aqueduct and a wet year recharging 112,500 ac-ft.

Phase I Goose Lake Slough Turnout Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1]	Monthly PG&E Cost[2]	Monthly Mission Unit Cost[3]	DWR Conveyance Cost	Total Monthly Cost	Total Annual Cost[4]	Average Cost per Ac-Ft[5]
Dry Year (Returning water to Aqueduct)	$ 1,500.00	$ 300.00	$ 52.78	$ -	$ 1,852.78	$ 22,233.33	$ 0.89
Wet Year (Conveying water for Recharge)	$ 4,000.00	$ 60,000.00	$ 52.78	$ -	$ 64,052.78	$ 235,683.33	$ 4.19
Idle Year	$ 1,000.00	$ 300.00	$ 52.78	$ -	$ 1,352.78	$ 16,233.33	

1. Operation cost includes canal maintenance, field staff time, equipment cost, weed control cost, rodent control cost, and overhead cost.
2. Monthly PG&E cost to operate (4) 300 hp lift pumps moving 240 cfs, Total 50,000 ac-ft / year
3. Average monthly cost for cellular service to (1) Mission Unit
4. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 3.5 months of recharging up to 56,250 ac-ft and 8.5 months at idle costs.
5. Dry year pumping 25,000 ac-ft and a wet year recharging 56,250 ac-ft.

Phase II Well Field Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	DWR Conveyance Cost	Total Monthly Cost	Total Annual Cost if Utilized for 12 Months[6]	Average Cost per Ac-Ft[7]
Dry Year (Pumping Wells)	$ 8,000.00	$ 144,900.00	$ 316.67	$ -	$ 153,216.67	$ 1,838,600.00	$ 73.54
Wet Year (Recharging Water)	$ 9,000.00	$ 1,500.00	$ 316.67	$ -	$ 10,816.67	$ 88,150.00	$ 1.57
Idle Year	$ 4,100.00	$ 1,500.00	$ 316.67	$ -	$ 5,916.67	$ 71,000.00	

1. Operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent control cost, and estimated overhead.
2. Cost includes one additional piece of equipment for property maintenance
3. Monthly PG&E cost to operate (6) 400 hp wells
4. Average monthly cost for cellular service to (6) Mission Units
5. Assumed 35 cfs flow rate for a 30 day month for a total of 2,083 ac-ft of water recovered per month or 25,000 ac-ft/yr
6. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 3.5 months of recharging up to 56,250 ac-ft and 8.5 months at idle costs.
7. Dry year pumping 25,000 ac-ft and a wet year recharging 56,250 ac-ft.

Total Project Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	DWR Monthly Conveyance Cost	Total Monthly Cost	Total Annual Cost if Utilized for 12 Months[6]	Average Cost per Ac-Ft[7]
Dry Year (Pumping Wells and Returning Water)	$ 25,500.00	$ 291,600.00	$ 844.44	$ -	$ 317,944.44	$ 3,815,333.33	$ 76.31
Wet Year (Conveying and Recharging Water)	$ 31,000.00	$ 260,486.00	$ 844.44	$ 462,053.57	$ 754,384.01	$ 2,801,371.83	$ 24.90
Idle Year	$ 13,300.00	$ 4,800.00	$ 844.44	$ -	$ 18,944.44	$ 227,333.33	

Appendix E

Replacement

Cost Estimate

Irvine Ranch Water District

Replacement Cost Estimate

Canal Maintenance Cost

Item	Description	Useful Life	Number of Replacement in 50 Years	Quantity to be Replaced	Units	Unit Cost	Extended Cost
1	Concrete Canal Panel Repair*	1	50	13	EA	$ 2,000.00	$ 1,300,000.00
2	Levee Road Aggregate Base**	1	50	100	CY	$ 35.00	$ 175,000.00
3	Replace Safety Buoy Replacement	25	1	1	LS	$ 25,000.00	$ 25,000.00
4	Replace Ladder Rung Replacement	25	1	1	LS	$ 25,000.00	$ 25,000.00
						Subtotal:	$ 1,525,000.00
						Annualized over 50 Years:	$ 30,500.00

*Replacing 5% of liner during the 50 year period

**Replacing 0.5% of aggregate base annually

Lift Station Maintenance Cost

Item	Description	Useful Life	Number of Replacement in 50 Years	Quantity to be Replaced	Units	Unit Cost	Extended Cost
5	Replace Electric Motor	15	3	18	EA	$ 95,000.00	$ 5,130,000.00
6	Replace Lift Pump	15	3	18	EA	$ 150,000.00	$ 8,100,000.00
7	Replace Pressure Gauge	15	3	36	EA	$ 50.00	$ 5,400.00
8	Replace Control Panel AC	20	2	3	EA	$ 2,500.00	$ 15,000.00
9	Replace VFD AC	20	2	18	EA	$ 2,500.00	$ 90,000.00
10	Replace Site Light Solar Panel	25	1	6	EA	$ 2,000.00	$ 12,000.00
11	New Site Painting	25	1	3	EA	$ 3,000.00	$ 9,000.00
12	Replace Site Flood Light	25	1	6	EA	$ 400.00	$ 2,400.00
13	Replace Site Motion Sensor	25	2	3	EA	$ 350.00	$ 2,100.00
14	Replace Site Canopy Lights	25	1	3	EA	$ 350.00	$ 1,050.00
15	Replace Site Camera	25	1	3	EA	$ 400.00	$ 1,200.00
16	Miscellaneous Electrical & PM	2	25	3	EA	$ 1,500.00	$ 112,500.00
17	Misc. Valve Replacement	25	1	18	EA	$ 20,000.00	$ 360,000.00
						Subtotal:	$ 13,840,650.00
						Annualized over 50 Years:	$ 276,813.00

Aqueduct Turnout Maintenance Cost

Item	Description	Useful Life	Number of Replacement in 50 Years	Quantity to be Replaced	Units	Unit Cost	Extended Cost
18	Replace Flow Meter	25	1	2	EA	$ 90,000.00	$ 180,000.00
19	Slide Gate Actuator	25	1	2	EA	$ 7,000.00	$ 14,000.00
20	Miscellaneous Electrical & PM	2	25	1	EA	$ 500.00	$ 12,500.00
						Subtotal:	$ 206,500.00
						Annualized over 50 Years:	$ 4,130.00

Phase II Turnout Maintenance Cost

Item	Description	Useful Life	Number of Replacement in 50 Years	Quantity to be Replaced	Units	Unit Cost	Extended Cost
21	Replace Flow Meter	25	1	2	EA	$ 90,000.00	$ 180,000.00
22	Slide Gate Actuator	25	1	2	EA	$ 7,000.00	$ 14,000.00
23	Miscellaneous Electrical & PM	2	25	1	EA	$ 500.00	$ 12,500.00
						Subtotal:	$ 206,500.00
						Annualized over 50 Years:	$ 4,130.00

West Basin Turnout Maintenance Cost

Item	Description	Useful Life	Number of Replacement in 50 Years	Quantity to be Replaced	Units	Unit Cost	Extended Cost
24	Replace Flow Meter	25	1	3	EA	$ 90,000.00	$ 270,000.00
25	Slide Gate Actuator	25	1	3	EA	$ 7,000.00	$ 21,000.00
26	Miscellaneous Electrical & PM	2	25	1	EA	$ 500.00	$ 12,500.00
						Subtotal:	$ 303,500.00
						Annualized over 50 Years:	$ 6,070.00

Well Site Maintenance Cost - Phase I

Item	Description	Useful Life	Number of Replacement in 50 Years	Quantity to be Replaced	Units	Unit Cost	Extended Cost
27	Replace Electric Motor	15	3	6	EA	$ 95,000.00	$ 1,710,000.00
28	Replace Deep Well Pump Bowls	15	3	6	EA	$ 30,000.00	$ 540,000.00
29	Replace Flow Meter	25	1	6	EA	$ 10,000.00	$ 60,000.00
30	Flow Meter Calibration	5	9	6	EA	$ 1,500.00	$ 81,000.00
31	Replace Solenoid Valve	15	3	6	EA	$ 250.00	$ 4,500.00
32	Replace Pressure Gauge	20	2	6	EA	$ 50.00	$ 600.00
33	Control Panel AC	20	2	6	EA	$ 2,500.00	$ 30,000.00
34	Replace Site Light Solar Panel	25	1	6	EA	$ 2,000.00	$ 12,000.00
35	New Site Painting	25	1	6	EA	$ 3,500.00	$ 21,000.00
36	Replace Site Flood Light	25	1	6	EA	$ 400.00	$ 2,400.00
37	Replace Site Motion Sensor	15	3	6	EA	$ 200.00	$ 3,600.00
38	Replace Site Canopy Lights	25	1	6	EA	$ 200.00	$ 1,200.00
39	Replace Site Camera	25	1	6	EA	$ 350.00	$ 2,100.00
40	Replace Oil Reservoir	25	1	6	EA	$ 300.00	$ 1,800.00
41	Miscellaneous Electrical & PM	2	25	6	EA	$ 600.00	$ 90,000.00
						Subtotal:	$ 2,560,200.00
						Annualized over 50 Years:	$ 51,204.00

Goose Lake Slough Turnout Maintenance Cost

Item	Description	Useful Life	Number of Replacement in 50 Years	Quantity to be Replaced	Units	Unit Cost	Extended Cost
42	Electric Motor	25	1	4	EA	$ 85,000.00	$ 340,000.00
43	Lift Pump	25	1	4	EA	$ 140,000.00	$ 560,000.00
44	Flow Meter	25	1	2	EA	$ 90,000.00	$ 180,000.00
45	Miscellaneous Electrical & PM	2	25	4	EA	$ 500.00	$ 50,000.00
						Subtotal:	$ 1,130,000.00
						Annualized over 50 Years:	$ 22,600.00

Well Site Maintenance Cost - Phase II

Item	Description	Useful Life	Number of Replacement in 50 Years	Quantity to be Replaced	Units	Unit Cost	Extended Cost
46	Replace Electric Motor	15	3	6	EA	$ 95,000.00	$ 1,710,000.00
47	Replace Deep Well Pump Bowls	15	3	6	EA	$ 30,000.00	$ 540,000.00
48	Replace Flow Meter	25	1	6	EA	$ 10,000.00	$ 60,000.00
49	Flow Meter Calibration	5	9	6	EA	$ 1,500.00	$ 81,000.00
50	Replace Solenoid Valve	15	3	6	EA	$ 250.00	$ 4,500.00
51	Replace Pressure Gauge	20	2	6	EA	$ 50.00	$ 600.00
52	Control Panel AC	20	2	6	EA	$ 2,500.00	$ 30,000.00
53	Replace Site Light Solar Panel	25	1	6	EA	$ 2,000.00	$ 12,000.00
54	New Site Painting	25	1	6	EA	$ 3,500.00	$ 21,000.00
55	Replace Site Flood Light	25	1	6	EA	$ 400.00	$ 2,400.00
56	Replace Site Motion Sensor	15	3	6	EA	$ 200.00	$ 3,600.00
57	Replace Site Canopy Lights	25	1	6	EA	$ 200.00	$ 1,200.00
58	Replace Site Camera	25	1	6	EA	$ 350.00	$ 2,100.00
59	Replace Oil Reservoir	25	1	6	EA	$ 300.00	$ 1,800.00
60	Miscellaneous Electrical & PM	2	25	6	EA	$ 600.00	$ 90,000.00
						Subtotal:	$ 2,560,200.00
						Annualized over 50 Years:	$ 51,204.00
						Total:	$ 22,332,550.00
						Annualized over 50 Years:	$ 446,651.00

Footnotes:

1. Unit replacement costs above include material and labor costs.

Appendix B- MBK Engineers Technical Memorandum

MBK ENGINEERS

Water Resources ◆ Flood Control ◆ Water Rights

TECHNICAL MEMORANDUM

DATE: August 10, 2017

TO: Paul Weghorst, Fiona Sanchez, and Natalie Palacio of Irvine Ranch Water District

PREPARED BY: Lee Bergfeld, P.E., and Shankar Parvathinathan, P.E., of MBK Engineers

SUBJECT: Analysis of Kern Fan Groundwater Storage Project for Water Storage Investment Program

Introduction

This technical memorandum presents information on the numerical modeling analysis for the Kern Fan Groundwater Storage Project (Project) in support of a grant application for the Water Storage Investment Program (WSIP). The Project will recharge and store up to 100,000 acre-feet (af) of water from the Sacramento-San Joaquin Delta (Delta), when available. The Project will provide both public and non-public benefits by storing additional water in the aquifers that underlie the Kern River Fan in wet years, and by extracting water in dry years, to provide both ecosystem and water supply benefits.

Project Operations Overview

The Project will operate by recharging and storing water supplied by the State Water Project (SWP) from the Delta, under the Article 21 Program. Article 21 water is available, in accordance with long-term Water Supply Contracts, for State Water Contractors that have signed the Monterey Amendment. Article 21 water is available when there is water in excess of SWP needs. This typically occurs in wet years when precipitation and runoff in the Delta watershed exceed long-term averages. Article 21 water will be delivered to the Project utilizing available capacity in the California Aqueduct and the Cross Valley Canal. The Project includes 400 cubic feet per second (cfs) of dedicated conveyance capacity to move water in either direction between the Project spreading basins and the Cross Valley Canal.

The Project also includes approximately 1,200 acres of spreading basins, with a recharge rate of approximately 13,000 to 26,000 af per month, depending on antecedent conditions, and an extraction capacity of 45,000 af per year. Project storage capacity will be split between accounts for public benefits (25,000 af), Irvine Ranch Water District (IRWD) (37,500 af) and Rosedale-Rio Bravo Water Storage District (Rosedale) (37,500 af). Water will be stored in the

Project based on the percent of capacity dedicated to each account, i.e., 37.5% to IRWD, 37.5% to Rosedale, and 25% to public benefits.

The Project will be operated to provide both public and non-public benefits. An overview of operations to provide each type of benefit is provided in the following sections.

Operations for Public Benefits

Water can be withdrawn from the Project to provide multiple benefits. The Project can be integrated with Oroville Reservoir operations because water stored in the Project can be extracted and delivered to the California Aqueduct to meet a portion of SWP Table A demands that would otherwise be met with water released from Oroville Reservoir and exported from the Delta at Banks Pumping Plant. An operational agreement with the Department of Water Resources (DWR) will allow the Project to integrate with Oroville operations to provide public benefits.

Under the operational agreement, DWR will release short-term pulse flows (Ecosystem Pulse) from Oroville, in April or May, to improve habitat conditions for rearing, downstream migration of spring and fall-run Chinook, and benefits to other fish species. Ecosystem Pulses are expected to improve conditions in the Feather River, downstream of Oroville Dam, and the Sacramento River, from the confluence with the Feather River through the Delta. DWR will make Ecosystem Pulses when water is available in the Project's public benefits account. The magnitude and duration of the Ecosystem Pulse will be determined based on the volume of water available in the Project and the expected fisheries benefit. The Project will target making Ecosystem Pulses in drier years when Oroville Reservoir will not make flood control releases.

After making an Ecosystem Pulse, water in storage in Oroville Reservoir will be lower by the volume of the pulse. However, the Project will be providing water to meet SWP demands in the export service area, thereby providing a means to "recover" storage in Oroville. Oroville storage will recover by reducing releases to support demands in the export service area, typically in the July through September period. Under this operation, Oroville carryover storage at the end of September is expected to be essentially the same as without the Project.

Figure 1 illustrates the Project's effects on Oroville Reservoir storage and flows in the Feather River for an example year, from April through September.

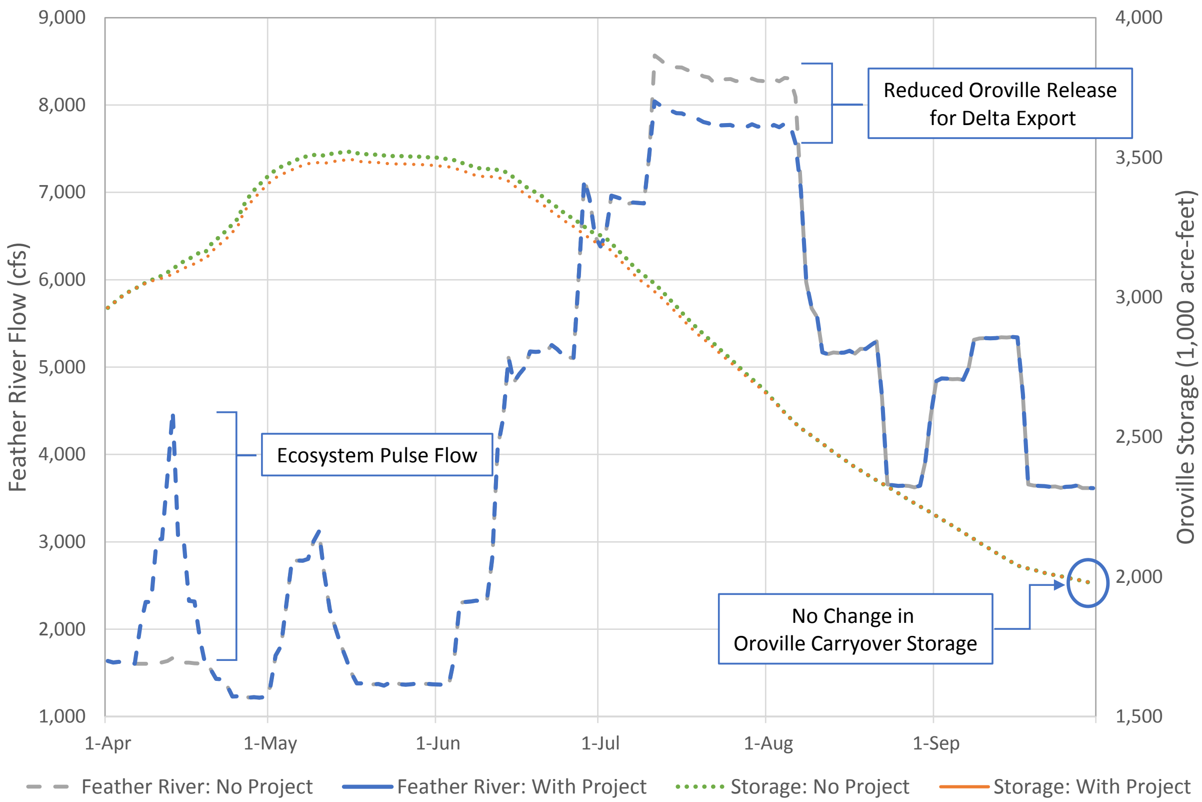


Figure 1. Example of Project Public Benefits through Integration with Oroville Reservoir

Once it is determined that an Ecosystem Pulse will be made, the Project will begin extracting water from the public benefits account for delivery back to the California Aqueduct and SWP Table A contractors. This will likely begin shortly before or after the Ecosystem Pulse is released from Oroville. Water extracted from the Project will replace SWP water that would otherwise be provided from San Luis Reservoir. Therefore, water provided by the Project can essentially be stored in the SWP portion of San Luis Reservoir and will increase storage in San Luis compared to a without-project condition. SWP storage in San Luis will also be affected by a reduction in Banks pumping expected to occur when Oroville release is reduced for a short period in the July through September period. Immediately following this period of reduced Banks pumping, SWP storage in San Luis may be lower than under a without-project condition. Project extraction will continue until the volume of Ecosystem Pulse has been extracted and SWP San Luis storage has returned to the same level as it would have originally been, absent the Project.

Figure 2 illustrates the potential start and end dates for Project extraction from the Public Benefits account, and the Project's effects on storage in SWP San Luis and Banks pumping for an example year, from April through November.

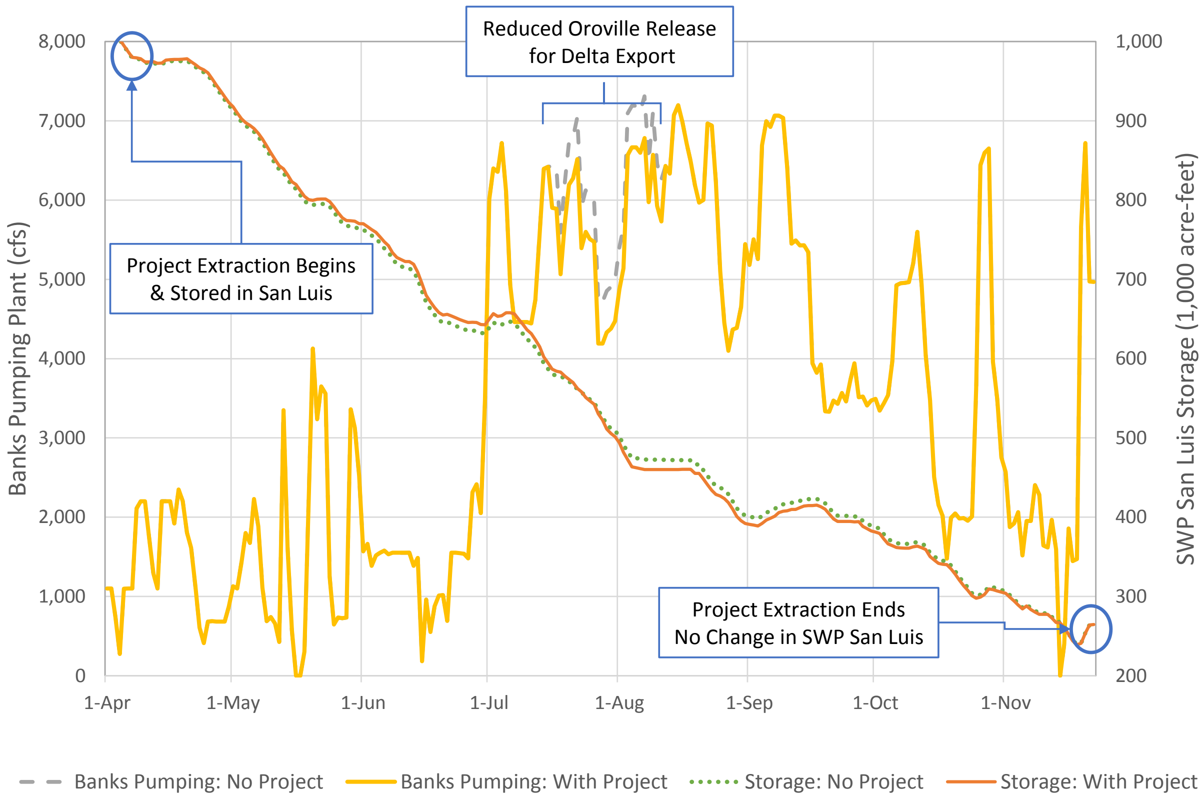


Figure 2. Example of Effect of Project Operations on SWP San Luis Reservoir and Banks Pumping

Operations for Non-Public Benefits

Water stored in accounts for IRWD and Rosedale provides a water supply benefit for these two agencies. These deliveries would be made on behalf of IRWD as a landowner in Dudley Ridge Water District (DRWD) and Rosedale as a sub-unit of the Kern County Water agency. IRWD will physically extract water from the Project for delivery during years of reduced available supply from other sources in their supply portfolio; these may include years of below average SWP Table A allocations. Rosedale will manage water stored in the Project account as another source in their water supply portfolio.

Analytical Approach

The analytical approach involves the use of CalSim II model results to depict the without-Project (Baseline) scenario. The CalSim II model simulates operations of Central Valley Project (CVP) and SWP in order to meet existing environmental and regulatory requirements, contract obligations, and other system requirements. The operation of the Project is then simulated in a spreadsheet model that layers the Project onto the Baseline operation of the CVP and SWP as simulated in CalSim II. The spreadsheet model simulates the with-Project scenario. The Project benefits and effects are then determined and quantified by comparison of the with-Project and without-Project scenarios.

The Baseline scenario for this analysis is the WSIP 2030 CalSim II model dated November 2, 2016, and available from the WSIP website. This model simulation is described as a without-project, 2030 future condition with projected climate and sea-level conditions for a thirty-year period centered at 2030. The Project scenario is simulated using a spreadsheet operations model which operates on a monthly time-step similar to CalSim II for the period October 1921 through September 2003 and utilizes CalSim II baseline depiction of CVP/SWP operations.

Study Area

While the project is located in Kern County, effects of the Project extend to the Delta for the source of water and upstream on the Feather River for ecosystem benefits. Additionally, water supply developed by the Project may be delivered within the SWP service area.

The Project is expected to affect the following locations:

1. Delta outflows
2. SWP Delta exports
3. Flows in Feather and Sacramento rivers and inflows to Delta
4. Storage in Lake Oroville
5. Storage in San Luis Reservoir
6. Water supplies for IRWD, DRWD, and Rosedale

Spreadsheet Model Assumptions

The spreadsheet model calculates the water supply available to the Project as additional Article 21 available from the Delta. The CalSim II Baseline simulation include existing Article 21 demands and deliveries. The spreadsheet model simulates the additional Article 21 demand of the Project and the associated increase in SWP Delta exports. Additional Article 21 deliveries to the Project are simulated when there is:

a. Available surplus in the Delta in excess of the existing regulatory requirements and demands
b. Available export capacity at Banks Pumping Plant
c. The SWP portion of San Luis Reservoir is full in the Baseline

The spreadsheet model simulates the additional Article 21 export from the Delta at times when there is available capacity in the California Aqueduct to convey the water to the Project and recharge the water based on Project recharge capacity. There is an estimated conveyance loss of 3 percent between the Delta and the Project.

Water is simulated as stored in the Project in each of the three accounts: public or ecosystem, IRWD, and Rosedale. Water stored in each account is subject to a loss percentage of 10% for Rosedale, 12.5% for ecosystem, and 15% for IRWD. Project recharge rates are simulated as a function of recharge in preceding months based on information provided by IRWD (Figure 3).

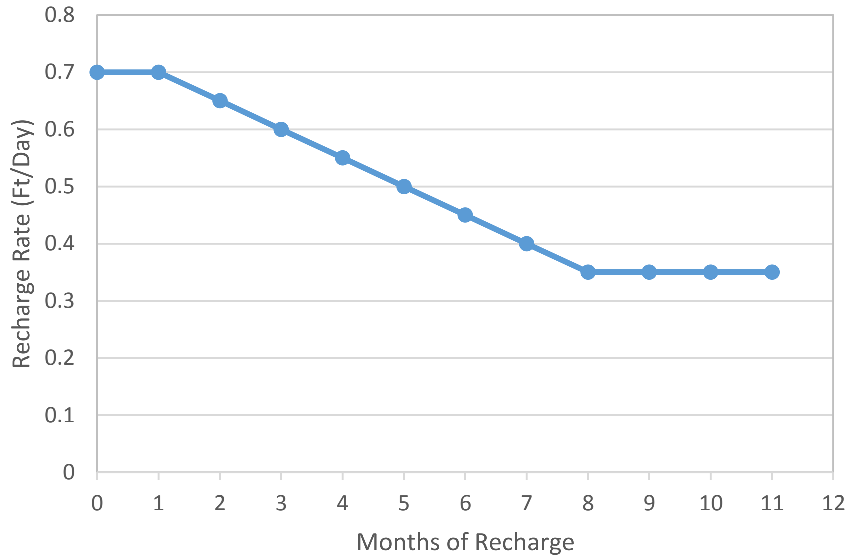


Figure 3. Project Recharge Rate

Water is extracted from the Project to provide both public and non-public benefits. Public benefits are achieved when the volume of water stored in the public benefits or ecosystem account is adequate to provide an Ecosystem Pulse flow of sufficient magnitude to create benefits. A volume of 18 thousand acre-feet (TAF), or 300 cfs for a period of one month, was assumed in the spreadsheet model as the threshold to create ecosystem benefits. Additionally, this volume is increased by Delta carriage[1] water costs that are saved in the year the Ecosystem Pulse is released. The reduced carriage water costs are a benefit of the Project, because Project water was exported during periods of Delta surplus with no carriage water cost and stored in the export service area. The spreadsheet model assumes 20 percent carriage water and the 3 percent conveyance loss can be saved when extracting water from the Project for delivery within the export service area instead of meeting those demands from Oroville Reservoir.

The spreadsheet model simulates water is extracted from the Project for water supply benefits to Rosedale and IRWD in years when SWP Table A allocations are less than 50 percent.

Available Water Supply

This section presents a summary of available Article 21 water supply for the Project. Figure 4 shows a summary of available Article 21 supply by water year type (Sacramento Valley Year Type Index) at the Project based on WSIP 2030 CalSim II modeling results. This available supply is calculated by considering constraints on available Banks pumping capacity, conveyance

[1] Carriage water is defined as marginal export costs, or the extra water needed to carry a unit of water across the Delta to the CVP and SWP pumping plants in the South Delta while maintaining a constant salinity. Or more practically, when the exports are increased by one unit, the Sacramento flow is increased by one unit plus the amount of carriage water to maintain a constant Delta salinity. In other words, carriage is the water cost of Delta exports when salinity standards are controlling.

capacities in the California Aqueduct, and capacity to convey water from the California Aqueduct to the Project, and conveyance losses.

On an average annual basis, available Article 21 supply at the project diversion from the California Aqueduct is 8 TAF with most of the supply available during Wet years. There is no Article 21 supply during Dry and Critical years. Figure 5 shows a summary of Article 21 supply by month. March shows the greatest supply of Article 21 followed by February. Article 21 is mostly available between December and May, with no supply available during the reminder of the year. Figure 6 shows available supply on an annual basis. As stated earlier, most of the water supply is available during Wet years and in a few Above Normal and Below Normal years. There is no water supply for the Project during Dry and Critical years.

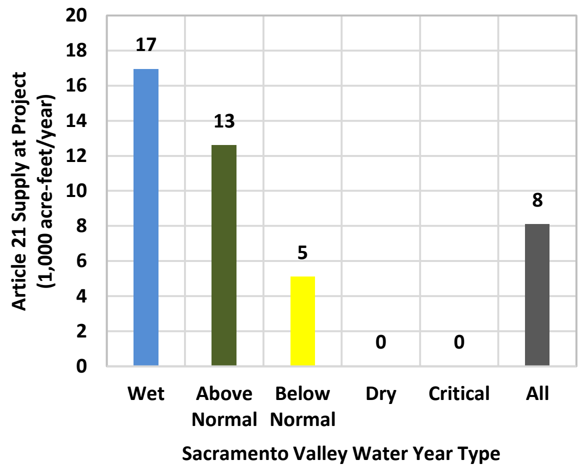


Figure 4. Available Article 21 Supply at Project by Sacramento Valley Water Year Type

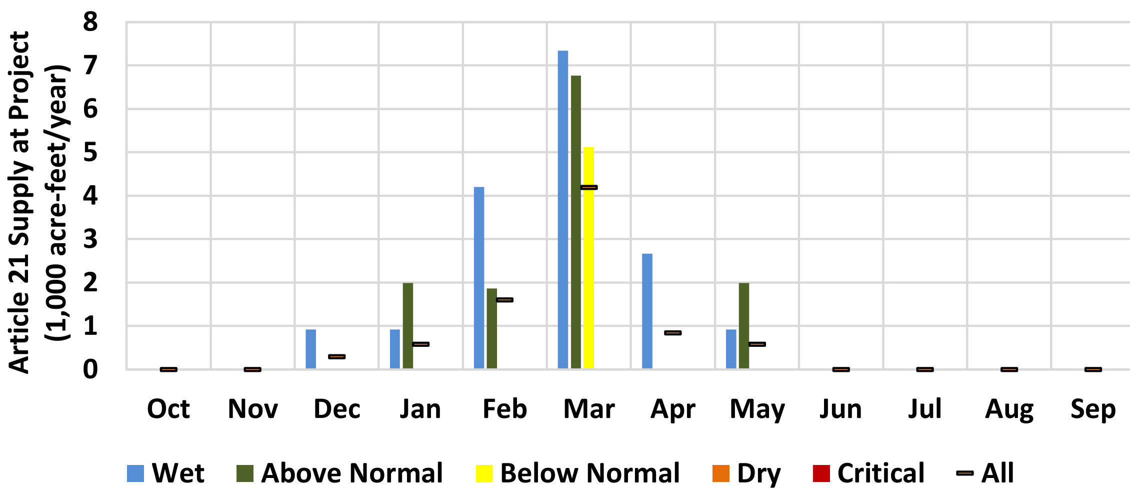


Figure 5. Average Monthly Available Article 21 Supply at Project

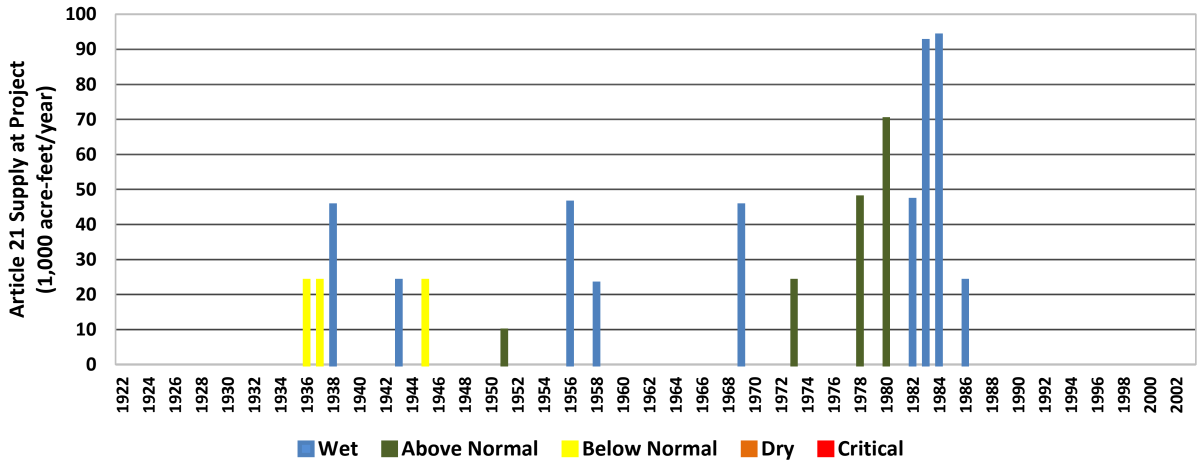


Figure 6. Annual Time-Series of Available Article 21 Supply at Project

Results

This section summarizes the results for the Project operations based on a comparison of Baseline and with-Project results. Results are presented as the change from Baseline operations to quantify the effects of the Project. Results also include the potential benefits of the Project related to emergency response to an event that disrupts water supply operations in the Delta (Delta event).

Table 1 presents a summary of the Project performance. Of the 8 TAF average annual flow available at the California Aqueduct, Project recharge is approximately 6.1 TAF and occurs primarily in Wet years. This water is stored in the Project and extracted to provide public and non-public benefits. Under 2030 WSIP conditions, the Project could provide six pulse releases from Oroville Reservoir over the 82-year period analyzed, and provide an average annual ecosystem water supply of 1.3 TAF. This includes 0.84 TAF of Project extraction from the ecosystem account, a 23% savings in carriage and conveyance losses that is available upstream of the Delta as a result of the Project, and a 0.2 TAF reduction in Orville flood control releases. Local water supply benefits are 4.5 TAF annually, with 2.0 TAF for IRWD and 2.5 TAF for Rosedale.

Table 1. Summary of the Project Performance

Year Type	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
Wet	11	0	0	0	0
Above Normal	13	0	0	1	0
Below Normal	5	0	0	4	6
Dry	0	5	5	4	6
Critical	0	1	2	2	1
All Years	**6.1**	**6**	**1.3**	**2.0**	**2.5**

Figure 7 shows the frequency of the Ecosystem Pulses by water year type. As noted earlier, the pulses are made during Dry and Critical years when Feather River flows are lower and pulses may create a higher potential for benefits to the ecosystem. Figure 8 shows an average pulse flow rate by month. In this analysis, April was selected as the month for Ecosystem Pulses. The operations could be modified to provide Ecosystem Pulses in May, under actual operations.

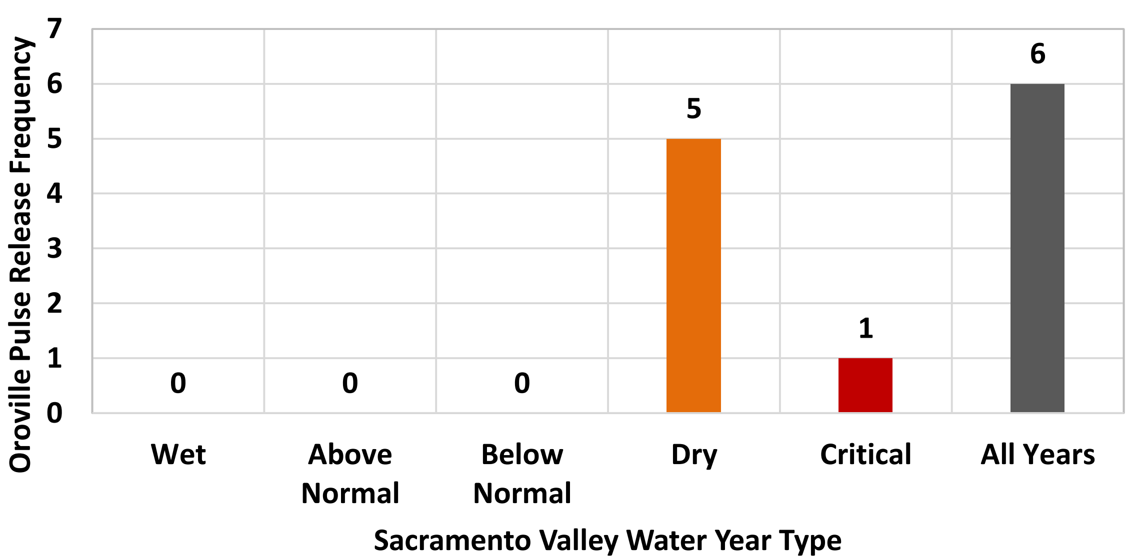


Figure 7. Frequency of Ecosystem Pulses

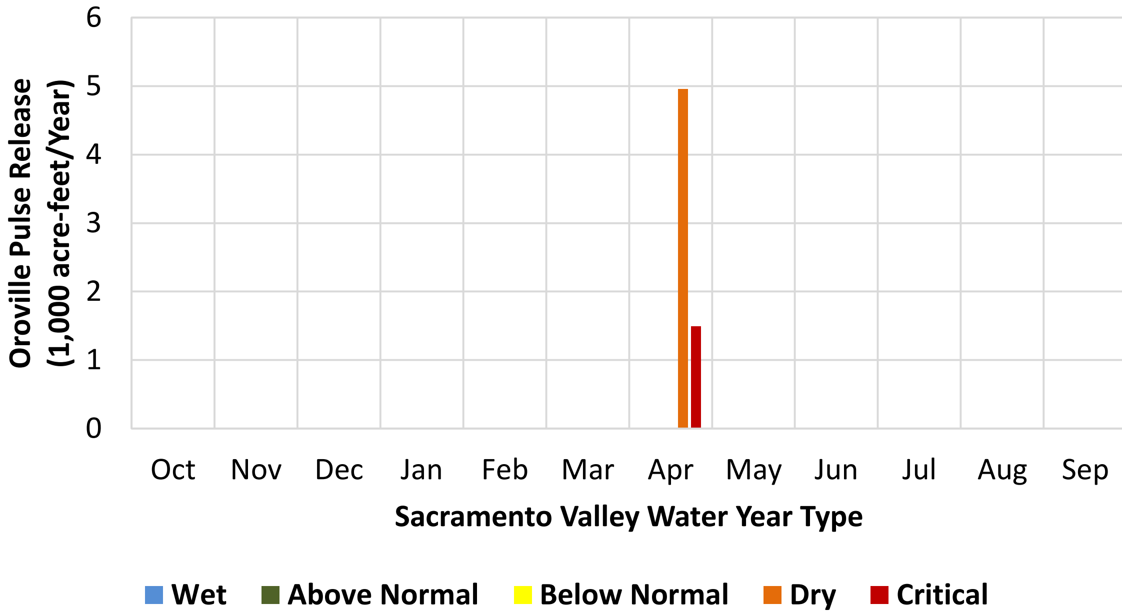


Figure 8. Pulse Release Volume

Figure 9 shows changes in Oroville Reservoir releases with the Project. Flows in the Feather River are higher under the Project conditions during April when Ecosystem Pulses are made from Oroville. The release of Ecosystem Pulses results in lower Oroville storage under the Project conditions after making Ecosystem Pulse releases. Storage in Oroville would be recovered in later months by reducing releases from Oroville when Feather River flows are in excess of the minimum instream flow requirements and Oroville is releasing water to support SWP Delta exports. Oroville Reservoir is typically releasing water to support Delta exports in the July through September period. Oroville releases are reduced in this period to compensate for the Ecosystem Pulses resulting in lower Feather River flows under the Project conditions to recover the volume of the Ecosystem Pulse. Analysis in the spreadsheet model attempts to recover the Ecosystem Pulse volume in Oroville in the same year as when the pulse is made, such that Oroville carryover storage is not affected. In actual operations, it may be possible to develop an operational plan that would pre-deliver water into Oroville in other years, such that Oroville storage remains is increased, as compared to Baseline, prior to making the Ecosystem Pulse release.

Figure 9 also shows a reduction in Oroville Reservoir releases in February. In most years, the reduction of Oroville Reservoir occurs in July following release of Ecosystem Pulse in April, with the exception of in 1977. In 1977, the Ecosystem Pulses are made in April and Oroville storage remains lower under the Project conditions until the next available opportunity to refill the reservoir, which comes in February of 1978, when the reservoir releases are reduced to compensate for Ecosystem Pulses released in April 1977. Thus, Oroville Reservoir releases are lower in February 1978 under the Project conditions, as compared to the Baseline. Simulated changes in Oroville release are expected to create the same change in Feather River flows below Oroville and Sacramento River flow from the confluence with the Feather into the Delta.

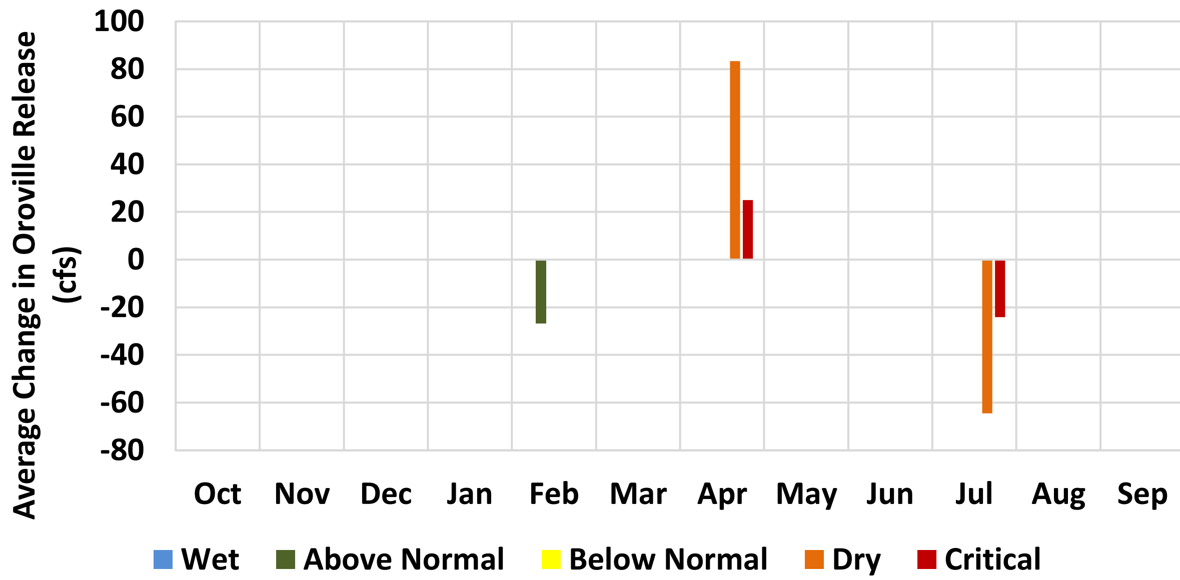


Figure 9. Change in Oroville Releases

Figure 10 shows changes in Delta outflows under the Project conditions. Delta outflows are greater during April of Dry and Critical years under the Project condition when Oroville is making Ecosystem Pulses. Ecosystem Pulses in April and May of Dry and Critical years are expected to increase Delta outflow because Delta exports are typically constrained in these months by regulatory requirements such as San Joaquin River inflow-to-export ratio or Old and Middle River flow requirements. Delta outflows can be lower in January through May of Below Normal and wetter years when Delta outflow is diminished either due to capture of Article 21 surplus water for the Project or due to a reduction in Oroville releases. Figure 11 presents a similar plot, showing change in SWP Delta exports under the Project conditions. SWP Delta exports are typically greater under Project conditions, as surplus flows are captured at the export pumps and delivered to the Project. SWP Delta exports show a reduction in Dry and Critical years as compared to the Baseline due to a reduction in Oroville releases.

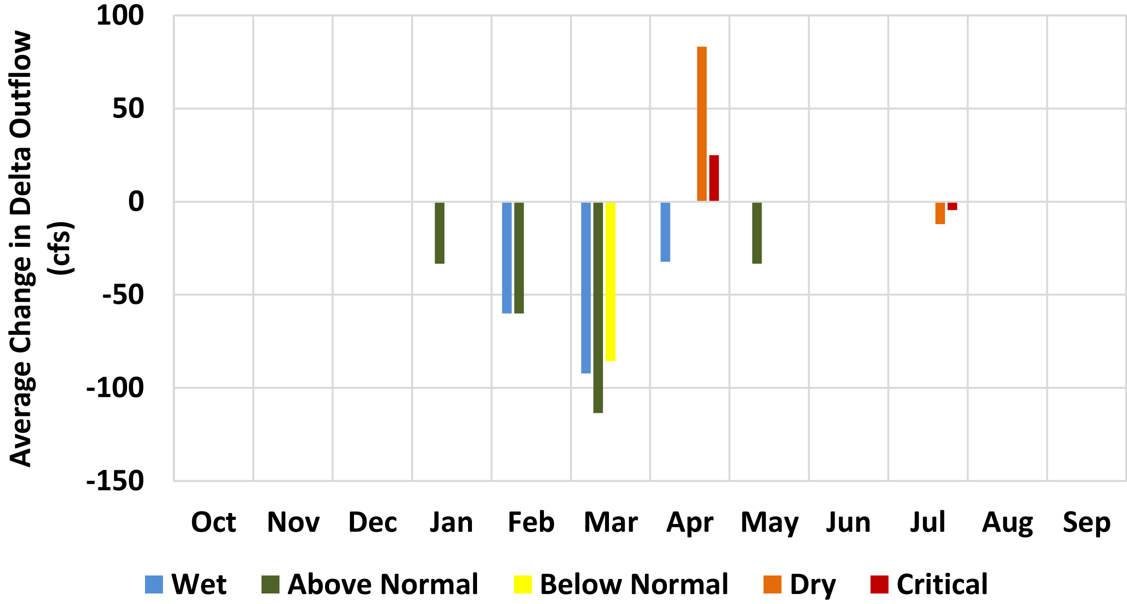


Figure 10. Change in Delta Outflow

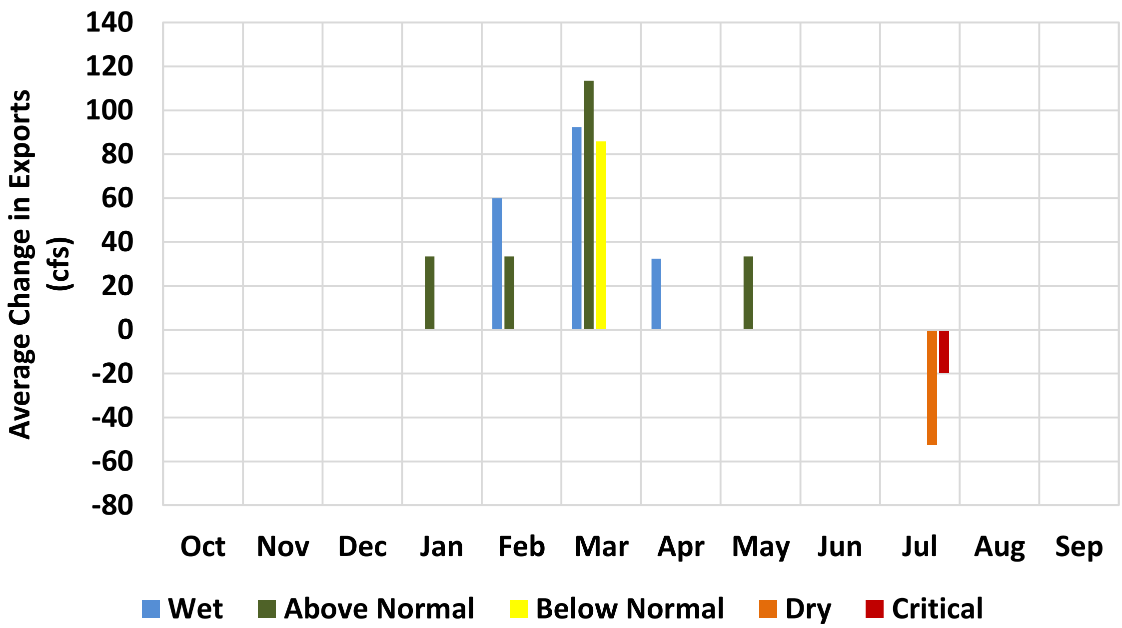


Figure 11. Change in SWP Delta Exports

Figure 12 shows end of October storage in the Project by water year type. On an average annual basis, Project storage is 18 TAF at the end of October. Project storage varies significantly by year type, from 32 TAF in Wet years to 2 TAF in Critical years. Higher storage in Wet years is expected, as it corresponds to periods where Article 21 water is available. Project storage during a Dry or Critical year is water carried over from previous years. Overall, Project storage is dependent on water supply, demand, and operations. Project storage at the end of October may be an indication of potential water available as an emergency supply for IRWD, Rosedale, or for other purposes.

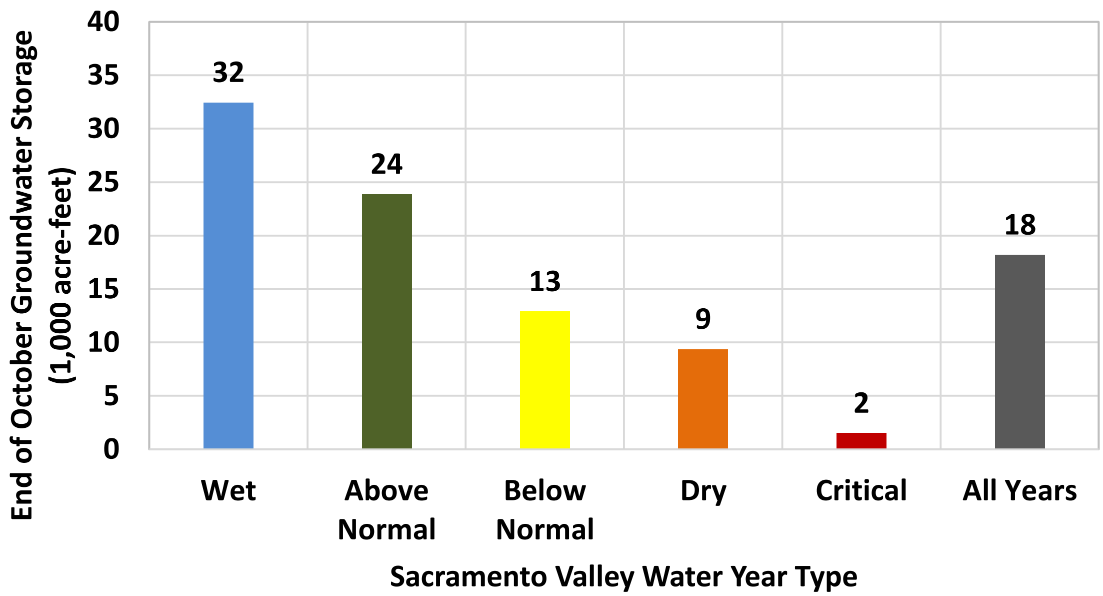


Figure 12. End of October Project Groundwater Storage

Emergency Response Benefits

The WSIP technical guidance document provides directions for analysis of emergency response benefits of potential Projects. WSIP technical guidance states that for an event in the Delta that disrupts water supply operations (Delta event), applicants should assume a single event that occurs 30 years into the Project operation period. Applicants must also show how the emergency response operation affects the Project's normal operations and benefits in years following the event.

The Project can provide emergency response benefits by storing water south of the Delta that can be extracted and made available after a Delta event. The probability of water being stored in the Project in any year is one measure of potential emergency response benefit. Figure 13 shows the probability of exceedance for the end of October Project storage in the combined three accounts. A marker at approximately 20 TAF, corresponding to an exceedance probability of approximately 30 percent, shows the simulated Project storage 30 years into the Project operation period.

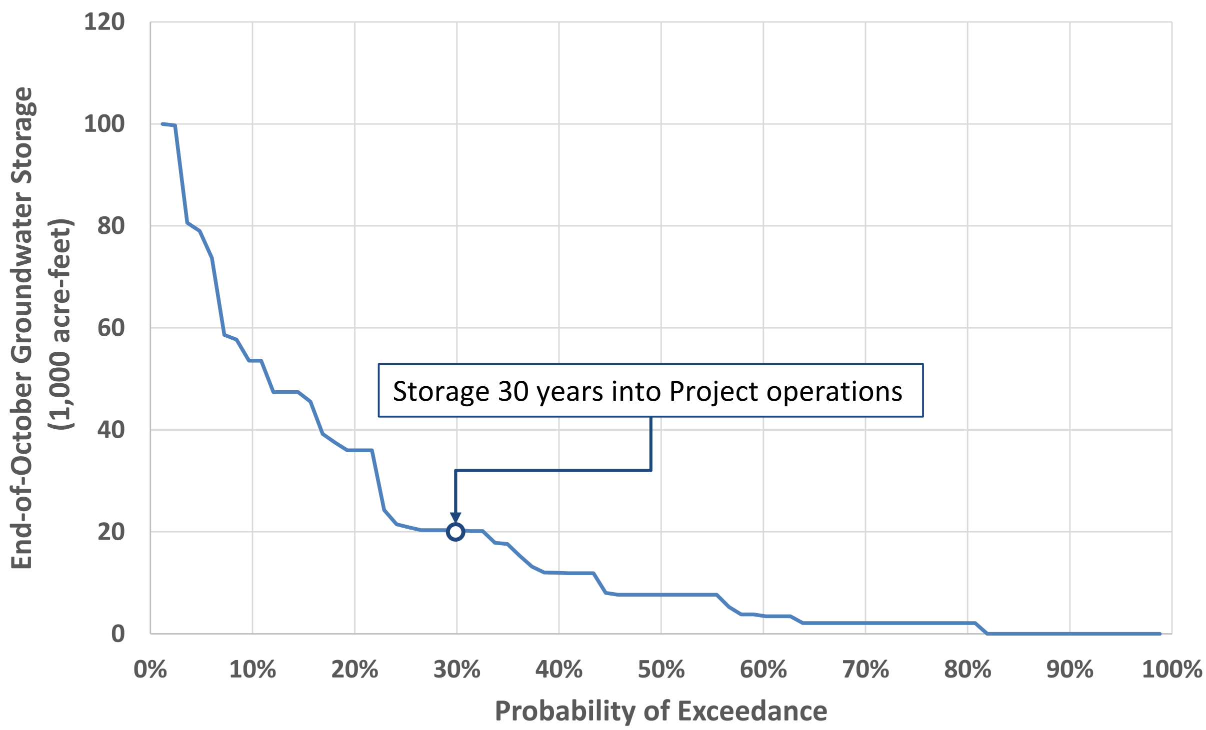


Figure 13. Probability of Exceedance for End of October Project Groundwater Storage

As illustrated in Figure 13, Project storage is 20.4 TAF 30 years into the Project operation period. Water in storage in each account is 13.2 TAF in the ecosystem account, 3.5 TAF in the IRWD account, and 3.7 TAF in the Rosedale account. In response to a Delta event at this time, it is assumed the entire 20.4 TAF could be available for emergency response benefits over a period of approximately six months using the Project extraction capacity of 3.8 TAF per month.

The effect of emergency response operations on the Project performance was evaluated by simulating extraction of 20.4 TAF at 30 years into the Project operation and then comparing the results for Project operations without the emergency response operations. When Project storage is extracted for emergency response benefits, there is a reduction in Ecosystem Pulse release frequency from six to five pulses because most of the emergency supply is provided from the ecosystem account. Additionally, there is a marginal reduction in water supply benefits to IRWD and Rosedale by approximately 0.1 TAF/year.

Uncertainty Analyses

This section presents uncertainty analyses related to potential future (WSIP 2070) climate change, including Project performance during critical droughts, and the California WaterFix. Uncertainty analyses were performed using the same technical approach as analysis at the future 2030 level wherein a CalSim II baseline was used to represent the without-project scenario and serve as an input to the spreadsheet model to simulate the with-project scenario. The spreadsheet model has the capability to post-process CalSim II model results for simulations that include California WaterFix to determine availability of additional Article 21 for the Project.

Climate Change

Climate change analysis is performed using the WSIP 2070 CalSim II model that reflects future climate and sea level conditions in the year 2070. Table 2 presents a summary of the Project performance under 2070 climate change conditions. Results are presented as average annual Project operations under a 2070 conditions by Sacramento Valley Year Type Index. The final row of the table “Change” represents the change in Project performance from the 2030 condition, presented in Table 1. With climate change, Project benefits diminish slightly due to a reduction in available water supply. Average annual recharge is reduced by 0.4 TAF or approximately 7% as compared to 2030 conditions. The frequency of Ecosystem Pulses is reduced from six years under 2030 conditions, to five years under 2070 climate conditions. Water supply benefits also diminish slightly by approximately 0.3 TAF (7%) on an average annual basis. Though Project performance is reduced with climate conditions, depicted in the WSIP 2070 baseline, it is similar to the expected performance in 2030. The Project is still able to provide both public and non-public benefits under the assumed, future climate change.

Table 2. Summary of the Project Performance under WSIP 2070 Climate Change

Year Type	Project Recharge (TAF)	# of Pulses (Years)	Eco. Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
Wet	12	0	0	1	0
Above Normal	12	0	0	1	0
Below Normal	1	0	0	4	5
Dry	0	5	5	4	6
Critical	0	0	0	0	0
All Years	**5.7**	**5**	**1.1**	**1.9**	**2.2**
Change	**-0.4**	**-1**	**-0.2**	**0**	**-0.3**

Project Performance during Drought

Section 10 of the WSIP Technical Reference document, requires that applicants assess the volume of water stored in a Project at the beginning and end of a five-year drought that may be used for public benefits, under the 2070 condition. In the period of analysis, the most significant five-year or longer droughts occurred from 1929 through 1934, and 1987 through 1992. This section presents a discussion on Project performance during these two drought sequences.

In the model simulation period of 1921-2003, Article 21 water is available for the first time in the year 1937. Therefore, Project storage is zero at the beginning of the drought in 1929 as there is no water stored prior to the drought and the conditions remains unchanged as there is no water available for recharge during the 1929-1934 drought.

Figure 14 shows an annual time series plot of the groundwater storages, recharge and pumping for the drought sequence beginning in water year 1987. Figure 14 shows there is no recharge of Article 21 water during the drought; however, Project storage at the beginning of this drought is nearly 38 TAF due to carryover from previous years. Stored water is pumped out of the ground from the IRWD and Rosedale accounts for water supply in the first six months of this drought and the storage gradually declines to approximately 14 TAF by the end of 1987. Approximately 14 TAF remains in the Project's ecosystem account throughout the drought period because the volume of stored water is not adequate to initiate an Ecosystem Pulse release from Oroville for fishery benefits.

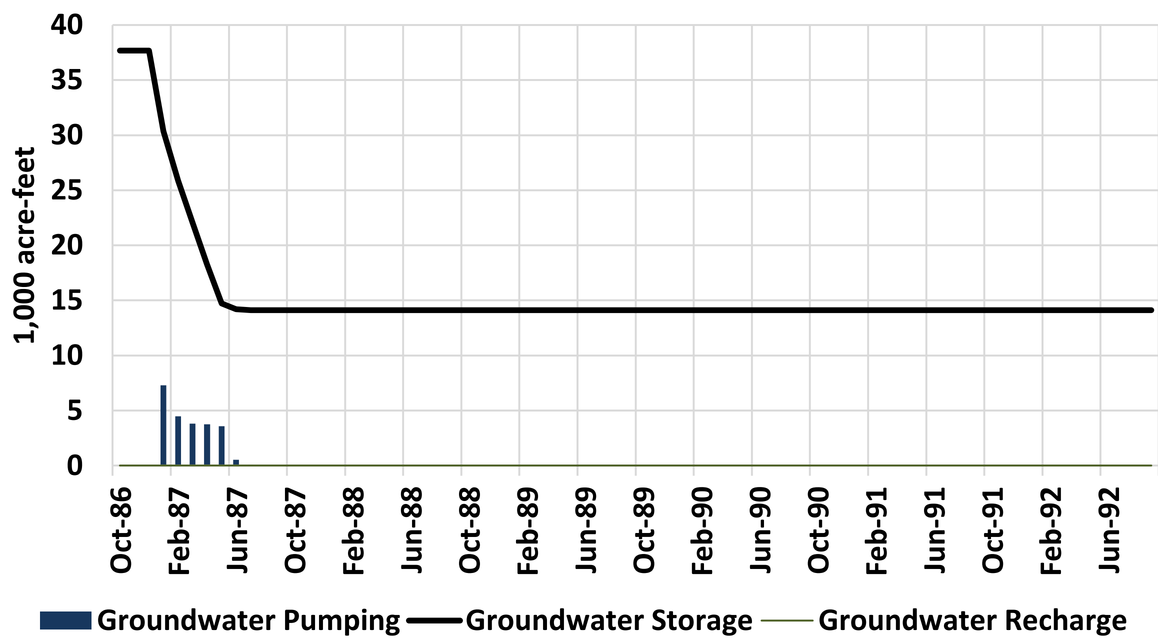


Figure 14. Performance of the Project during 1987-1992 Drought

Figure 15 shows a comparison of recharge and pumping for the three different Project accounts for this six-year period. During this drought, there is no pumping of water from the environmental account as the volume of stored water is not adequate to initiate an Ecosystem Pulse release from Oroville for fishery benefits. Therefore, approximately 14 TAF of stored water is available for public benefits during this drought sequence. Additionally, the Project provided an average of 3.9 TAF of water supply benefits to IRWD and Rosedale over the six-year drought.

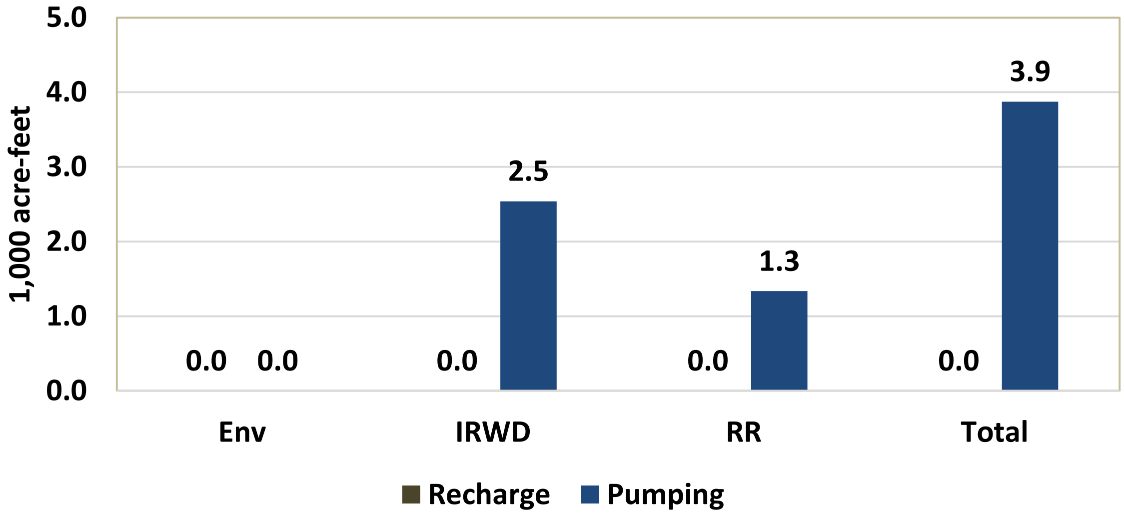


Figure 15. Annual Summary of the Project Yield during 1987-1992 Drought

California WaterFix

This section summarizes results from the sensitivity analysis performed to assess Project performance with California WaterFix (CWF). For this analysis, CalSim II models developed by DWR and Reclamation for the Biological Assessment for CWF were used. The DWR CWF CalSim II models include 2025 Early Long Term (ELT) climate change assumptions that differ from the WSIP 2030 climate change assumptions. Therefore, it is not appropriate to compare Project performance based on a WSIP 2030 model baseline to Project performance based on a DWR ELT model baseline. In order to provide a proper comparison of the potential Project performance, Project operations were first simulated using the DWR ELT without CWF baseline. Table 3 shows a summary of the Project performance under DWR ELT model without WaterFix.

Table 3. Summary of the Project Performance under DWR ELT without CWF

Year Type	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
Wet	12	0	0	0	0
Above Normal	6	0	0	0	1
Below Normal	3	0	0	3	2
Dry	0	3	3	6	5
Critical	0	1	1	0	2
All Years	**5.2**	**4**	**0.9**	**1.8**	**1.9**

Table 4 contains the same metrics for Project performance under DWR ELT model with CWF. Results are presented as average annual Project operations with CWF by Sacramento Valley Year Type Index. The final row of the table (Change) represent the change in Project performance from the DWR ELT without CWF condition presented in Table 3. Average annual Project recharge is approximately 11 TAF with CWF, nearly 6 TAF greater than DWR ELT without CWF. Increases in the ability to recharge water with CWF increase the frequency of Ecosystem Pulses from four years to seven. Similarly, the Project yield to IRWD and Rosedale are increased by approximately 4 TAF with CWF.

Table 4. Summary of the Project Performance under DWR ELT with CWF

Year Type	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
Wet	22	0	0	1	0
Above Normal	18	0	0	1	0
Below Normal	7	0	0	6	6
Dry	0	6	6	9	11
Critical	0	1	1	3	3
All Years	**10.7**	**7**	**1.5**	**3.9**	**3.9**
Change	**+5.5**	**+3**	**+0.7**	**+2.0**	**+2.0**

Feasibility and Implementation Risk Tab

A.1 Feasibility Documentation:

Attach feasibility studies or documentation that demonstrates the proposed project's technical, environmental, economic, and financial feasibility as described in TR section 3.5. See also regulations section 6003(a)(1)(O)

MBK Excel Model

The complete excel model is too large to attach, however a list of the worksheets included in the excel model uploaded is presented below.

Worksheets	Description
Documentation	This worksheet
KFControl	Includes the input controls for the model and model output results
Model	Contains the model logic and operations.
ExpAnalysis	Calsim post-process files for calculating Delta outflows,export capacity etc
ExpAnalysis_Alt	
Control_Calc	
Control_Calc_alt	
CalsimIn	
BaseOut	Calsim Model outputs used in the post-processing calculations and also in the model for different operations of SWP/CVP etc
Altout	
WSIP2030	
WSIP2070	
DWR_WF_SJRR	
DWR_NA_SJRR	
Unitconv	Miscelanneous files for model calculations
Year Types	
River Indices	
Control	
Table	
Charts	

File: IRWD_Attach 1_MBK_Model_KernFan.xlsm

Feasibility and Implementation Risk Tab

A.2 Permit List:

Provide a listing and status of all local, state, and federal permits, certifications, and other approval necessary for the construction and operation of the project. See section 6003(a)(1)(W) of the regulations.

File: Tab5-A2_IRWD_Permits_FINAL.pdf

PERMITS AND APPROVALS

As required per Section 6003(a)(1)(W) of the Regulations the application will include: A list of permits known to be necessary for construction and operation of the proposed project, along with a description of the status of and time to obtain each permit

For the proposed Kern Fan Groundwater Storage Project, IRWD and Rosedale will comply with all necessary permits and permitting procedures related to the proposed project. IRWD and Rosedale will work with all of the associated agencies to obtain the necessary permits and approvals for the Project. The regulatory approvals and permits that are expected to be required for construction and/or operation of the Project include:

Agency	*Permit/Approval*	*Status*
California Department of Water Resources (DWR)	Approval for use of the California Aqueduct to convey water. Approval of any unbalanced exchange agreements between DRWD and IRWD, and MWD. Agreement among DWR, DRWD, KCWA and MWD and Change in Point of Delivery of a Portion of DRWD SWP Supplies	DWR State Water Project Analysis Office (SWPAO) and SWP operations staff have been consulted with respect to the proposed operational exchanges that would make water available for the public ecosystem benefits that would be derived from the pulse flows. SWPAO has identified that uncertainties and contractual issues would need to be worked through with the project partners. This work would begin immediately should the CWC select the Project for funding. It is expected that the efforts would result in a Coordinated Operating Agreement that would executed between the project partners and DWR.
Dudley Ridge Water District (DRWD)	Approval of participation terms if project is selected for funding	DRWD letter dated August 7, 2017, in support of project and willingness to consider terms for participation if project is selected for funding
Kern County Water Agency (KCWA)	Approval for use of the Cross Valley Canal conveyance; Approval of participation terms if project is selected for funding	

County of Kern Environmental Health Division	Permits for well construction	
State Water Resources Control Board	Storm Water Pollution Prevention Plans (SWPPP)	
Kern County Roads Department	Easements for canal crossings	
Metropolitan Water District of Southern California (MWD)	Consent to deliver, exchange, and convey water	Coordinated, Operating, Water Storage, Exchange and Delivery Agreement executed April 21, 2011

The anticipated permits and approvals required for this Project are similar to those required for previous groundwater storage projects and programs implemented by IRWD and Rosedale. IRWD and Rosedale are therefore well acquainted with the permitting process and foresee no obstacles in acquiring the necessary permits and approvals.

Feasibility and Implementation Risk Tab

A.3 Schedule:

Attach an estimated schedule for the proposed project until the first year of operation. If the schedule is included in another attachment, identify the location. See section 6003(a)(1)(W) of the regulations.

Files: Tab5_A3_IRWD_Schedule_Text_FINAL.pdf
Tab5-A3_IRWD_Schedule_FINAL.pdf

Tab 5a3 Schedule through first year of Operation

The Kern Fan Groundwater Storage Project's (Kern Fan Project) will require approximately 6 years and 3 months to design, bid and construct. As presented in the following figure, the schedule is broken into three components: design, bid and construction. Within an individual component such as construction multiple activities can occur at the same time. Following is a summary of each component of the schedule:

Design:

The design portion of the schedule will be completed in approximately 2 years and 4 months. Major activities include developing a funding agreement between partners, acquisition of land, engineering and design, procurement of easement and right of-ways, assessment and mitigation of environmental impacts and permitting.

Bid:

The bid portion of the schedule will be completed in approximately 5 months. Major activities include advertising the project, pre-qualification of contractors, reviewing bid submittals and issuing a notice of award and a notice to proceed.

Construction:

The construction portion of the schedule will be completed in approximately 3 years and 6 months. Major activities include shop drawing submittal and review, recharge basin construction, well drilling and development, well equipping, conveyance canal construction, conveyance equipping, check structure and turnout construction, procuring electrical service, startup and close out. The first 16 months of the schedule focus on Phase 1 facilities only, the next 18 months include both Phase 1 and 2 facilities and the last 6 months include Phase 2 facilities only.

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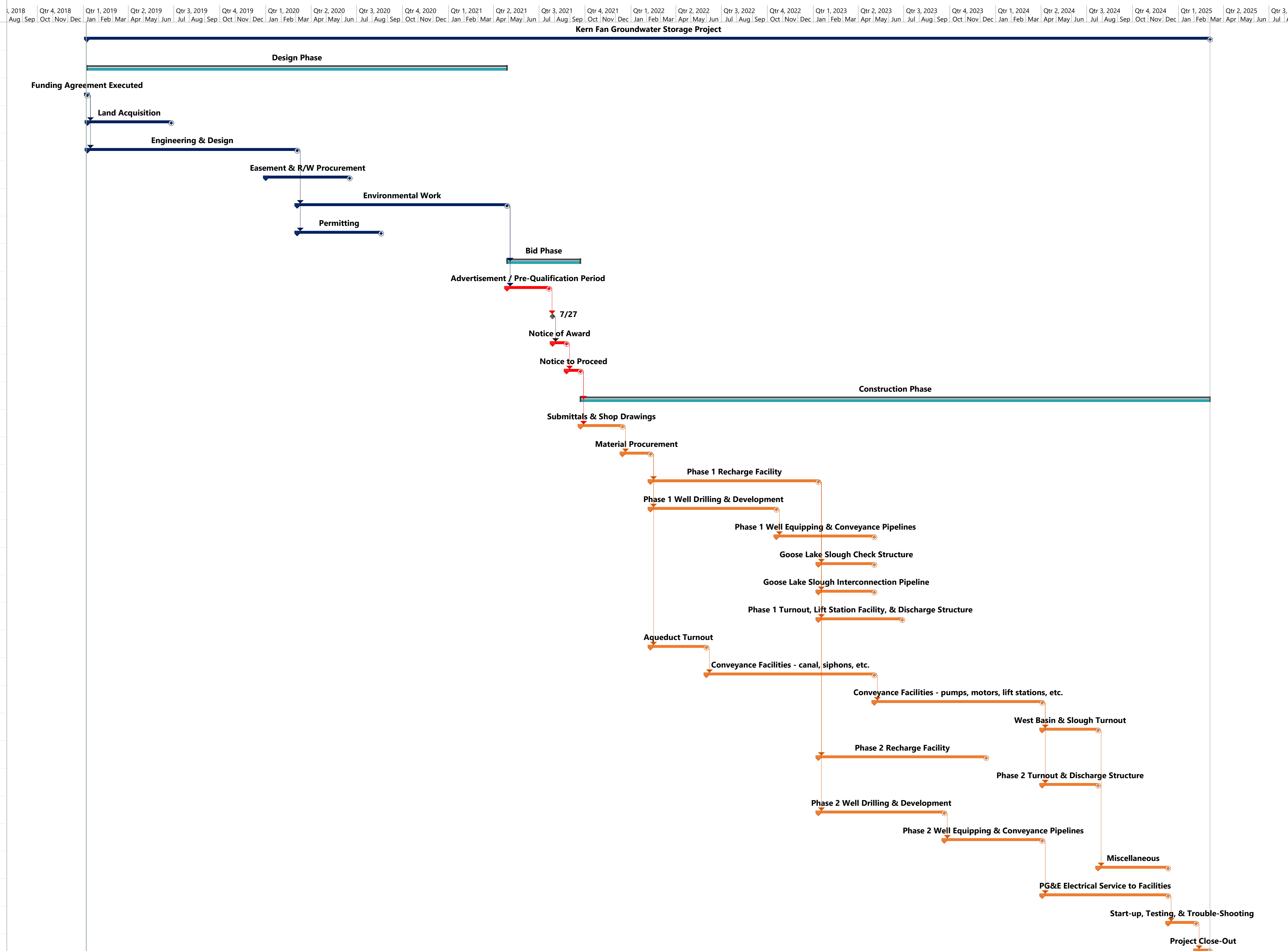
ID	Task Mode	Task Name	Duration	Start	Finish
0		**Kern Fan Groundwater Storage Project**	**1606 days**	**1/8/2019**	**3/4/2025**
1		**Design Phase**	**601 days**	**1/8/2019**	**4/27/2021**
2		Funding Agreement Executed	1 day?	1/8/2019	1/8/2019
3		Land Acquisition	6 mons	1/9/2019	6/25/2019
4		Engineering & Design	15 mons	1/9/2019	3/3/2020
5		Easement & R/W Procurement	6 mons	1/1/2020	6/16/2020
6		Environmental Work	15 mons	3/4/2020	4/27/2021
7		Permitting	6 mons	3/4/2020	8/18/2020
8		**Bid Phase**	**105 days**	**4/28/2021**	**9/21/2021**
9		Advertisement / Pre-Qualification Period	3 mons	4/28/2021	7/20/2021
10		Bids Due	5 days	7/21/2021	7/27/2021
11		Notice of Award	1 mon	7/28/2021	8/24/2021
12		Notice to Proceed	1 mon	8/25/2021	9/21/2021
13		**Construction Phase**	**900 days**	**9/22/2021**	**3/4/2025**
14		Submittals & Shop Drawings	3 mons	9/22/2021	12/14/2021
15		Material Procurement	2 mons	12/15/2021	2/8/2022
16		Phase 1 Recharge Facility	12 mons	2/9/2022	1/10/2023
17		Phase 1 Well Drilling & Development	9 mons	2/9/2022	10/18/2022
18		Phase 1 Well Equipping & Conveyance Pipelines	7 mons	10/19/2022	5/2/2023
19		Goose Lake Slough Check Structure	4 mons	1/11/2023	5/2/2023
20		Goose Lake Slough Interconnection Pipeline	4 mons	1/11/2023	5/2/2023
21		Phase 1 Turnout, Lift Station Facility, & Discharge Structure	6 mons	1/11/2023	6/27/2023
22		Aqueduct Turnout	4 mons	2/9/2022	5/31/2022
23		Conveyance Facilities - canal, siphons, etc.	12 mons	6/1/2022	5/2/2023
24		Conveyance Facilities - pumps, motors, lift stations, etc.	12 mons	5/3/2023	4/2/2024
25		West Basin & Slough Turnout	4 mons	4/3/2024	7/23/2024
26		Phase 2 Recharge Facility	12 mons	1/11/2023	12/12/2023
27		Phase 2 Turnout & Discharge Structure	4 mons	4/3/2024	7/23/2024
28		Phase 2 Well Drilling & Development	9 mons	1/11/2023	9/19/2023
29		Phase 2 Well Equipping & Conveyance Pipelines	7 mons	9/20/2023	4/2/2024
30		Miscellaneous	5 mons	7/24/2024	12/10/2024
31		PG&E Electrical Service to Facilities	9 mons	4/3/2024	12/10/2024
32		Start-up, Testing, & Trouble-Shooting	2 mons	12/11/2024	2/4/2025
33		Project Close-Out	1 mon	2/5/2025	3/4/2025



Project: Kern Fan Groundwater
Date: 7/19/2017

Task | Split | Milestone | Summary | Project Summary | Inactive Task | Inactive Milestone | Inactive Summary | Manual Task | Duration-only | Manual Summary Rollup | Manual Summary | Start-only | Finish-only | External Tasks | External Milestone | Deadline | Progress | Manual Progress

Feasibility and Implementation Risk Tab

A.4 Environmental Document:

Attach the most recent publicly available environmental document for the proposed project. If the document is available on a website, provide a link to the document(s). See section 6003(a)(1)(S) of the regulations.

Files: Tab5_A4 IRWD_Final EIR Stockdale.pdf
Tab5_A4 IRWD_ScopeforEnviro_ESA_FINAL.pdf

ENVIRONMENTAL DOCUMENTATION

As required per Section 6003(a)(1)(S) of the Regulations the application will include: Most recent version of publicly-available environmental documentation for the project

A Final Environmental Impact Report was prepared, certified, and approved in December 2015 for the Stockdale Integrated Banking Project (Stockdale Project). For purposes of the Stockdale Project Final EIR, Rosedale is the Lead Agency and IRWD is the Responsible Agency. The Stockdale Project Final EIR includes program-level analysis of impacts in accordance with *CEQA Guidelines* Section 15168 of a third project site yet to be identified. The third project site accounted for in the Stockdale Project Final EIR is now designated to be Phase 1 of the Kern Fan Groundwater Storage Project (Kern Fan Project). Upon identification of the Phase 1 project site, subsequent project-level environmental review will be conducted. The Stockdale Project Final EIR will provide basis for anticipated project-level CEQA analysis for Phase 1 of the Kern Fan Project. For purposes of CEQA, Phase 2 of the Kern Fan Project is considered a fourth site in the vicinity of the Stockdale Project. Environmental review for the Kern Fan Project will therefore be completed as a Supplemental EIR (SEIR) to the Stockdale Project Final EIR. The SEIR will be completed such that the third site is specifically identified along with appurtenant conveyance facilities to be evaluated at a project-level and a fourth site added to be evaluated at a program-level. All environmental review for the Kern Fan Project will be completed prior to the implementation of Project facilities.

An estimated schedule to complete environmental review under a proposed Supplemental EIR and the estimated cost is included in the ESA scope of work attached as a separate file in **"Feasibility and Implementation Risk" Tab, Attachment 4**.

The Stockdale Project Final EIR can be found online at: http://www.irwd.com/images/pdf/doing-business/environmental-documents/env-documents-2015/NOD_Stockdale_EIR-web.pdf

ESA

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July 26, 2017

Jo Ann Corey
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

Subject: Kern Fan Groundwater Storage Project CEQA documentation

Dear Ms. Corey:

As requested by Irvine Ranch Water District (IRWD), ESA has developed a scope of work for environmental documentation, pursuant to the California Environmental Quality Act (CEQA) for the proposed Kern Fan Groundwater Storage Project (Kern Fan Project).

The proposed Kern Fan Project aims to receive funding through the California Water Commission's (CWC) Water Storage Investment Program (WSIP). The goal of the WSIP is to fund water storage projects that provide public benefits, improve operation of the state water system, determine if they are cost effective, and provide a net improvement in ecosystem and water quality conditions. The WSIP would receive funding via Proposition 1, also known as the Water Quality, Supply and Infrastructure Act of 2014.

The Kern Fan Project was developed from the Storage Integration Study through the Association of California Water Agencies (ACWA). This study defined and quantified the benefits of integrating the operation of new storage projects with the existing State Water Project (SWP) and Central Valley Project (CVP) in the interest of helping to fulfill statewide water supply needs and priorities. As such, eight projects were described in this study that could provide such benefits, including the proposed Kern Fan Project.

The proposed Kern Fan Project would serve to develop a regional water bank in the Kern Fan to capture and store water during conditions when surface water is abundant. The Project would be implemented in two phases and would consist of two new recharge and recovery facilities, jointly owned by IRWD and Rosedale Rio Bravo Water Storage District (Rosedale). The first phase would include purchasing 640 acres of land in the Kern Fan area while the second phase would involve acquiring an additional 640 acres for expansion of the water banking facilities in order to provide ecosystem benefits in the Delta.

In December 2015, IRWD and Rosedale certified the Stockdale Integrated Water Banking Project (Stockdale Project) Final Environmental Impact Report (Final EIR) in compliance with CEQA. The Final EIR included a program-level analysis of a 640-acre recharge and recovery site, the location of which had not been identified. For purposes of CEQA, Phase 1 of the proposed Kern Fan Project can be considered the third site of the Stockdale Project since it is within the boundaries set in the Final EIR. In addition, Phase 2 of the Kern Fan Project adds a fourth site in the vicinity of the Stockdale Project.

Using this framework, ESA has prepared a scope of work for a supplemental EIR to the Stockdale Project Final EIR, such that the third site is specifically identified along with appurtenant conveyance facilities, and a fourth site is being added to be evaluated at a program level.

1. Project Understanding

As mentioned above, the proposed Kern Fan Project would be implemented in two phases: Phase 1 and Phase 2. Our understanding of the project is based on staff reports from IRWD and the July 2017 concept/feasibility report prepared by Dee Jaspar & Associates for the Kern Fan Project.

Phase 1

Phase 1 includes purchasing approximately 640 acres of land within Rosedale's boundary and within the boundaries of the Stockdale Project Final EIR. Groundwater recharge facilities including interbasin structures, conveyance facilities, and six groundwater recovery wells would be located on this property as shown on the Feasibility Study Map, which is included as Appendix A in the Dee Jasper report (July 2017). The initial recharge at this proposed Phase 1 property would be 230 cubic-feet per second (cfs) but decrease to an approximate maintenance rate of 115 cfs.

The conveyance facilities would include a conveyance pipeline, check structure, and turnout structure with lift station. Since water would be conveyed to the Phase 1 property for groundwater recharge from Friant-Kern Canal or Kern River via the Goose Lake Slough or from the Cross Valley Canal (CVC) via the Rosedale Intake Canal, a conveyance pipeline would be constructed between the Rosedale Intake Canal and the proposed Phase 1 property. A new check structure would be constructed in the Goose Lake Slough with a reinforced concrete turnout structure to convey water from the Goose Lake Slough to the proposed Phase 1 property. The turnout structure would include a lift station with four 60 cfs pumps. Each pump would be equipped with 300 horsepower (hp) vertical motors, discharge piping, metering, appurtenances, lighting, electrical, controls, and SCADA communication.

Another component of Phase 1 includes the construction of six recovery wells which would return water to the Goose Lake Slough or to the CVC via the Rosedale Intake Canal. Each well would be 20-inch diameter cased to approximately 920 feet with an approximate capacity of 5 cfs. The wells would be equipped with vertical turbine pumps, 400 hp vertical motors, discharge piping, appurtenances, electrical and controls, and site improvements.

In order to have capacity in the Goose Lake Slough to recharge water at Phase 1 property, water would be supplied to the existing Rosedale West Basins via a new canal, three lift stations, and a reinforced concrete turnout. As a result, the final component of Phase 1 includes the construction of a canal, lift stations, and a reinforced concrete turnout at the California Aqueduct to convey 500 cfs of water approximately 10 miles to the easterly end of Rosedale West Basins. The proposed concrete lined canal would convey this water supply and have siphon crossings at several locations including East Side Canal, KWB Main Canal, WKWD 36" DIP Transmission Main, Stockdale Highway, Kosareff Storage Yard & Residence, and Interstate 5 (I-5) Freeway.

Three lift stations would be constructed within the canal where the first two lift stations would consist of a reinforced concrete pump station, six 83 cfs low lift pumps with 400 hp vertical motors, discharge piping appurtenances, electrical and controls and the third station would consist of a reinforced concrete pump station, six 67 cfs low lift pumps with 300 hp vertical motors, discharge piping appurtenances, electrical and controls. The first two lift stations would convey 500 cfs to the east side of the I-5 freeway and the third lift station would convey 400 cfs to the West Basins and the Goose Lake Slough. Lastly, a reinforced concrete turnout structure would be constructed at the east end of the West Basins to convey recharge water to the West Basins and Goose Lake Slough if needed.

Phase 2

Similar to Phase 1, Phase 2 includes the construction and operation of groundwater recharge and recovery facilities and the purchase of an additional 640 acres of land within the Rosedale boundary but outside of the limits of the Stockdale Project Final EIR. The preliminary location for Phase 2, shown on the Feasibility Study Map (Dee Jasper, July 2017), is used for purposes of scoping a program level assessment for Phase 2; however, this location is subject to change. Groundwater recharge would initially occur at 230 cfs but would decrease to an approximate maintenance rate of 115 cfs. Phase 2 would consist of the construction of levees, interbasin structures, conveyance facilities, and six groundwater recovery wells. These would be 20-inch diameter wells cased to approximately 920-feet. Each well would be equipped with vertical turbine pumps, 400 hp vertical motors, discharge piping, appurtenances, electrical and controls, and site improvements. These recovery wells would return water to the California Aqueduct, the Goose Lake Slough, or the CVC via the Rosedale Intake Canal.

2. Scope of Work

ESA proposes to provide environmental documentation that complies with the State CEQA Guidelines. All deliverables defined below in the scope of work will be provided in electronic format unless otherwise indicated. Electronic files will include both Microsoft Word and Adobe PDF format. All electronic deliverables will be made available on a password-protected FTP site and/or provided on CD where indicated.

Task 1: Project Initiation and Project Management

ESA will attend a kick-off meeting at IRWD offices. ESA will prepare a schedule and outline for the Draft Supplemental EIR (SEIR). After the kick-off meeting, ESA will prepare and submit an initial data request for information necessary to inform the project description and the impact analyses.

ESA will provide regular status updates to IRWD and Rosedale. Potential impacts to schedule will be reported to both agencies promptly. ESA will participate in monthly team conference calls with IRWD and Rosedale on an as-needed basis to maintain focus on action items and milestones for effective schedule management. ESA will be available for additional team meetings as identified in the tasks below, at IRWD offices or by teleconference over the course of the Project. We anticipate approximately eight (8) hours per month for Project management and coordination for the duration of the Project (14-15 months), including correspondence and invoicing.

Task 2: Project Description

ESA will prepare a draft project description based on information provided by IRWD and Rosedale. This scope of work assumes that IRWD and Rosedale will provide ESA with materials sufficient to inform the project description, including the Phase 1 and Phase 2 project components, footprints, and general characteristics/features. Phase 1 components will be described specifically while Phase 2 components will be described generally. The project description will include project location and setting, site characteristics, project objectives and need, components of the project, construction methods and schedule, and operation and maintenance requirements, including operational energy usage. This section will also include the requested permits and approvals for the proposed project.

In addition, ESA will submit a preliminary list of the past, present, and reasonably foreseeable future projects and activities in the surrounding areas that will serve as the basis for the cumulative impact analysis, as well as an overview of the Project alternatives to be analyzed in the EIR. ESA will submit the draft project description to IRWD and Rosedale for review. ESA will attend up to two (2) team meetings to discuss the project description and will revise the project description up to two times per comments from both agencies.

Task 3: Notice of Preparation and Notice of Completion

Concurrently with preparation of the Project Description (Task 2), ESA will prepare the Notice of Preparation (NOP) and Notice of Completion (NOC) as required by the State CEQA Guidelines including a brief description of the Project, site map, and summary of potential environmental impacts of the project. This scope of work assumes that an Initial Study will not be prepared or included with the NOP.

ESA will confer with IRWD and Rosedale to create a mailing list that identifies appropriate stakeholders. ESA will conduct mailings to the State Clearinghouse, responsible and trustee agencies, surrounding property owners and persons requesting notice. ESA will post notices in local newspapers and with the Orange County and Kern County Clerks. ESA will attend one (1) meeting with the Project team for this task.

Task 4: Public Scoping

ESA will work with IRWD and Rosedale to coordinate and attend two (2) public Scoping Meetings, one in the vicinity of the Project location and Rosedale in Kern County and one in the vicinity of IRWD in Orange County. ESA will prepare presentation materials and conduct an interactive presentation to solicit and record public comments pertaining to the scope and content of the EIR.

ESA will prepare a scoping memorandum summarizing the scoping process and comments received during the NOP review period and Scoping Meetings. The comment memorandum will be included as an Appendix to the

Draft SEIR. In addition to the Scoping Meetings, ESA will attend one (1) rehearsal meeting with the Project team prior to the Scoping Meeting for this task.

Task 5: Technical Studies

Task 5a: Biological Resources Technical Report

ESA will prepare a Biological Technical Report (BTR) that provides an assessment of Project impacts to biological resources. The BTR will be appended to the Draft SEIR and referenced in the Biological Resources chapter of the Draft SEIR. Biological Technical Report (BTR) will summarize the biological field survey methodology, findings, and mitigation recommendations. This serves to streamline the EIR chapter and improve readability.

ESA in-house biologists will conduct a CNDDB database search to update the special status-species with potential occur in the vicinity of the Project, relative to those identified in the previous Stockdale Project Final EIR. ESA biologists will conduct a field survey to characterize the baseline conditions of biological resources at the Project sites, for use in evaluating Project impacts. The field survey will focus on the footprint of facilities associated with Phase 1 of the Project. A windshield survey in and around the Project vicinity will inform the description of baseline conditions in the area being considered for Phase 2 facilities. The field survey will take two people up to three days to complete. Once the baseline conditions are established, ESA will evaluate the potential impacts to special-status species, communities and habitats. Mitigation recommendations will be included if necessary, along with a discussion of the applicability of any mitigation measures from the previous Stockdale Project Final EIR. The BTR will include a comprehensive list of permits required from resource agencies to implement the project as well.

Our scope of work assumes that no direct evidence of special-status species, such as the burrowing owl, will be detected during the field survey. If found, ESA will discuss with both IRWD and Rosedale the need for additional focused surveys for such species and submit an additional scope and fee for consideration by IRWD and Rosedale if necessary.

Task 5b: Cultural Resources Technical Report

ESA will conduct a Phase I Cultural Resources Assessment (CRA) to evaluate the potential impacts associated with the Project. A field survey will be conducted, which will take two people up to three days to complete. The Phase 1 components will be the focus of the cultural resources survey. ESA will conduct a records search at the Southern San Joaquin Valley Information Center at California State University, Bakersfield. ESA will notify the Native American Heritage Commission and request a list of interested Native American Groups if necessary. ESA will mail notices to local Native American groups to request whether the Project is located in an area of cultural significance if necessary. ESA will summarize information from the records search and site survey and identify the potential for impacts to archaeological, historical, and Native American resources in the Phase I CRA. Similar to the BTR, the CRA will serve to streamline the Cultural Resources EIR chapter and improve readability. Citing the results of the CRA, the EIR will identify potential impacts of the Project and provide mitigation measures to minimize impacts.

In addition, ESA will conduct a records search of the Project area to identify the potential for significant paleontological resources to be encountered during construction. The CRA will summarize the results of the records search and identify mitigation measures necessary to minimize impacts.

Task 6: Prepare an Administrative Draft SEIR

ESA will prepare an Administrative Draft SEIR (ADSEIR) in accordance with State CEQA Guidelines. The ADSEIR will include the project description, including any revisions that occur as a result of the Scoping Meeting. The ADSEIR will summarize environmental setting, regulatory framework, potential environmental impacts, and proposed mitigation by resource area. Phase 1 will be evaluated at a project level, and Phase 2 will be evaluated at a program level. As required by CEQA, the setting will describe the baseline conditions in the study area "as it exists before the commencement of the project" and the effects of the Project on existing conditions. The impact analysis will identify direct, indirect, and cumulative impacts for design, construction, and operation of the Project based on thresholds of significance. The analysis will include all environmental topics in Appendix F and Appendix G of the CEQA Guidelines. Mitigation measures will be identified to avoid or substantially lessen potential environmental effects. The ADSEIR will also provide an analysis of CEQA project alternatives.

To the extent feasible, ESA will leverage in the information in the Stockdale Project Final EIR to streamline the effort to prepare the Kern Fan Project ADSEIR. For similar impacts, mitigation measures adopted in the Stockdale Project Final EIR will be incorporated into the Kern Fan Project ADSEIR.

ESA will submit the ADSEIR to IRWD and Rosedale for review. ESA will attend two (2) team meetings during the ADSEIR preparation stage. The following issue areas will be addressed in the ADSEIR.

Aesthetics

The ADSEIR will summarize the aesthetic and visual impacts associated with construction and operation of the proposed Project. The ADSEIR will include photographs and a description of existing visual conditions in the Project area and will evaluate if the proposed Project will substantially degrade the existing visual character of the Project area. The ADSEIR will evaluate the potential effects to public view corridors resulting from the proposed Project and determine whether the Project would substantially alter the character of scenic vistas or create substantial new sources of light and glare. Mitigation measures will be identified if necessary to reduce aesthetic impacts.

Air Quality

The ADSEIR will summarize existing air quality in the Project area and will identify current attainment plans for criteria pollutants. The San Joaquin Valley Air Pollution Control District (APCD) thresholds of significance will be identified for operational and construction activities. ESA will coordinate with the Project team to identify construction-related and operational impacts of the Project to air quality. Utilizing the California Emissions Estimator Model (CalEEMod), Version 2011.1.1 emissions model, ESA will estimate emissions of criteria pollutants resulting from the construction methods to be used in construction of Phase 1 facilities. These results will be extrapolated to estimate air emissions associated with construction of Phase 2 facilities. The ADSEIR will also estimate long-term operational emissions for both Phase 1 and Phase 2 based on estimates of equipment operation and energy use. ESA will prepare a data request to identify the types, number, and duration of use of equipment needed for operational and construction activities. The ADSEIR will provide the setting and air quality impact assessment and mitigation measures will be developed to minimize air pollutant emissions. The ADSEIR will compare Project emissions with APCD threshold of significance. The ADSEIR will also evaluate the Project's consistency with the regional air quality attainment plans and will address global climate change issues (see GHGs below).

Biological Resources

Impact analysis in the ADSEIR will be based on the Biological Technical Report (BTR) (see Task 5a). The ADSEIR will document the existing biological resources in the Phase 1 and Phase 2 project areas, present the potential impacts as identified in the BTR, and include recommended mitigation measures as necessary. As required for the CWC WSIP, the ADSEIR will also describe how the Project will provide ecosystem benefits in the Sacramento-San Joaquin Delta. This scope of work assumes that IRWD will provide the technical analysis of such ecosystem benefits.

Cultural Resources

Impact analysis in the ADSEIR will be based on the Cultural Resources Assessment (CRA) (see Task 5b). The ADSEIR will document the existing cultural and historic resources in the Phase 1 and Phase 2 project areas, present the potential impacts as identified in the CRA, and include recommended mitigation measures as necessary.

Geology, Soils and Mineral Resources

The ADSEIR will include regional and local geologic and seismologic data pertinent to the Project area, including information from the U.S. Geological Survey and California Geological Survey as well as data from any geotechnical reports prepared for the Phase 1 sites. The ADSEIR will identify potential geologic impacts of the Project and will provide mitigation measures to minimize the effects where possible. The ADSEIR also will identify any mineral resource zones or oil well fields in the Project area and potential impacts related to access to such resources.

Greenhouse Gas Emissions (GHGs)

The ADSEIR will include analysis of Greenhouse Gas Emissions (GHGs) for the Project. Construction-related and operational GHGs would be quantified in terms of CO2 equivalents (CO2e) to account for varying warming potential of gases, and compared to regional thresholds of significance. ESA will also determine whether the Project would interfere with implementation of the California Global Warming Solutions Act of 2006 (Assembly Bill No. 32, or AB32) or Governor Schwarzenegger's Executive Order S-3-05, which both set State-wide goals to reduce GHGs to 1990 levels by 2020. This analysis will consider the collective size of Project facilities with respect to levels of CO2e emissions and the energy efficiency parameters of the Project.

Hazards and Hazardous Materials

ESA will conduct a search of publically-available databases (including the Cortese List in accordance with Appendix G of the CEQA Guidelines) to identify any hazardous materials sites in the Project vicinity. The ADSEIR will summarize the results of the database search and rely on other Project-related documentation (e.g., Phase I Site Assessments) to identify known contamination sites at the Phase 1 properties and the general vicinity for Phase 2 components. The EIR will list potentially hazardous materials used at the Project sites historically and disclose hazardous materials to be stored or used during construction and operation of the proposed Project. The ADSEIR will address potential soil contamination and groundwater contamination due to construction and operation of the Project. Mitigation measures will be developed to minimize potential hazards where feasible.

Hydrology and Water Quality

The ADSEIR will identify surface water and groundwater resources in the Project area and will evaluate potential impacts posed by the Project during construction and operation. The ADSEIR will rely on geotechnical investigations and groundwater modeling to be provided by IRWD and Rosedale that describe the recharge capacities of the Project sites and potential impacts of recharge and extraction activities both onsite and offsite in accordance with the Project terms of operation. The ADSEIR will summarize the results of a groundwater drawdown analysis for proposed production well operations and a mounding analysis for proposed recharge operations. The ADSEIR will provide groundwater quality data and analyze the impact of Project operations on any nearby plumes. The ADSEIR will describe storm water runoff control requirements and provide mitigation if necessary to meet construction and operational storm water runoff quality requirements. The ADSEIR will describe the applicability of Rosedale's Long Term Recovery Operations Plan, as developed for the Stockdale Project and appended to that Final EIR

Land Use, Agriculture and Forestry

ESA will conduct land use surveys of the Project area to identify current uses and sensitive receptors. Local General Plans, airport master plans, and habitat conservation plans will be identified and summarized as applicable. State-designated important farmland and Kern County agricultural preserves in the Project area also will be identified. The ADSEIR will identify the adopted land use and agricultural goals and policies that could be affected by the Project. The ADSEIR will evaluate consistency of the proposed project with existing land uses within the project area and develop mitigation measures to avoid or substantially lessen inconsistencies where feasible. This scope of work assumes that Phase 1 of the Project would not permanently remove any agricultural land from production, and as such, the California Agricultural Land Evaluation and Site Assessment (LESA) model is not required to evaluate impacts.

Noise

ESA will briefly describe and discuss existing noise sources at the Project site and describe the existing noise environment. ESA will summarize state and local noise policies, regulations, and standards as they pertain to the proposed project. The EIR will discuss the potential for onsite construction activities to generate noise and affect sensitive receptors. This discussion will be based upon proposed construction activities and scheduling information provided by IRWD and Rosedale. Otherwise, this discussion will be based upon peak noise and vibration levels generated by an assumed standard mix of construction equipment and activities. The ADSEIR will evaluate the Project compliance with existing noise standards and policies.

Population and Housing / Growth Inducement

ESA will evaluate and discuss the potential for the Project to indirectly induce growth due to the potential for the Project to remove an obstacle to growth, namely water supply. The ADSEIR will discuss population growth in both IRWD and Rosedale's service area, along with general water supply and demand projections. The ADSEIR will discuss the purpose of the Project to improve overall water supply reliability within IRWD's service area rather than a predictable water source that would support development on an annual basis.

Tribal Cultural Resources

This scope of work assumes that IRWD and Rosedale will implement the Tribal outreach and consultation as required by Assembly Bill 52. The ADSEIR will summarize the results of such outreach and consultation, noting whether any Tribal Cultural Resources will be impacted by the Project and any mitigation measures agreed upon by IRWD, Rosedale and the Tribes.

Transportation/Traffic

The ADSEIR will characterize the existing regional and local transportation networks and traffic conditions in the Project area, including traffic flow, access, and circulation conditions. The ADSEIR will assess the potential for construction traffic and operational traffic to affect local roadways. ESA will estimate Project construction traffic volume on the basis of estimates of earthwork quantities onsite, worker crew size, and equipment needs. Mitigation measures will be developed if required to reduce adverse effects to traffic and circulation.

Utilities, Service Systems, and Energy

The ADSEIR will review the potential effects of the Project on utilities and energy services resulting from both construction and operation of the Project. The ADSEIR will describe any potential need for water entitlements to operate the Project and identify potential impacts to local and regional energy supplies and capacity due to Project operation.

Cumulative Effects

ESA will address potential cumulative impacts of implementing the proposed Project in conjunction with past, present, and reasonably foreseeable public and private projects in the immediate Project area. The analysis will include a description of the geographic area in which cumulative impacts could be experienced for each resource area. ESA will consult the local General Plan and relevant agencies to compile a list of major projects planned within or near the area over the next 10-15 years as well as projects under way or completed in the last five years. A brief description of the relevant past, present, and proposed future projects occurring in the area that could produce effects similar to the Project will be provided. As CEQA requires, the analysis will focus on the potential for the Project's impacts to be cumulatively considerable when combined with the impacts of other related projects.

Alternatives

The ADSEIR will evaluate alternatives to the Project including the No Project Alternative plus up to two additional alternatives, as dictated by Project impacts and CEQA requirements. The ADSEIR will compare the alternatives to determine if any would substantially meet the project objectives and reduce significant impacts associated with the proposed Project. As required by CEQA, IRWD and Rosedale will consider any alternatives identified by agencies or others at scoping meetings or in response to the NOP and determine whether they should be included in the ADSEIR as feasible or infeasible. The ADSEIR will identify the environmentally superior alternative based on the conclusions of the analysis.

Task 7: Prepare a Screencheck Draft SEIR

ESA will revise the Draft SEIR per the comments received from IRWD and Rosedale staff on the ADSEIR. ESA will prepare a Screencheck Draft SEIR for review by both agencies. ESA will attend one (1) team meeting to discuss revisions to the ADSEIR prior to circulating the Screencheck Draft SEIR to IRWD and Rosedale to review.

Task 8: Prepare Public Draft SEIR, Notice of Availability, and Notice of Completion

ESA will incorporate comments from IRWD and Rosedale staff and prepare the Public Draft SEIR. ESA will compile the mailing list and conduct the mailing and public noticing required by CEQA for the Public Draft SEIR. ESA will prepare and file the NOC with the State Clearinghouse and the Notice of Availability (NOA) of the Draft SEIR with both the Orange County and Kern County Clerks. The notices will include the date and location of public meetings on the Draft SEIR. ESA will produce up to five (5) bound hard copies, fifty (50) CDs containing electronic versions of the Public Draft EIR, fifty (50) NOAs, and five (5) NOCs, and two (2) CDs with PDF files of the Draft Public SEIR, NOA, and NOC for IRWD and Rosedale records.

Task 9: Conduct Public Meeting

ESA will organize and arrange two (2) Public Meetings to receive comments on the Draft SEIR, one in Orange County and one in Kern County. ESA will take the lead in conducting a presentation. ESA will prepare presentation materials and an agenda and conduct a presentation. Presentation and/or hard copy materials will be approved by IRWD and Rosedale in advance of the meeting. The presentation will be organized as a summary overview of the Draft SEIR and will identify potential environmental issues. The purpose of the meeting will be to collect additional comments on the Draft SEIR. ESA will document all comments received during the Public Meetings and will incorporate them into the Final EIR if applicable.

Task 10: Prepare Final SEIR and Response to Comments

At the conclusion of the public review period, ESA will work with IRWD and Rosedale to obtain all comments received on the Draft SEIR. ESA will provide a detailed review and evaluation of all of the comments received. ESA will develop a strategy for addressing the comments and will present this approach to IRWD and Rosedale during a team meeting. An Administrative Final SEIR containing proposed responses to comments to the Draft SEIR will be prepared once ESA's approach is agreed with by IRWD and Rosedale staff.

After incorporation of comments on the Administrative Final SEIR, ESA will prepare a Screencheck Final SEIR for review by IRWD and Rosedale. ESA assumes that comments on the Screencheck Final SEIR will be minimal, due to early consultation with both agencies when comments are received.

The Response to Comments in conjunction with the Draft SEIR will constitute the Final SEIR. After IRWD and Rosedale have reviewed the Final SEIR, ESA will incorporate the necessary revisions into the document and will mail a copy to each entity that commented.

Task 11: Prepare Findings, Statement of Overriding Considerations, Notice of Determination

ESA will prepare draft Findings of Fact and a Statement of Overriding Considerations (SOC) (if necessary) for review by the IRWD and Rosedale Boards of Directors. ESA will incorporate IRWD and Rosedale's comments and will prepare the final Findings. ESA will also attend one (1) EIR Certification Hearing. ESA will prepare and file the Notice of Determination (NOD) with the County Clerks and the State Clearinghouse following certification by Rosedale first as the CEQA Lead Agency and IRWD second as a Responsible Agency. The 2017 CEQA filing fees for California Department of Fish and Wildlife are included as part of this task.

Task 12: Prepare a Mitigation Monitoring Compliance and Reporting Program

In compliance with Public Resources Code Section 21081.6, ESA will prepare a draft Mitigation Monitoring Compliance and Reporting Program (MMCRP) for review by IRWD and Rosedale. MMCRP describes the required mitigation necessary to avoid or reduce significant impacts, the responsible parties, tasks, and schedule necessary for monitoring mitigation compliance.

3. Cost Estimate and Schedule

Attached as **Table 1** is a detailed cost estimate showing the level of effort for each task described above, based on hourly assumptions and ESA standard billing rates. The cost of the proposed project is not-to-exceed $259,242.

The following is ESA's estimated 14-15-month schedule for implementing the above scope of work. This schedule assumes a kick-off date of June 2019.

Task No.	Task Name	Duration	Start	Finish
1	Kickoff Meeting	0	6/3/2019	6/3/2019
2	Project Description and Data Request	6 weeks	6/3/2019	7/15/2019
3	ESA prepares a NOP and NOC	6 weeks	6/3/2019	7/15/2019
4	30-day Scoping Period and Public Meeting	30 days	7/15/2019	8/14/2019
5	Technical Reports	8 weeks	7/15/2019	9/9/2019
6	Prepare Administrative Draft SEIR	16 weeks	8/14/2019	1/1/2020
7	Prepare Screencheck Draft SEIR	6 weeks	1/1/2020	2/26/2020
8	Prepare Public Draft SEIR, NOA, and NOC	2 weeks	2/26/2020	3/25/2020
9	45-day Draft SEIR Review and Public Meeting	45 days	3/25/2020	5/9/2020
10	Prepare Final SEIR and Response to Comments	8 weeks	5/9/2020	7/18/2020
11	Prepare Findings, SOC, and NOD	3 weeks	7/18/2020	8/8/2020
12	Prepare MMRCP	3 weeks	7/18/2020	8/8/2020

Please do not hesitate to contact Jennifer Jacobus at 213-599-4300 if you have any questions about our scope of work or level of effort. We appreciate the opportunity to propose on this effort and to continue to support the development of IRWD and Rosedale's cooperative groundwater banking activities in Kern County.

Sincerely,

Tom Barnes
Vice President
Director, Southern California Water Practice Group

Jennifer Jacobus
Senior Managing Associate, Southern California Water Practice Group

TABLE 1: PRICING PROPOSAL
ESA Labor Detail and Expense Summary

						S. Shirayama										
	Employee Name	T. Barnes	G. Ainsworth	M. Burns	J. Jacobus	C. Ehringer	T. Molioo	C. Castillo	T. Witwer		J. Anderson	G. Jafolla	S. Hemphill			
		M. Strauss				E. Schniewind	S. Spano	M. Gonzalez								
						A. Sako										
	Title	Senior Director II	Director III	Director II	Managing Associate III	Managing Associate II	Senior Associate II	Associate II	Associate I	Subtotal	Project Technician III	Project Technician II	Project Technician I	Subtotal	Hours	Labor Price
Task #	**Task Name/Description**	$265	$230	$215	$195	$180	$150	$120	$100		$120	$115	$95			
1	Project Initiation and Management															
	Kickoff meetings/Outline	4			8					$ 2,620				$ -	12	$ 2,620
	Project Meetings (monthly)	6			12		12			$ 5,730				$ -	30	$ 5,730
	Project Management	8			70		34			$ 20,870			6	$ 570	118	$ 21,440
2	Project Description	1			24			40		$ 9,745	8	8		$ 1,880	81	$ 11,625
3	NOP and NOC	1			12		16	24	4	$ 8,285	2	2	4	$ 850	65	$ 9,135
4	Public Socping	1			24		24	8		$ 9,505	4			$ 480	61	$ 9,985
5a	Bio Resources Tech Report		4		2		50	36	10	$ 14,130	8	4		$ 1,420	114	$ 15,550
5b	Cultural Resources Tech Report	4			8	32		46	10	$ 14,900	8	4		$ 1,420	112	$ 16,320
6	Admin Draft SEIR													$ -	-	$ -
	Aesthetics				1		1	28		$ 3,705	4			$ 480	34	$ 4,185
	Air Quality					12	1		40	$ 6,310				$ -	53	$ 6,310
	Biological Resources		2		1		24			$ 4,255	4			$ 480	31	$ 4,735
	Cultural Resources	2			1	8		20		$ 4,565	2			$ 240	33	$ 4,805
	Geology, Soils, and Mineral Resources				1	8		20		$ 4,035	4			$ 480	33	$ 4,515
	GHG and Energy Efficiency					8			28	$ 4,240				$ -	36	$ 4,240
	Hazards and Hazardous Materials				1	4	1	28		$ 4,425	4			$ 480	38	$ 4,905
	Hydrology and Water Quality	2		2	16	16		60		$ 14,160	8			$ 960	104	$ 15,120
	Land Use, Agriculture, Forestry				1		1	40		$ 5,145	8			$ 960	50	$ 6,105
	Noise					4	1		24	$ 3,270	2			$ 240	31	$ 3,510
	Transportation and Traffic				1		1	24		$ 3,225	4			$ 480	30	$ 3,705
	Tribal Cultural Resources					4		16		$ 2,640	2			$ 240	22	$ 2,880
	Utilities, Service Systems and Energy				2			20		$ 2,790				$ -	22	$ 2,790
	Alternatives				16		32			$ 7,920	2			$ 240	50	$ 8,160
	Cumulative Effects				8		24	16		$ 7,080	4			$ 480	52	$ 7,560
	Growth Inducement				8		8	8		$ 3,720	2		2	$ 430	28	$ 4,150
	QA/QC, Meetings, Production, Mail-out	4			16		4	4		$ 5,260		8	4	$ 1,300	40	$ 6,560
7	Prepare Screencheck Draft SEIR	2			24	4	24	40		$ 14,330	4	4	2	$ 1,130	104	$ 15,460
8	Prepare Public Draft SEIR, NOA, and NOC				16			16		$ 5,040	2	4	8	$ 1,460	46	$ 6,500
9	Public Meeting	1			24		24	16		$ 10,465	4	2		$ 710	71	$ 11,175
10	Final SEIR and RTC	4			40	8	24	16		$ 15,820		8	8	$ 1,680	108	$ 17,500
11	Prepare Findings, SOC, NOD	2			8			12		$ 3,530		2		$ 230	24	$ 3,760
12	Mitigation Monitoring Compliance and Reporting Program				4			16		$ 2,700		2		$ 230	22	$ 2,930
										$ -				$ -	-	$ -
										$ -				$ -	-	$ -
Total Hours		42	6	2	349	108	306	554	116		90	48	34	$ 172	1,655	
Subtotals - Labor Costs		$ 11,130	$ 1,380	$ 430	$ 68,055	$ 19,440	$ 45,900	$ 66,480	$ 11,600	$ 224,415	$ 10,800	$ 5,520	$ 3,230	$ 19,550		**$ 243,965**
Percent of Effort - Labor Hours Only		2.5%	0.4%	0.1%	21.1%	6.5%	18.5%	33.5%	7.0%		5.4%	2.9%	2.1%		100.0%	
Percent of Effort - Total Project Cost		4.3%	0.5%	0.2%	26.3%	7.5%	17.7%	25.6%	4.5%		4.2%	2.1%	1.2%			94.1%

ESA Labor Costs		**$ 243,965**
Communication Fee on Labor Cos	3%	**$ 7,319**
ESA Non-Labor Expenses		
Reimbursable Expenses (Mileage, Printing, Database Searches)		$ 7,958
ESA Equipment usage (see Attachment A for detail		$ -
Subtotal ESA Non-Labor Expenses		**$ 7,958**
Subconsultant Costs (see Attachment B for detail		**$ -**

TOTAL PROJECT PRICE **$ 259,242**

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Feasibility and Implementation Risk Tab

A.5 Impacts and Consultation:

Summarize the project's impacts on environmental or cultural resources and how the project will mitigate or minimize impacts to those resources, or identify where in the CEQA document this information can be found. If any environmental or cultural impacts will not be fully mitigated, explain. See regulations section 6003(a)(1)(U)

If applicable, identify whether Tribal Consultation has been initiated for the project. If it has, provide supporting documentation, or identify the location in the CEQA document. If consultation has not been initiated, state whether consultation is expected and when consultation is expected to be initiated. See regulations section 6003(a)(1)(U).

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ENVIRONMENTAL AND CULTURAL RESOURCE IMPACTS

Per Sections 6003(a)(1)(T) and 6003(a)(1)(U) of the Regulations:
Summary of how the project may impact environmental or cultural resources and how the project will mitigate or minimize impacts to those resources;
If applicable, evidence of Tribal Cultural Resource consultation under CEQA;

To date, programmatic environmental review work has been completed for Phase 1 of the Kern Fan Groundwater Storage Project (Kern Fan Project). A Final Environmental Impact Report was prepared, certified, and approved in December 2015 for the Stockdale Integrated Banking Project (Stockdale Project). The Stockdale Project Final EIR includes a program-level analysis of impacts in accordance with *CEQA Guidelines* Section 15168 of a third project site yet to be identified. The third project site accounted for in the Stockdale Project Final EIR is now designated to be Phase 1 of the Kern Fan Project. Upon identification of the Phase 1 project site, subsequent project-level environmental review will be conducted. The Stockdale Project Final EIR will provide the basis for anticipated project-level CEQA analysis for Phase 1 of the Kern Fan Project. For purposes of CEQA, Phase 2 of the Kern Fan Project is considered a fourth site in the vicinity of the Stockdale Project. Environmental review for the Kern Fan Project will therefore be completed as a Supplemental EIR (SEIR) to the Stockdale Project Final EIR. The SEIR will be completed such that the third site is specifically identified along with appurtenant conveyance facilities to be evaluated at a project-level and a fourth site added to be evaluated at a program-level.

As part of the environmental review a Biological Technical Report (BTR) will be prepared for Phase 1 and Phase 2. The BTR will be appended to the Draft SEIR and summarize mitigation recommendations. Additionally, a Phase 1 Cultural Resources Assessment (CRA) will be conducted and used as a reference in the Draft SEIR to identify potential impacts of the Kern Fan Project and provide mitigation measures. The Draft SEIR will summarize the environmental setting, regulations, framework, potential environmental impacts and proposed mitigation measures by resource area. Phase 1 will be evaluated at a project level and Phase 2 will be evaluated at a program level. The impact analysis will identify direct, indirect and cumulative impacts for design, construction and operation of the Kern Fan Project based on thresholds of significance. Mitigation measures will be identified to avoid or substantially lessen environmental effects. IRWD and Rosedale anticipate that due to the similarity of the Kern Fan and Stockdale Projects and the vicinity of their locations, impacts identified in the Kern Fan Project will be similar to those identified in the Stockdale Project. For similar impacts, mitigation measures adopted in the Stockdale Project Final EIR will be incorporated into the Kern Fan Project Draft SEIR.

Impacts identified in the Stockdale Project Final EIR would occur during construction and operation of the project. Most construction impacts would be short term and are either considered less than significant or are reduced to less than significant levels with appropriate mitigation measures. Operation of the Stockdale Project would primarily affect hydrology and groundwater, in particular changes in groundwater levels during recharge and recovery operations. Operational impacts either are considered less than significant or reduced to less than significant levels with appropriate mitigation measures. The Stockdale Project Final EIR concludes that the project, which includes program analysis of Phase 1 of the Kern Fan Project, would not result in any significant and unavoidable impacts. IRWD and Rosedale expect that upon further project-level analysis, the Kern Fan Project will not result in significant or unavoidable impacts.

A summary of potential impacts and mitigation measures are included at the end of this section. Additional detail on the potential impacts and mitigation measures can be found in Chapter 3 of the Stockdale Project Final EIR. The entire Stockdale Project Final EIR can be found at: http://www.irwd.com/images/pdf/doing-business/environmental-documents/env-documents-2015/NOD_Stockdale_EIR-web.pdf

IRWD and Rosedale will also implement the Tribal outreach and consultation, as required by Assembly Bill 52. The Draft SEIR will summarize the results of such outreach and consultation, noting whether any Tribal Cultural Resources will be impacted by the Kern Fan Project and any mitigation measures agreed upon by IRWD, Rosedale and the Tribes.

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
Aesthetics		
Impact AES-1: The proposed project could alter the existing visual character of the sites by changing the land use from agricultural production to a combination of groundwater recharge, water conveyance, and agricultural production.	None required.	Less than Significant.
Impact AES-4: The proposed project would create new sources of nighttime lighting.	**Mitigation Measure AES-1:** All nighttime construction lighting and security lighting installed on new facilities shall be shielded and directed downward to avoid light spill onto neighboring properties.	Less than Significant with Mitigation.
Agriculture and Forestry Resources		
Impact AGR-1: The proposed project would build groundwater banking and conveyance facilities on lands designated as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance.	None required.	Less than Significant.
Impact AGR-2: The proposed project could build groundwater banking facilities on lands under a Williamson Act contract.	**Mitigation Measure AGR-1:** If the third Stockdale project site is under a Williamson Act contract, then the use of the property would be managed as applicable in accordance with Kern County's *Agricultural Preserve Standard Uniform Rules*, which identify land uses that are compatible within agricultural preserves established under the Williamson Act.	Less than Significant with Mitigation.
Impact AGR-3: The proposed project could convert farmland to a combined land use of groundwater recharge and agricultural production.	Implement **Mitigation Measure BIO-5**.	Less than Significant with Mitigation.
Air Quality		
Impact AQ-1: The proposed project could conflict with or obstruct implementation of SJVAPCD air quality plan.	None required.	Less than Significant.
Impact AQ-2: Construction and/or operation of the project could generate emissions of criteria air pollutants that could contribute to existing nonattainment conditions.	None required.	Less than Significant.
Impact AQ-3: Construction and operation of the project could result in cumulatively considerable increases of criteria pollutant emissions.	None required.	Less than Significant.

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
Impact AQ-4: Construction and/or operation of the project could expose sensitive receptors to substantial pollutant concentrations.	None required.	Less than Significant.
Impact AQ-5: Operation of the project could create objectionable odors affecting a substantial number of people.	None required.	Less than Significant.
Biological Resources		
Impact BIO-1: Construction of the proposed project could result in adverse impact to special-status species.	**Mitigation Measure BIO-1:** The following measures would reduce potential impacts to nesting and migratory birds and raptors to less than significant levels: • Within 15 days of site clearing, a qualified biologist shall conduct a preconstruction, migratory bird and raptor nesting survey. The biologist must be qualified to determine the status and stage of nesting by migratory birds and all locally breeding raptor species without causing intrusive disturbance. This survey shall include species protected under the Migratory Bird Treaty Act including the tricolored blackbird. The survey shall cover all reasonably potential nesting locations for the relevant species on or closely adjacent to the proposed project site. • Nesting habitat should be removed prior to the bird breeding season (February 1 – September 30). • If an active nest is confirmed by the biologist, no construction activities shall occur within 250 feet of the nesting site for migratory birds and within 500 feet of the nesting site for raptors. The buffer zones around any nest within which project-related construction activities would be avoided can be reduced as determined acceptable by a qualified biologist. Construction activities may resume once the breeding season ends (February 1 – September 30), or the nest has either failed or the birds have fledged. **Mitigation Measure BIO-2:** If construction activities are scheduled to take place outside of the Swainson's hawk nesting season (which runs from March 1 – September 15), then no preconstruction clearance surveys or subsequent avoidance buffers are required. If construction activities are initiated within the nesting season then preconstruction nesting surveys shall be conducted by a qualified biologist prior to ground disturbance, in accordance with the guidance provided in the *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley* (Swainson's Hawk Technical Advisory Committee, 2000). The required windshield surveys shall cover a one-half mile radius around the project sites. If a nest site is found, the qualified biologist shall determine the appropriate buffer zone around the nest within which project-related construction activities would be avoided. In addition, the qualified biologist shall consult with Rosedale and/or IRWD to determine whether consultation with CDFW is necessary. **Mitigation Measure BIO-3:** A pre-construction survey shall be conducted for burrowing owls 14 to 30 days prior to clearing of the site by a qualified biologist in accordance with the most recent CDFW protocol, currently the *Staff Report on Burrowing Owl Mitigation* (CDFW 2012). Surveys shall cover suitable burrowing owl habitat disturbed by construction including a 500-foot buffer. The survey would	Less than Significant with Mitigation.

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
	identify adult and juvenile burrowing owls and signs of burrowing owl occupation. This survey shall include two early morning surveys and two evening surveys to ensure that all owl pairs have been located. If occupied burrowing owl habitat is detected on the proposed project site, measures to avoid, minimize, or mitigate impacts shall be incorporated into the proposed project and shall include, but not be limited to, the following: • If owls are identified on or adjacent to the site, a qualified biologist shall provide a pre-construction Worker's Environmental Awareness Program to contractors and their employees that describes the life history and species protection measures that are in effect to avoid impacts to burrowing owls. Construction monitoring will also occur throughout the duration of ground-disturbing construction activities to ensure no impacts occur to burrowing owl. • Construction exclusion areas shall be established around the occupied burrows in which no disturbance shall be allowed to occur while the burrows are occupied. Buffer areas shall be determined by a qualified biologist based on the recommendations outlined in the most recent Staff Report on Burrowing Owl Mitigation (CDFW 2012). • If occupied burrows cannot be avoided, a qualified biologist shall develop and implement a Burrowing Owl Management Plan. The biologist shall develop the Plan in consultation with Rosedale and/or IRWD and shall coordinate with CDFW as necessary. **Mitigation Measure BIO-4:** IRWD and Rosedale shall conduct a USFWS-approved "early evaluation" of the project area to determine if the project sites represent San Joaquin kit fox habitat. If the evaluation shows that the San Joaquin kit fox does not utilize the project sites, and the project will not result in take, then no further mitigation shall be required for this endangered species. If the "early evaluation" finds potential for the presence of kit fox, USFWS may require a San Joaquin kit fox survey to be conducted by a qualified biologist, in accordance with the most recent USFWS *San Joaquin Kit Fox Survey Protocol*. If it is determined that the San Joaquin kit fox has the potential to utilize the property then the following measures are required to avoid potential adverse effects to this species: • Rosedale and/or IRWD shall initiate discussions with the USFWS to determine appropriate project modifications to protect kit fox, including avoidance, minimization, restoration, preservation, or compensation. • If evidence of active or potentially active San Joaquin kit fox dens is found within the area to be impacted by the proposed project, compensation for the habitat loss shall be determined and provided in consultation with USFWS and CDFW. **Mitigation Measure BIO-5:** Prior to ground disturbing activities at the Goose Lake Slough and third Stockdale site, a qualified biologist shall conduct a pre-construction floristic survey and, if deemed necessary, focused rare plant survey of project areas to determine and map the location and extent of special-status plant species populations and natural communities of special concern within disturbance areas. Focused rare plant surveys shall occur during the typical blooming periods of special-status plants with the potential to occur. The plant surveys shall follow the CDFW Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (November 24, 2009). If a special-status plant species is found to be present, and avoidance of the species and/or habitat is not feasible, the implementing agency shall retain a qualified botanist to prepare and implement a	

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
	Revegetation/Restoration Mitigation Plan. **Mitigation Measure BIO-6:** Prior to ground disturbing activities at the third Stockdale site, a habitat assessment shall be conducted by a qualified biologist to determine the potential for special-status wildlife species to occur within affected areas. If the habitat assessment determines that a special-status species has the potential to be present within a minimum of 500 feet of the construction zone, a qualified biologist shall determine whether subsequent focused surveys are required prior to project implementation to determine presence or absence. If a special-status wildlife species is found to be present, and avoidance of the species and/or habitat is not feasible, then Mitigation Measures BIO-1 through BIO-4 shall be implemented as appropriate, or Rosedale and/or IRWD shall consult with a qualified biologist to prepare a species-specific mitigation plan and determine whether consultation with wildlife agencies are recommended.	
Impact BIO-2: The proposed project could have a substantial adverse effect on sensitive natural communities.	Implement **Mitigation Measure BIO-5**.	Less than Significant with Mitigation.
Impact BIO-3: The proposed project could have a substantial adverse effect on federally protected wetlands.	**Mitigation Measure BIO-7:** For project components that have potential to impact jurisdictional features, prior to ground disturbing activities, a qualified biologist shall be retained to conduct a jurisdictional delineation in areas that may be affected by the project. If jurisdictional resources are identified, the qualified biologist shall prepare a jurisdictional delineation report outlining the potential acreage of jurisdictional features that may be impacted. The jurisdictional delineation report will be submitted to USACE for a jurisdictional determination. If the delineation report determines that jurisdictional waters and/or wetlands are present within the project site, regulatory permits may be required prior to project impacts which include mitigation and/or compensation to reduce impacts to jurisdictional features to a less than significant level. Based on the results of the delineation report, permits required may include a 404 or Nationwide Permit from USACE, a 401 Certification from RWQCB and/or a Streambed Alteration Agreement from CDFW. Project impacts under 0.10 acres may not require a permit from USACE but only a notification of impact. The appropriate permits required to reduce impacts to jurisdictional features will be determined through initial consultation with the resource agencies.	Less than Significant with Mitigation.
Impact BIO-4: The proposed project could conflict with the Metropolitan Bakersfield Habitat Conservation Plan.	None required.	Less than Significant.
Cultural Resources		
Impact CUL-1: The project could cause a substantial adverse change in the significance of a historical or archaeological resource, as defined in CEQA Guidelines Section 15064.5.	**Mitigation Measure CUL-1:** In the event that prehistoric or historic subsurface cultural resources are discovered during ground-disturbing activities, all work within 50 feet of the resources will be halted and Rosedale or IRWD (as applicable) will consult with a qualified archaeologist to assess the significance of the find according to *CEQA Guidelines* Section 15064.5. If any find is determined to be significant, then Rosedale or IRWD and the archaeologist will meet to determine the appropriate avoidance measures or other appropriate mitigation. Rosedale or IRWD (as applicable) will make the final determination. All significant cultural materials recovered will be, as necessary and at the discretion of	Less than Significant with Mitigation.

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
	the consulting archaeologist, subject to scientific analysis, professional museum curation, and documentation according to current professional standards. In considering any suggested mitigation proposed by the consulting archaeologist in order to mitigate impacts to historical resources or unique archaeological resources, Rosedale or IRWD will determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) will be instituted. Work may proceed on other parts of the project site while mitigation for historical resources or unique archaeological resources is being carried out. **Mitigation Measure CUL-2:** For any project components not previously subject to archaeological survey (e.g., the third Stockdale site), prior to the initiation of ground disturbance, a qualified archaeologist shall be retained to carry out a Phase I Cultural Resources Survey of the project component. The Phase I Survey shall identify and evaluate the significance of any resources that may be directly or indirectly impacted by the proposed project. The Phase I Survey effort shall be documented in a Phase I Report. If as a result of the additional Phase I Survey any resource is found to be a historical or unique archaeological resource as defined in PRC Section 21084.1 and 21083.2(g), respectively, then **Mitigation Measure CUL-1** shall be implemented.	
Impact CUL-2: The project could directly or indirectly affect a unique paleontological resource or site or unique geologic feature, as defined in CEQA Guidelines Section 15064.	**Mitigation Measure CUL-3:** In the event that paleontological resources are discovered, Rosedale or IRWD (depending upon the project component) will notify a qualified paleontologist. The paleontologist will document the discovery as needed, evaluate the potential resource, and assess the significance of the find under the criteria set forth in *CEQA Guidelines* Section 15064.5. If fossil or fossil bearing deposits are discovered during construction, excavations within 50 feet of the find will be temporarily halted or diverted until the discovery is examined by a qualified paleontologist. The paleontologist will notify the appropriate agencies to determine procedures that would be followed before construction is allowed to resume at the location of the find. If Rosedale or IRWD determines that avoidance is not feasible, the paleontologist will prepare an excavation plan for mitigating the effect of the project on the qualities that make the resource important. The plan will be submitted to Rosedale or IRWD for review and approval prior to implementation. **Mitigation Measure CUL-4:** Once the location of the third Stockdale site is determined (or any additional project components), prior to the initiation of ground disturbance, a paleontological literature, map, and museum locality review shall be conducted in order to assess the paleontological sensitivity of the project component. If the literature, map, and museum locality review identifies potentially sensitive paleontological resources, then a qualified paleontologist shall be retained to conduct a pedestrian survey and assessment of the project component. A report shall be prepared which summarizes the results of the survey and assessment and provides recommendations regarding implementation of mitigation, such as **Mitigation Measure CUL-3**.	Less than Significant with Mitigation.

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
Impact CUL-3: The proposed project could result in adverse impacts to human remains.	**Mitigation Measure CUL-5:** If human remains are uncovered during project construction, Rosedale or IRWD (as applicable) shall immediately halt work, contact the Kern County Coroner to evaluate the remains, and follow the procedures and protocols set forth in Section 15064.4 (e)(1) of the *California Environmental Quality Act Guidelines*. If the Coroner determines the remains are Native American in origin, the Coroner shall contact the Native American Heritage Commission (NAHC). As provided in Public Resources Code Section 5097.98, the NAHC shall identify the person or persons believed to be most likely descended from the deceased Native American. The most likely descendent shall be afforded the opportunity to provide recommendations concerning the future disposition of the remains and any associated grave goods as provided in PRC 5097.98.	Less than Significant with Mitigation.
Geology, Soils, and Seismicity		
Impact GEO-1: The proposed project could expose new structures to adverse effects related to strong seismic ground shaking, ground failure, and liquefaction.	Implement **Mitigation Measure HYDRO-2.**	Less than Significant with Mitigation.
Impact GEO-2: The proposed project could result in soil erosion or the loss of topsoil.	Implement **Mitigation Measure HYDRO-1.**	Less than Significant with Mitigation.
Impact GEO-3: Operation of the proposed project could affect groundwater levels and result in on-site or off-site subsidence from compaction.	None required.	Less than Significant.
Greenhouse Gas Emissions		
Impact GHG-1: The proposed project could generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.	None required.	Less than Significant.
Impact GHG-2: The proposed project could conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.	None required.	Less than Significant.
Hazards and Hazardous Materials		
Impact HAZ-1: The proposed project could create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.	None required.	Less than Significant.

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
Impact HAZ-2: The proposed project could create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.	**Mitigation Measure HAZ-1:** Prior to construction at Stockdale East, Rosedale shall collect representative samples of soils remaining in place near the oilfield as identified in the Phase 1 Environmental Site Assessment. The samples shall be analyzed for total petroleum hydrocarbons and pesticides. Rosedale shall avoid if feasible or otherwise remove from the site soils identified as containing hazardous quantities of contaminants and dispose of such soils in accordance with applicable hazardous waste regulations. **Mitigation Measure HAZ-2:** In the event that asbestos-containing materials are uncovered during project construction, work at the project sites shall immediately halt and a qualified hazardous materials professional shall be contacted and brought to the project sites to make a proper assessment of the suspect materials. All potentially friable asbestos-containing materials shall be removed in accordance with Federal, State, and local laws and the National Emissions Standards for Hazardous Air Pollutants guidelines prior to ground disturbance that may disturb such materials. All demolition activities shall be undertaken in accordance with California Occupational Safety and Health Administration standards, as contained in Title 8 of the CCR, Section 1529, to protect workers from exposure to asbestos. Materials containing more than one percent asbestos shall also be subject to San Joaquin Valley Air Pollution Control District regulations. Demolition shall be performed in conformance with Federal, state, and local laws and regulations so that construction workers and/or the public avoid significant exposure to asbestos-containing materials. **Mitigation Measure HAZ-3:** A Phase I Environmental Site Assessment shall be prepared for the Central Intake Pipeline and the third Stockdale project site to identify potential hazards and hazardous materials located within a one-mile radius. The construction contractor shall be informed of potential hazards and shall develop appropriate plans to avoid or remediate hazards.	Less than Significant with Mitigation.
Impact HAZ-3: The proposed project could emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.	**Mitigation Measure HAZ-4:** In the event the third Stockdale project site is located within a quarter mile of any school facilities, prior to construction, the contractors shall coordinate the proposed project construction route with the impacted school district and school facility to avoid school safety routes.	Less than Significant with Mitigation.
Impact HAZ-4: The proposed project could be located on a site which is included on a list of hazardous materials sites and could create a significant hazard to the public or the environment.	Implement **Mitigation Measure HAZ-3**.	Less than Significant with Mitigation.
Impact HAZ-5: The proposed project operation could cause an increase in airborne insect populations.	**Mitigation Measure HAZ-5:** IRWD and Rosedale shall coordinate with the Kern County Department of Public Health Services and the Kern Mosquito and Vector Control District prior to project operations to develop and implement, if necessary, appropriate insect abatement methods. Such methods shall not utilize any substances that may contaminate groundwater.	Less than Significant with Mitigation.

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
Hydrology and Water Quality		
Impact HYDRO-1: The proposed project could violate water quality standards or waste discharge requirements during construction or project operation.	**Mitigation Measure HYDRO-1:** The SWPPP for the proposed project shall include the following BMPs: • Establish an erosion control perimeter around active construction and contractor layout areas including silt fencing, jute netting, straw waddles, or other appropriate measures to control sediment from leaving the construction area. • Stockpiled soils shall be watered, covered, or otherwise managed to prevent loss due to water and wind erosion. • Install containment measures at fueling stations and at fuel and chemical storage sites. Employ good house-keeping measures including clearing construction debris and waste materials at the end of each day.	Less than Significant with Mitigation
Impact HYDRO-2: The proposed project could deplete groundwater supplies and lower the groundwater table through extraction of banked groundwater.	None required.	Less than Significant.
Impact HYDRO-3: Recharge operations on the proposed project site could result in groundwater mounding that could potentially impact underground structures or impair recharge efforts of adjacent groundwater banking operations.	**Mitigation Measure HYDRO-2:** Prior to operation of the project, Rosedale shall develop and implement a shallow groundwater monitoring plan for purposes of protecting subsurface structures of the Cross Valley Canal (CVC). Piezometers shall be installed adjacent to the CVC at Stockdale East and the third Stockdale project site if applicable. Piezometers have already been installed at Stockdale West. The location and design of the new piezometers shall be approved by the Kern County Water Agency (KCWA). Piezometers at the Stockdale Properties shall be used to monitor groundwater levels beneath the CVC. Prior to initiating the project, a California state licensed geotechnical engineer shall conduct an analysis to determine the critical depth at which shallow groundwater would pose a threat to the stability of CVC structures. Based on this analysis, the monitoring plan shall identify depths at which monitoring frequency shall change, such as from monthly to weekly to daily, as shallow groundwater levels approach the critical depth. The monitoring plan shall also identify the depth at which project operation would cease such that the critical depth would not be reached and the conditions under which project operation could resume. The monitoring plan shall be approved by KCWA.	Less than Significant with Mitigation.
Impact HYDRO-4: The proposed project could substantially alter the existing drainage pattern of a site that could result in substantial erosion or siltation on- or off-site.	Implement **Mitigation Measure HYDRO-1.**	Less than Significant with Mitigation.
Impact HYDRO-5: The proposed project could substantially degrade groundwater quality by the addition of recharge water.	Implement **Mitigation Measure HAZ-1**	Less than Significant with Mitigation

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
Impact HYDRO-6: The proposed project could place structures within a 100-year flood hazard area.	**Mitigation Measure HYDRO-3:** If the third Stockdale project site includes a flood hazard area, then associated project facilities would be designed either: (1) to avoid development within the flood hazard area, or (2) to ensure that flood hazards or flood elevations on neighboring parcels are not significantly altered.	Less than Significant with Mitigation.
Lane Use and Planning		
Impact LU-1: The proposed project could conflict with any applicable land use plan, policy, or regulation of the jurisdiction over the project.	**Mitigation Measure LU-1:** A General Plan Amendment may be requested from Kern County to eliminate the mid-section line setback requirements from the Stockdale properties.	Less than Significant (LU-1 is not required)
Impact LU-3: The proposed project could conflict with the Metropolitan Bakersfield Habitat Conservation Plan.	None required.	Less than Significant.
Mineral Resources		
Impact MRS-1: The proposed project could block access to oil resources beneath the Stockdale Properties.	None required.	Less than Significant.
Noise		
Impact NOISE-1: The proposed project could generate noise levels that exceed noise standards.	None required.	Less than Significant.
Impact NOISE-2: The proposed project could generate or result in excessive groundborne vibration or groundborne noise levels.	None required.	Less than Significant.
Impact NOISE-3: The proposed project could result in a substantial permanent increase in ambient noise levels in the project vicinity.	None required.	Less than Significant.
Impact NOISE-4: The proposed project could result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity.	**Mitigation Measure NOISE-1:** To reduce temporary construction related noise impacts at the third Stockdale site, the following shall be implemented by the construction contractor: a. Place all stationary construction equipment so that emitted noise is directed away from sensitive receptors nearest the project site. b. Locate equipment staging in areas that will create the greatest possible distance between construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction. c. Ensure proper maintenance and working order of equipment and vehicles, and that all	Less than Significant with Mitigation.

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
	construction equipment is equipped with manufacturers approved mufflers and baffles. d. Install sound-control devices in all construction and impact equipment, no less effective than those provided on the original equipment.	
Transportation and Traffic		
Impact TR-1: The proposed project could conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system.	**Mitigation Measure TR-1:** For project features that require open-trench construction across roadways, the Construction Traffic Control Plan for the proposed project shall include measures that ensure Rosedale provides signage and flagging to alert motorists of pending and actual lane or road closures and detours. Such measures shall conform to the requirements of the Kern County Roads Department and any requirements of related encroachment permits.	Less than Significant with Mitigation.
Impact TR-2: The proposed project could conflict with an applicable congestion management program and reduce the level of service of surrounding roads and highways.	None required.	Less than Significant.
Impact TR-3: The proposed project could result in a substantial increase to hazards due to a design feature or incompatible uses.	**Mitigation Measure TR-2:** IRWD and Rosedale shall require the construction contractor to prepare and implement a Construction Traffic Control Plan that conforms to requirements of the Kern County Roads Department, California Department of Transportation District 6, and the California Department of Transportation Manual on Uniform Traffic Control Devices and Work Area Traffic Control Handbook. The construction contractor shall obtain all necessary permits for the work within the road right-of-way or use of oversized/overweight vehicles that will utilize county maintained roads, which may require California Highway Patrol or a pilot car escort. Implement **Mitigation Measure HAZ-4**	Less than Significant with Mitigation.
Impact TR-4: The proposed project could result in inadequate emergency access.	Implement **Mitigation Measure TR-2.**	Less than Significant with Mitigation.
Utilities and Energy		
Impact UTIL-1: The proposed project could require new or expanded water supply resources or entitlements.	None required.	Less than Significant.
Impact UTIL-2: The proposed project could require additional landfill capacity.	None required.	Less than Significant.
Impact UTIL-3: The proposed project could result in a substantial increase in energy consumption that could affect local and regional energy supplies.	**Mitigation Measure UTIL-1:** IRWD and Rosedale shall install energy efficient equipment, including pumps and motors, for operation of the proposed project.	Less than Significant with Mitigation.

TABLE S-1
SUMMARY OF PROJECT IMPACTS AND MITIGATION MEASURES

Potential Impact	Mitigation Measure	Significance Determination
Cumulative Impacts		
Impact CUM-1: Concurrent construction of several projects in the vicinity of the Stockdale Properties could result in cumulative short-term impacts associated with air quality, biological resources, cultural resources, noise, traffic, and water quality.	**Mitigation Measure CUM-1:** The construction contractor shall consult with appropriate local agencies and jurisdictions prior to initiating ground-disturbing activities, to determine if other construction projects will occur coincidentally at the same time and in the vicinity of the proposed project, depending on project schedule. Coordination of construction activities for coincident projects shall occur to ensure impacts to noise and traffic do not compound to be cumulatively significant and to ensure compatibility of activities within construction zones. Adjustments to construction schedules and plans shall be made accordingly as necessary.	Less than Significant with Mitigation.
Impact CUM-2: The proposed project and related projects could result in cumulative long-term impacts to groundwater resources.	**Mitigation Measure CUM-2**: Operation of the proposed project shall be conducted in accordance with the Long Term Project Recovery Operations Plan Regarding Rosedale-Rio Bravo Water Storage District Projects (Long Term Operations Plan). The Long Term Operations Plan requires monitoring of groundwater conditions; annual predictions of project-related groundwater declines in the area; definition of negative project impact (NPI) to neighboring wells relative to no-project conditions; triggers for implementation of mitigation measures based on NPI that affects neighboring well operation; and mitigation measures to be implemented for different categories of wells. Mitigation measures include, but are not limited to, providing compensation to lower well pumps; reducing or adjusting pumping to prevent, avoid, or eliminate the NPI; or drilling a new well.	Less than Significant with Mitigation.
Impact CUM-3: The proposed project and related projects could result in cumulative long-term impacts to agricultural resources.	None required.	Less than Significant.

Benefit Calculation, Monetization, and Resiliency Tab

Benefit Calculation, Monetization, and Resiliency Tab

A.1 Project Conditions:

Attach description and assumptions of with project conditions for years 2030 and 2070, as defined in section 6004(a)(2) of the regulations, as well as a description of the with- and without-project current conditions. See also regulations section 6003(a)(1)(BB)

File: Tab6-A1_IRWD_With and Without Project Conditions_FINAL.pdf

Tab 6

A.1 Attach description and assumptions of with-project conditions for years 2030 and 2070, as defined in section 6004(a)(2) of the regulations, as well as a description of the with- and without-project current conditions. See also regulations section 6003(a)(1)(BB).

The Kern Fan Groundwater Storage Project's water supply and public benefits used the products developed by the Water Storage Investment Program (WSIP) for years 2030 (WSIP 2030) and 2070 (WSIP 2070) that were published on November 2, 2016. The WSIP 2030 ("near future") reference point captures climate conditions for the 30-year period surrounding 2030 (2016-2045) and the WSIP 2070 ("late future") captures late century climate conditions for the 30-year period surrounding 2070 (2056-2085). For additional information on how the climate projections were derived see the California Water Commission web site https://cwc.ca.gov.

For a description of how the CalSim II model was operated with and without project conditions using the WSIP 2030 and WSIP 2070 estimates see Feasibility and Implementation Risk Tab Attachment 1 (MBK Engineers, August 10, 2017) and the associated excel file model, a separate file located within the same Tab and Attachment 1. For a description of how the fish ecosystem benefits were evaluated using MBK's modeling results see Attachment 1 (Cramer Fish Sciences, August 4, 2017).

Benefit Calculation, Monetization, and Resiliency Tab

A.2 Preliminary Operations Plan

Attach the preliminary operations plan for the proposed project. See regulations section 6003(a)(1)(H) for details. If the preliminary operations plan is located in another attachment, identify the attachment and provide the location.

Files: Tab6-A2_IRWD Preliminary Operations Plan_FINAL.pdf
Tab 6-A2_IRWD_Preliminary Operations Excel_Final.xlsx

Kern Fan Groundwater Storage Project

Preliminary Operations Plan

Benefit Calculation, Monetization and Resiliency Tab
Attachment 2

The Kern Fan Groundwater Storage Project (Kern Fan Project or Project) will be operated to provide both public and non-public benefits by recharging and storing State Water Project (SWP) unallocated Article 21 water in the Kern County Subbasin of the San Joaquin Valley Groundwater Basin in wet years and extracting water when needed in dry years to provide ecosystem, emergency supply, and water supply benefits.

Key features of the Preliminary Operations Plan include:

1. Modeling and Analytical Approach
2. Project Facilities (Phase 1 and Phase 2)
3. Project Water Supply, Storage and Integration with SWP
4. Operations for Public and Non-Public Benefits
5. Uncertainties and Preliminary Adaptive Management Strategies

1. Modeling and Analytical Approach

Water Supply and Operations Modeling

MBK Engineers prepared an analysis based on the computer modeling for the Kern Fan Project. This analysis involved the use of CalSim II model results to depict the without Project (Baseline) scenario. The CalSim II model simulates operations of the Central Valley Project (CVP) and SWP in order to meet existing environmental and regulatory requirements, contract obligations and other system requirements. The model considers the effects of the Project extending to the Delta for source of water for the Project and upstream on the Feather River for ecosystem benefits. Project operations is expected to affect the following locations:

1. Delta outflows
2. SWP Delta exports
3. Flows in Feather and Sacramento Rivers and inflows to Delta
4. Storage in Lake Oroville
5. Storage in San Luis Reservoir
6. Water supplies for non-public benefit

The expected storage capacity associated with the Project that was modeled is 100,000 AF. This storage capacity was allocated into three groups of Project beneficiaries as follows:

- 25,000 AF to Ecosystem Benefits
- 37,500 AF to IRWD and Dudley Ridge Water District (DRWD)
- 37,500 AF to Rosedale and Kern County Water Agency (KCWA)

MBK Engineers estimated the Project yield using the CalSim II model results that depict the without-Project (Baseline) scenario within a spreadsheet model. The operation of Project is then layered onto the baseline operation of the CalSim II results to simulate the with-Project scenario. Project benefits are then determined and quantified by comparison of the with-Project and without-Project scenarios. The Baseline scenario for this analysis is the Water Storage Investment Program (WSIP) 2030 CalSim II model dated November 2, 2016. This model simulation is described as a without-project, 2030 and 2070 future conditions with projected climate and sea-level conditions for a thirty-year period centered at 2030 (WSIP 2030).

In addition to analyzing the project performance with the 2030 and 2070 WISP conditions an uncertainty analyses of potential future climate change and the California WaterFix were analyzed. MBK Engineers Technical Memorandum provides additional detail on the analytical approach and is included in **Feasibility and Implementation Risk Tab, Attachment 1** of the WSIP funding application.

Project Operations for Ecosystem Benefits

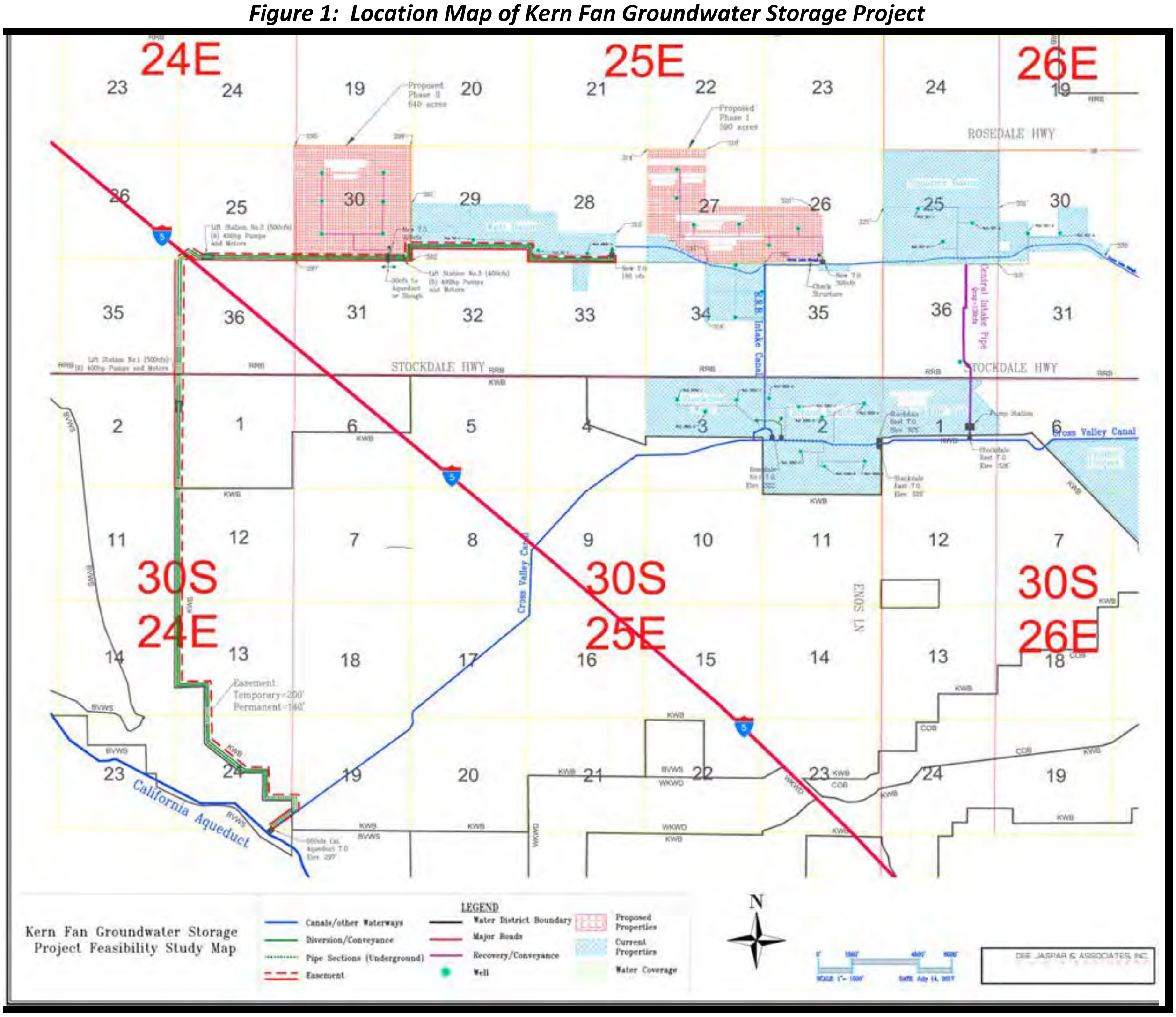
Cramer Fish Sciences (CFS) prepared a quantitative analysis and assessment of the Kern Fan Project's operations for ecosystem benefits. CFS consulted with MBK Engineers to analyze how additional system water from the Project could provide ecosystem benefits in the Delta. CFS found that the Kern Fan Project provides benefits meeting Ecosystem Priority 2 and Priority 12 criterion, specifically for the spring-run and winter-run Chinook salmon. CFS identifies that optimal pulse releases from Lake Oroville in the month of April provide the greatest benefit for the ecosystem priorities. The CFS Technical Memorandum provides additional detail on the project operations for ecosystem benefits and methods for quantifying ecosystem benefits and is included in **Physical Public Benefits Tab, Attachment 2** of the WSIP funding application.

2. Project Facilities

The Project includes the construction of water banking facilities on two project sites, over two phases. The Project sites are ideally located for recharge and recovery water banking activities within the Kern Fan. The Project lands and facility locations described herein may change during the property acquisition phase of the Project but the general location, facility sizes and ownership distribution are expected to remain similar. The Project will be integrated with the SWP by using existing capacity in the California Aqueduct and the Cross Valley Canal, constructing new conveyance, turnout and pumping facilities

As shown in Figure 1, Phase 1 lands could include about 640 acres located within Township 29 South (T-25S), Range 25 East (R-25E), Sections 26 and 27. Phase 2 lands could be comprised of about 640 acres located in T-25S, R-25E, Section 30.

Figure 1: Location Map of Kern Fan Groundwater Storage Project



Recharge, Recovery and Conveyance

A two-phased approach would be taken to the development of the Kern Fan Project. An engineering Concept Study was prepared for the Project which provides more detail of the project facilities and costs which is included under the **Benefit, Calculation, Monetization, Resiliency Tab, Attachment 9** of the WSIP application.

Phase 1

The first phase would be to develop the proposed third project site as contemplated in the Environmental Impact Report for the Stockdale Integrated Water Banking Project which would include the purchase of approximately 640 acres of land within Rosedale's service area in the Kern Fan. The first phase would include constructing conveyance facilities, recharge facilities, and 6 recovery wells and pipelines as necessary to develop a fully functioning water banking project.

The existing conveyance system that will supply recharge water to the Phase 1 lands is via the Goose Lake Slough or from the Cross Valley Canal (CVC) via the Rosedale Intake Canal. A new check structure would be constructed in the Goose Lake Slough with a reinforced concrete turnout structure constructed behind it to convey water from the Goose Lake Slough to the Phase 1 property. The anticipated recharge at the Phase 1 lands would initially be 230 cfs (0.7 ac-ft/d) and then drop to an approximate maintenance rate of 115 cfs (0.35 ac-ft/d).

The Goose Lake Slough currently has capacity to service Rosedale's existing West Basin recharge area. Therefore an alternative conveyance will be needed to convey water to Rosedale's West Basins which will also be used in the Phase 2 of the Kern Fan Project. A new reinforced concrete turnout at the California Aqueduct would be constructed under Phase 1 and canal to convey up to 500 cubic feet per second (cfs) approximately ten miles to the easterly end of the Rosedale's existing West Basins and Phase 2 property. Three lift stations would be needed for conveyance to the Project and the West Basins. Each lift station would also include a gravity bypass line with a slide gate to allow the reverse flow of recovery water back to the California Aqueduct.

Phase 1 would also include construction and equipping of six recovery wells with each well having an approximate capacity of 5 to 6 cfs. The Phase 1 recovery wells would be capable of returning water to the new canal, or the Goose Lake Slough or to the CVC via the Rosedale Intake Canal.

Phase 2

Phase 2 of the Kern Fan project would involve acquiring an additional 640 acres of land within Rosedale's service area for additional water banking facilities to meet the full expected project capacities. Water would be conveyed to this property from the California Aqueduct using the same Project diversion and canal constructed in Phase 1. The proposed Phase 2 property would be developed for the recharge and recovery of ground water. The anticipated recharge at this proposed property would initially be 230 cfs (0.7 ac-ft/d) and then drop to an approximate maintenance rate of 115 cfs (0.35 ac-ft/d). Phase 2 would include the construction and equipping of six recovery wells and associated conveyance pipelines.

Extraction of previously recharged water from both the Phase 1 and Phase 2 lands will occur during times of need when other available supplies are short to maximize the project's public and non-public benefits. A total of twelve new extraction wells will be constructed for the Project with a combined expected recovery capacity of up to 70 cfs. Each well will have a discharge capacity of approximately 5 to 6 cfs, and will be operated to minimize significant impacts to neighboring wells and will meet all Title 16 drinking water quality standards. The Phase 1 recovery wells would be designed to be capable of returning or exchanging water to the California Aqueduct by discharging to the Rosedale Intake Canal that flows to the Cross Valley Canal. The Phase 2 recovery wells will be designed to return water to the California Aqueduct using a gravity bypass line that allows reverse flow of the new proposed Project canal.

3. Project Water Supply, Storage and Integration with SWP

Project Water Supply

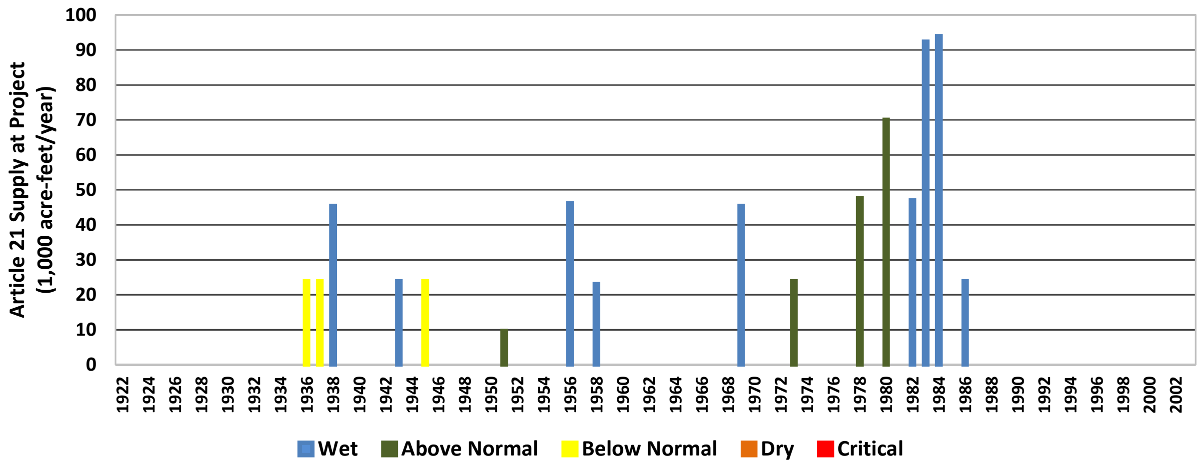
The Project will be located in Kern County and operated to support the SWP. The Project will operate by storing water supplied by the SWP under the Article 21 Program when available. Unallocated Article 21 water is available in accordance with long-term Water Supply Contracts for State Water Contractors who have signed the Monterey Amendment. Unallocated Article 21 water is available when there is water in excess of SWP needs, typically in wet years when precipitation and runoff in the Delta watershed exceed long-term averages. This Article 21 water supply will be delivered to the Project utilizing available capacity in the California Aqueduct to a new Project turnout to be constructed near the CVC.

MBK's spreadsheet model (MBK Engineers, 2017) calculates the water supply available to the Project as additional Article 21 available from the Delta. The CalSim II Baseline simulation includes existing Article 21 demands and deliveries. The spreadsheet model simulates the additional Article 21 demand of the Project and the associated increase in SWP Delta exports. Additional Article 21 deliveries to the Project are simulated when there is:

1. Available surplus in the Delta in excess of existing regulatory requirements and demands
2. Available export capacity and the SWP Banks Pumping Plant
3. The SWP portion of the San Luis Reservoir is full in the Baseline

Figure 2 presents a summary of available Article 21 water supply to the Project diversion from the California Aqueduct by water year type (Sacramento Valley Year Type Index) based on WSIP 2030 CalSim II modeling results. This available supply is calculated by considering constraints on available Banks pumping capacity, conveyance capacities in the California Aqueduct, the capacity to convey water from the California Aqueduct to the Project, and conveyance losses. On an average annual basis, available Article 21 supply at the project diversion from the California Aqueduct is 8 thousand acre feet (TAF) with most of the supply available during Wet years. There is no Article 21 supply during dry and critical years.

Figure 2: Article 21 Supply at Project Diversion



MBK models include delivery of up to 100,000 AF of unallocated SWP Article 21 water into the Kern Fan Project. These deliveries would be made on behalf of IRWD as a landowner in Dudley Ridge Water District (DRWD) and Rosedale as a sub-unit of the Kern County Water Agency (KCWA). During dry years and when needed, IRWD as a land owner in DRWD, DRWD and Rosedale would rely on the stored flows to provide non-public water supply benefits that improve water supply reliability.

Based on historical data, results of water modeling (MBK Engineers) indicate that in 2030 the Project would typically recharge Article 21 water during normal and wet periods, which on average occur in about 24 of 30 years. While Project storage will vary and be dependent upon water supply, demand and operations, the average annual Project storage is estimated at 18,000 AF at the end of October.

Project Storage

The Unallocated Article 21 water supplies recharged and stored in the Kern Fan Project will be allocated to the Project beneficiaries as follows:

25% to the Public or Ecosystem account
37.5% to the IRWD/DRWD account
37.5% to the Rosedale account

MBK's analysis simulated water stored in each of the three accounts. Water stored in each account is subject to a loss percentage of 10% for Rosedale, 12.5% for Ecosystem and 15% for IRWD. Project recharge rates are simulated as a function of recharge in preceding months based on IRWD and Rosedale experience and assumptions made in the Draft Concept Study (Dee Jaspar & Associates, 2017).

Approximately 25 percent of the stored water would be held as <u>SWP system</u> water that would be used for ecosystem benefits purposes. This 25 percent of the water would be made available for ecosystem benefits through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water, that is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet DRWD and Rosedale SWP Table A demands either directly or through operational exchanges. The SWP system water left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta. The 1-for-1 exchanges would result in the water extracted from the ground and used by DRWD and Rosedale being classified as Table A water and the water left in Oroville Reservoir for use in providing ecosystem benefits being classified as SWP system water.

Figure 3 presents an overview of the Kern Fan Project operations coordinated with SWP facilities.

Figure 3

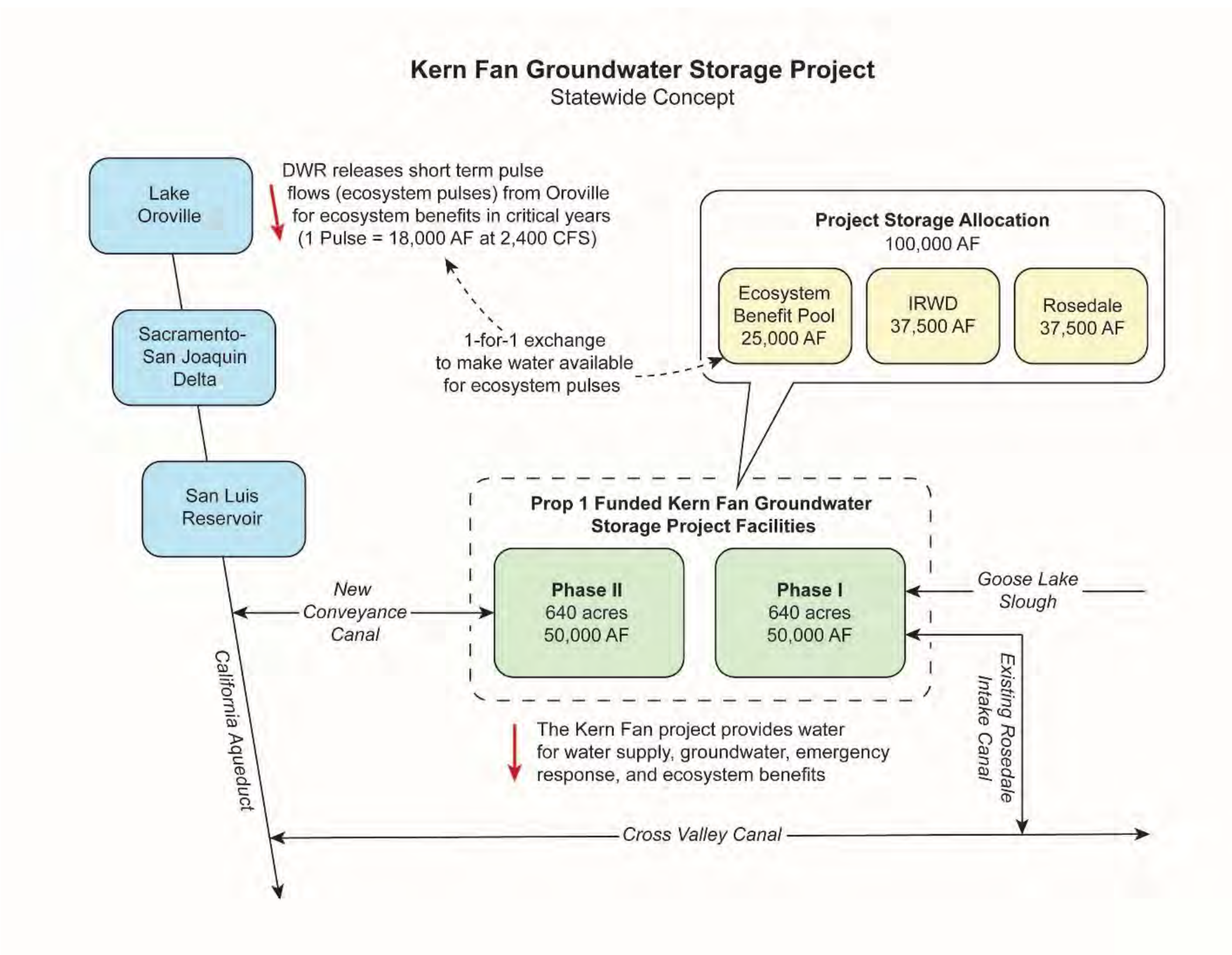
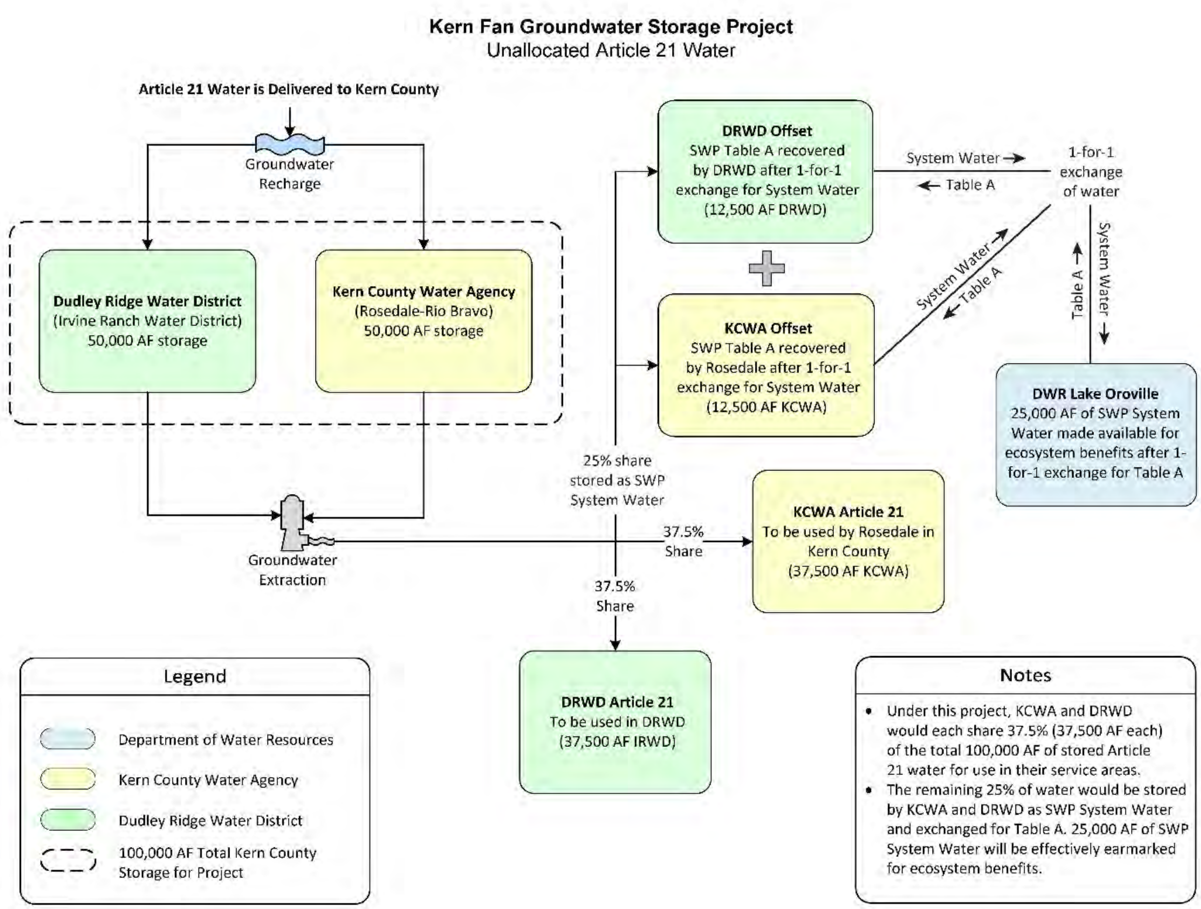


Figure 4 presents a conceptual diagram of how unallocated Article 21 water will be provided to the Project beneficiaries and how the Project yields system water for the Ecosystem account. As shown, up to 100,000 AF unallocated Article 21 water would be requested by participating SWP contractors, DRWD and KCWA, and delivered to the Project for storage. Stored water is distributed to project beneficiaries by percentage and later recovered and/or exchanged for use by the project beneficiary to provide public and non-public benefits.

Figure 4: Conceptual Project Operations



4. Operations for Public and Non-Public Benefits

Project Operations with SWP for Public Benefits

The Project will provide ecosystem and water quality benefits for the Delta and its tributaries by recharging and storing up to 100,000 acre-feet (AF) of unallocated Article 21 water in the Kern County groundwater basin for subsequent extraction for use during periods of need. The Project offers exceptional flexibility to DWR in managing SWP supplies for improved operations of the State water system. Water can be used from the Project's Ecosystem account to provide multiple benefits.

Approximately 25 percent of the water stored in the Project is designated for the Ecosystem account which would be held as SWP system water to be used for ecosystem benefits purposes when needed. Operation of the Project will be coordinated with that of the SWP to enable the DWR to release pulses of water from Oroville Reservoir when water is needed for fish spawning, rearing, and migration. The pulse flows (Ecosystem Pulses) will provide measurable improvements to environmental habitat in the Feather River downstream of Oroville Dam, and in the Sacramento River, from its confluence with the Feather River through the Delta thus meeting the criteria for WSIP Ecosystem Priorities 2 and 12 benefits.

Orville Reservoir Operations:

The MBK analysis documents how the Project will be integrated with Oroville Reservoir operations. Approximately 25 percent of the stored water in the Project would be held as SWP system water that would be used for ecosystem benefits purposes. This 25 percent of the water would be made available for ecosystem benefits through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water, that is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet DRWD and Rosedale SWP Table A demands either directly or through operational exchanges. The SWP system water left in Oroville Reservoir would then be used to provide short-term Ecosystem Pulse to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta. The magnitude and duration of the Ecosystem Pulses will be determined based on the volume of water available in the ecosystem account and the expected fisheries benefit. The Project will target making Ecosystem Pulses in drier years when Oroville Reservoir will not make flood control releases. See MBK's Technical Memorandum for more information on the modeling and impacts of the Project operations with the operations of the Oroville and the San Luis Reservoirs.

Operations for Ecosystem Benefits in Delta (Public Benefit - Ecosystem Priorities 2 & 12)

As described in Section 3 and in **Program Requirements Tab, Attachment 1** of the WSIP funding application, approximately 25 percent of the stored water by the Project would be held as SWP system water that would be used for ecosystem benefits purposes. The system water would be available for use by DWR through 1-for-1 exchanges that would provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the

Feather and Sacramento Rivers and Delta. This provides flexibility to DWR by making water available for instream flows when needed in dry and critical dry years.

MBK Engineers described the water project operations, river flows and water supply results associated with the Project. Cramer Fish Sciences (CFS) working with MBK Engineers utilized these same simulated flows including pulse flows and water project operations and CFS's quantitative analysis shows substantial net benefits to spring-run and winter-run Chinook salmon. Per the CFS analysis, the ecosystem pulses will improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids. CFS identified the month of April as the period that may provide the greatest benefit to ecosystem priorities.

MBK's modeling looked at the ecosystem pulse released from Oroville in April or May to improve habitat conditions for rearing, downstream migration of spring and winter-run Chinook, and benefits to other fish species. During dry and critical periods, which account for the remaining 6 of 30 years on average, ecosystem pulses would be released from Oroville Reservoir to provide net improvements in ecosystem habitat in the Delta. Per MBK's analysis, it is anticipated that the Project would apply six ecosystem pulses of 18,000 AF over 3.75-day periods in April at 2,400 cfs during dry or critical years. April was selected as a period of high relative abundance for downstream migration and rearing of juvenile salmon, however, the Project operation offers flexibility to accommodate DWR's operation of Oroville Reservoir and the SWP.

CFS found that overall for the 2030 condition, it is estimated that the spring-run of Chinook salmon would increase between 107 to 252 due to the ecosystem pulses. Winter-run Chinook salmon would also increase between 20 to 38 with the ecosystem pulses. Though April flow pulses are expected to benefit multiple fish species and life stages, the quantitative analysis focuses on assessing benefits to out-migrating juvenile spring-run and winter-run Chinook salmon. CFS also noted that reductions in estimated annual adult Chinook occur in some years as a result of increased Delta diversions associated with the Project, but these losses are outweighed by much larger benefits which accumulate across all years.

From MBK's report**,** Figure 5 below shows the frequency of the Ecosystem Pulses by water year type. As noted earlier, the pulses are made during Dry and Critical years when Feather River flows are lower and pulses may create a higher potential for benefits to the ecosystem. Figure 6 shows an average pulse flow rate by month. In this analysis, April was selected as the month for Ecosystem Pulses. The operations could be modified to provide Ecosystem Pulses in May, under actual operations.

Figure 5. Frequency of Ecosystem Pulses

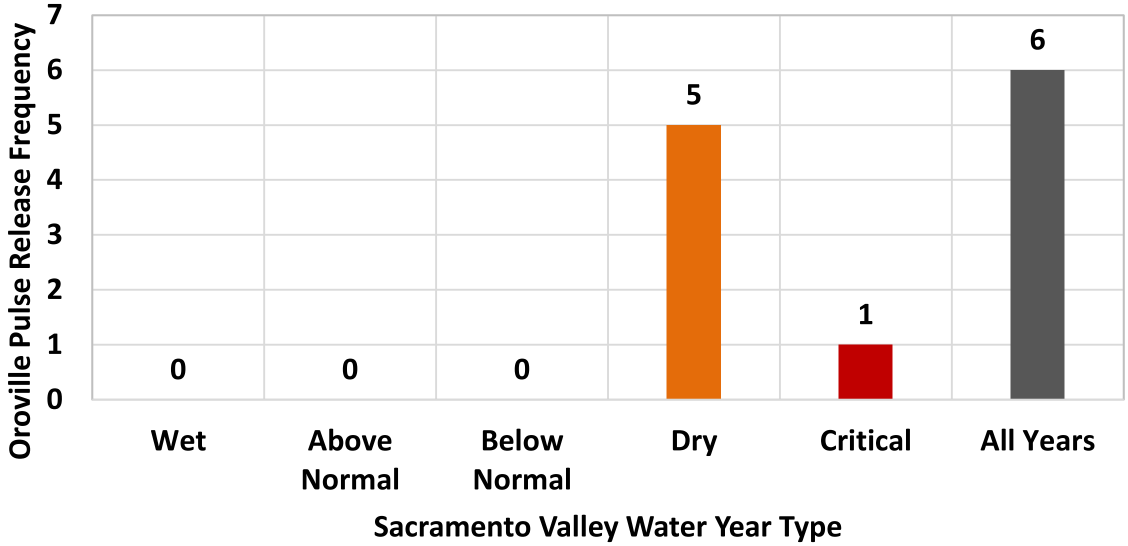
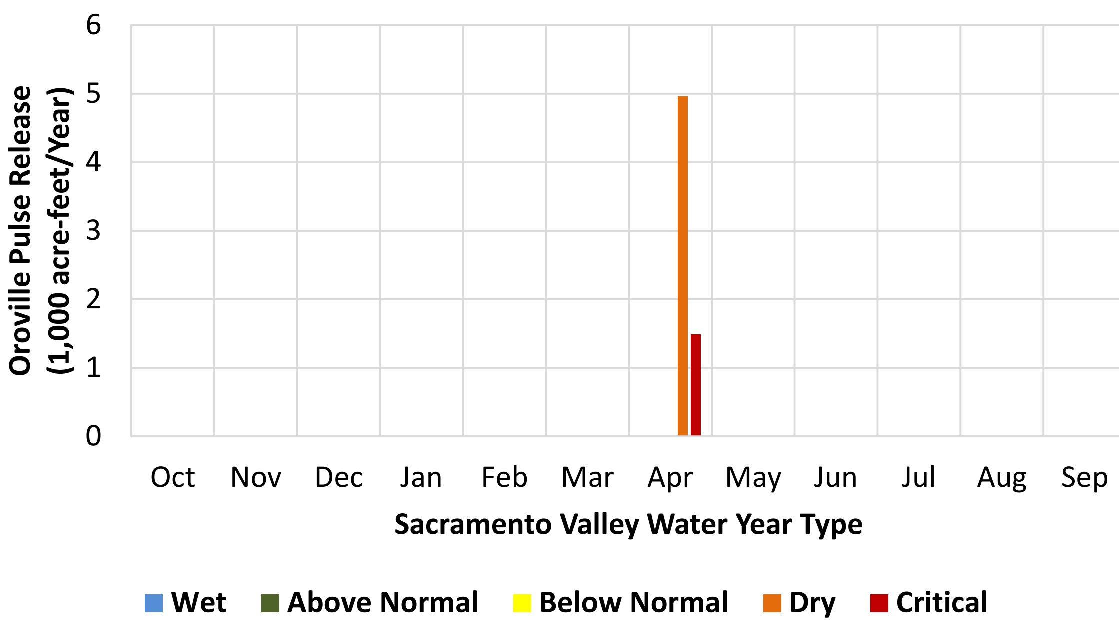


Figure 6. Pulse Release Volume



From MBK's report, Figure 7 also shows a reduction in Oroville Reservoir releases in February. In most years, the reduction of Oroville Reservoir occurs in July following release of Ecosystem Pulse in April, with the exception of in 1977. In 1977, the ecosystem pulses are made in April and Oroville storage remains lower under the Project conditions until the next available opportunity to refill the reservoir, which comes in February of 1978, when the reservoir releases are reduced to compensate for Ecosystem pulses released in April 1977. Thus, Oroville Reservoir releases are lower in February 1978 under the Project conditions, as compared to the

Baseline. Simulated changes in Oroville release are expected to create the same change in Feather River flows below Oroville and Sacramento River flow from the confluence with the Feather into the Delta.

Figure 7. Change in Oroville Releases

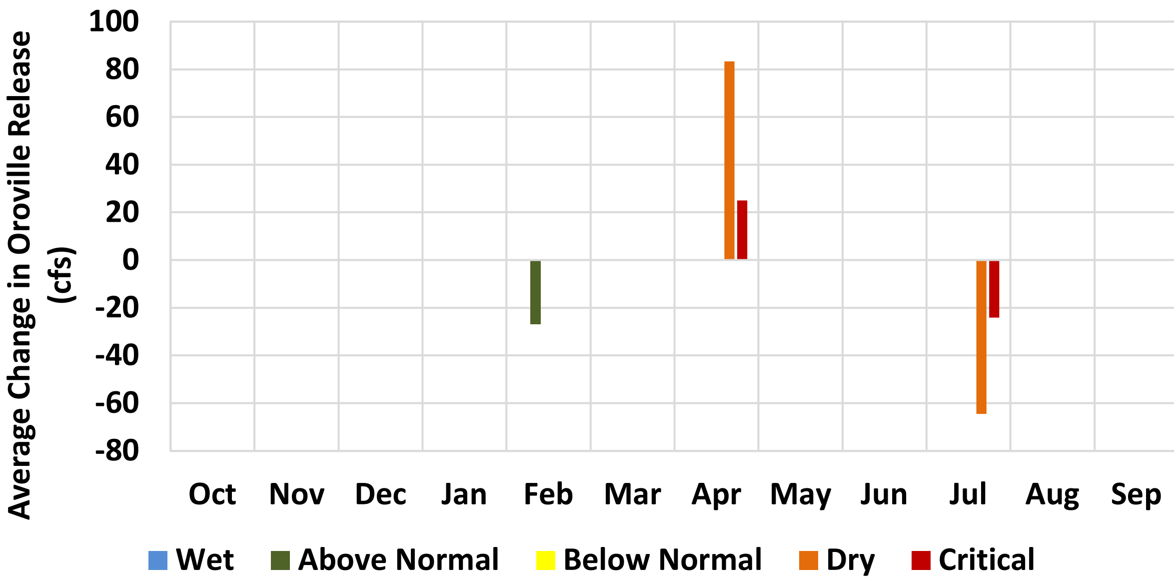


Figure 6 shows changes in Oroville Reservoir releases with the Project. Flows in the Feather River are higher under the Project conditions during April when Ecosystem Pulses are made from Oroville. The release of Ecosystem Pulses results in lower Oroville storage under the Project conditions after making Ecosystem Pulse releases. Storage in Oroville would be recovered in later months by reducing releases from Oroville when Feather River flows are in excess of the minimum instream flow requirements and Oroville is releasing water to support SWP Delta exports. Oroville Reservoir is typically releasing water to support Delta exports in the July through September period. Oroville releases are reduced in this period to compensate for the Ecosystem Pulses resulting in lower Feather River flows under the Project conditions to recover the volume of the Ecosystem Pulse. Analysis in the spreadsheet model attempts to recover the Ecosystem Pulse volume in Oroville in the same year as when the pulse is made, such that Oroville carryover storage is not affected.

Per MBK Engineers, in actual operations, it may be possible to develop an operational plan that would pre-deliver water into Oroville in other years, such that Oroville storage remains is increased, as compared to Baseline, prior to making the Ecosystem Pulse release.

Figure 8 shows changes in Delta outflows under the Project conditions. Delta outflows are greater during April of Dry and Critical years under the Project condition when Oroville is making Ecosystem Pulses. Ecosystem Pulses in April and May of Dry and Critical years are expected to increase Delta outflow because Delta exports are typically constrained in these months by regulatory requirements such as San Joaquin River inflow-to-export ratio or Old and Middle River flow requirements. Delta outflows can be lower in January through May of Below

Normal and wetter years when Delta outflow is diminished either due to capture of unallocated Article 21 surplus water for the Project or due to a reduction in Oroville releases.

Figure 8. Change in Delta Outflow

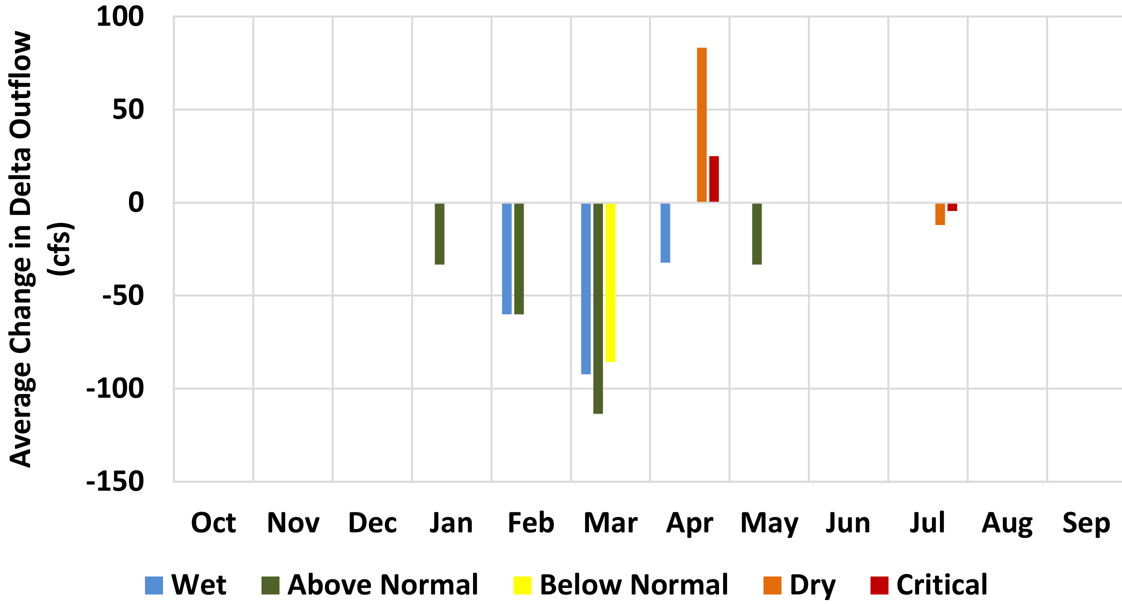


Figure 9 below presents a similar plot, showing change in SWP Delta exports under the Project conditions. SWP Delta exports are typically greater under Project conditions, as surplus flows are captured at the export pumps and delivered to the Project. SWP Delta exports show a reduction in Dry and Critical years as compared to the Baseline due to a reduction in Oroville releases.

Figure 9. Change in SWP Delta Exports

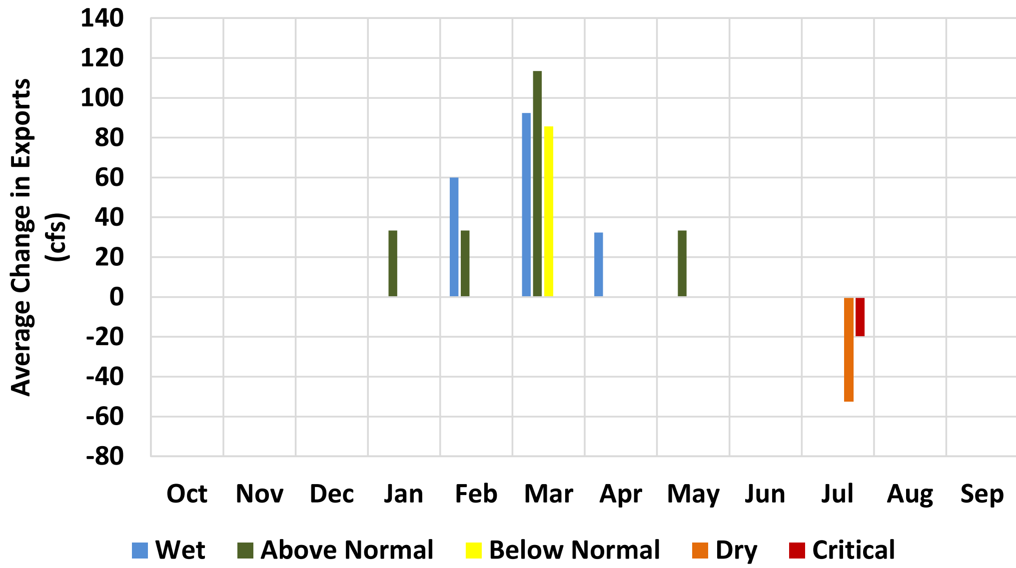


Table 1 presents a summary of the Project performance with the 2030 WISP conditions from MBK Engineers. Of the 8 TAF available to the project diversion approximately 6.1 TAF is able to be conveyed to the Kern Fan Project for recharge. This water is stored and then later extracted to provide public and non-public benefits. Under 2030 conditions, the Project could provide six pulse releases from Oroville Reservoir over the 82-year period analyzed and provide an average annual ecosystem water supply of 1.3 TAF. Non-public water supply benefits are 4.5 TAF annually, with 2.0 TAF for IRWD and DRWD and 2.5 TAF for Rosedale.

Table 1: Summary of Project Performance (WSIP 2030), MBK Engineers

Year Type	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
Wet	11	0	0	0	0
Above Normal	13	0	0	1	0
Below Normal	5	0	0	4	6
Dry	0	5	5	4	6
Critical	0	1	2	2	1
All Years	**6.1**	**6**	**1.3**	**2**	**2.5**

MBK Engineers also simulated the project performance under other projected conditions: (1) 2070 climate change, (2) without the California WaterFix, and (3) with the California Water Fix. While the numbers vary, the conclusions generally remain the same – operation of the Project and coordination with the SWP operation will support ecosystem pulse releases from Oroville Reservoir will yield a net increase in fishery benefits.

Operations for Incidental Wetland Habitat (Public Benefit - Ecosystem Priority 14)

The Kern Fan Project is expected to provide intermittent wetland habitat along the recharge basins-where marsh-like environments are established during recharge periods and create ideal habitat for waterfowl, shorebirds, raptors, and other native and migrating birds. These conditions will exist whenever recharge activity occurs on the Project sites.

The intermittent wetland habitat that will be provided by the Project will be approximately 1,200 acres in size which is the area of the recharge ponds located on both the Phase 1 and Phase 2 project sites. Water will be typically recharged at the Project sites during the winter months and will provide temporary habitat during wet, above normal, and below normal water years when recharge activity occurs. Under 2030 conditions during wet years when recharge activity occurs, the project can be expected to provide approximately 1.44 months of temporary habitat. Under these conditions during above normal years approximately 2 months of temporary habitat can be expected and during below normal years approximately 1 month of temporary habitat can be expected.

Over an 82 year simulation period using historical hydrology, the project is expected to have a total of 23 months of recharge under 2030 conditions. Using historical hydrology, it was determined that the project would have 1 to 3 months of temporary habitat during years in which recharge activity occurs depending on the year type. Duration of recharge was determined using the approximate area of recharge basins (1,200 acres), recharge rate of land (0.7 feet/day), and amount of water recharged per event.

Operations for Emergency Response-Extended Drought (Public Benefit):

A major benefit of the Project is that it will provide supplemental water to IRWD, Rosedale, and DRWD in the event of extreme drought, when other water resources are at their most expensive or may be limited. Groundwater stored as part of the project will be available to call on during a drought emergency or as an alternative supply in the case of a local supply outage. According to the WSIP Technical Guidance an emergency is defined as a critical year that occurs in the 3rd or later year of consecutive drought.

Per MBK's model, IRWD and Rosedale's accounts would receive 4,500 AF per year of water on an average annual basis under 2030 future conditions and 4,100 AF per year would be received on an average annual basis during 2070 future conditions. One-third of the water in the IRWD and Rosedale storage accounts will be dedicated to Emergency Response during extended droughts and two-thirds will be dedicated for water supply during other dry year conditions. The water used for Emergency Response purposes will be physically extracted from the Project utilizing the Phase 1 and Phase 2 recovery wells at the 3rd or later year of a multi-year drought. The Project recovery wells will have sufficient capacity to recover this emergency response drought water.

Operations for Emergency Response-Delta Failure (Public Benefit):

A separate emergency response benefit of the Project is the water supply that the Project could provide in the event of a levee failure in the Delta that curtails water project deliveries. The WSIP Technical Guidance explains that an emergency response to Delta Failure should be assumed to occur once, 30 years into the project operation period—2056 for this project.

According to MBK's analysis, under historical hydrologic conditions, the Project can provide Emergency Response benefits during a Delta levee failure by storing water south of the Delta that can be extracted and made available after a failure event. The probability of water being stored in the Project in any year is one measure of potential Emergency Response benefit. MBK found that the Project is likely to have 20,000 AF of water available for Emergency Response after 30 years of operation. MBK Engineering also explored how using the 20,000 acre-feet of water 30 years into the project life would affect other Project benefits. MBK found that the ecosystem pulse flows north of the Delta could affected. To be conservative in the analysis of these affects, the availability of pulse flows north of the Delta were assumed to be reduced due to the need for water for Emergency Response.

Operations for Water Supply – Non-Public Benefit:

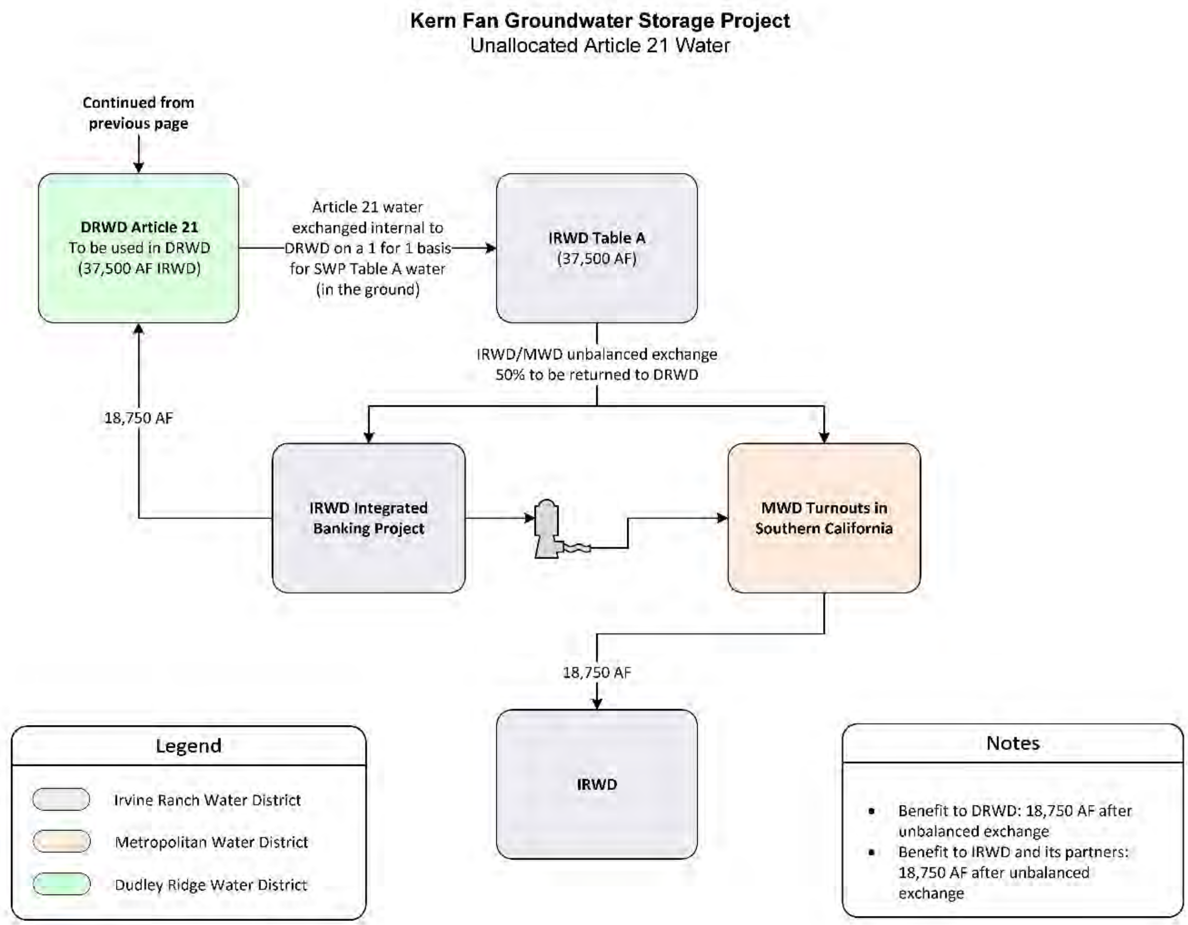
Water Supply benefits are non-public benefits that will accrue to IRWD, Rosedale, and DRWD, and their service area customers. Water stored in the IRWD, DRWD and Rosedale accounts will provide a water supply benefit to these agencies and their program partners during times of reduced water supply. The operations of the Project would be consistent with Rosedale's Conjunctive Use Program and IRWD's and Rosedale's existing water banking projects, including the Strand Ranch Integrated Banking Project and Stockdale Integrated Banking Project,

The Kern Fan Project will provide improved reliability and redundancy in supplies for Rosedale, IRWD and DRWD and their program partners. Recovery scenarios include Rosedale recovering water from the Project as needed to meet existing or future commitments under its Conjunctive Use Program. It is expected that IRWD and DRWD would receive water from the Project potentially during times when surface water and/or local supplies are interrupted or curtailed and likely in a dry or critical year.

According to modeling by MBK Engineers, the project will provide an annual expected additional supply of 4,500 acre-feet per year on an average annual basis under 2030 future conditions, and 4,100 acre-feet per year on an average annual basis under 2070 future conditions. IRWD and Rosedale will designate two-thirds of their water stored in their Project accounts for use as non-emergency water supply during below normal, dry, and critical water years.

As presented in Figure 10, the Article 21 water stored in the Project for IRWD as a land owner in DRWD would be exchanged for SWP Table A water on a 1-for-1 basis to IRWD. Under the terms of an unbalanced exchange, 50% of this water would be returned to DRWD and 50% to be recovered for used in IRWD's service area via existing canals, the California Aqueduct, and Metropolitan Water District of Southern California (MWD) facilities. The implementation of this unbalanced exchange would require extension of existing agreements in accordance with the IRWD's existing Coordinated, Operating, Water Storage, Exchange and Delivery Agreement that IRWD executed with MWD in April 2011.

Figure 10 IRWD and DRWD Water Supply Operations



Operations for Groundwater Benefit – Non-Public Benefit:

The Kern Fan Project would operate within the Rosedale service area overlying the Kern Fan area. Rosedale entered into two Memorandums of Understanding (MOUs) with adjoining entities in the Kern Fan area. The MOUs provide guidelines for operation and monitoring of Rosedale's groundwater banking programs. The Kern Fan Project would be subject to and operated consistent with these MOUs. The MOUs guidelines help to avoid, eliminate or mitigate adverse impacts to the groundwater basin and to the operation of other groundwater banking programs in the Kern Fan area.

Among other things, the MOUs establishes loss factors for water that is recharged in the basin. Surface evaporation losses are assessed at 6%, migration losses are assessed at 4% and water recharged for out-of-County uses is assessed an additional 5%. Water recharged into Rosedale's account incurs a total 10% loss and IRWD water is assessed 15%. The modeling analysis (MBK Engineers, 2017) assumes water is simulated as stored in the Project in each of three “accounts”: public or ecosystem, IRWD, and Rosedale. Water stored in each account is subject to a loss percentage of 10% for Rosedale, 12.5% for Ecosystem, and 15% for IRWD. MBK’s model accounted for these losses, so that the estimated water stored in each “account” is net of these losses. These losses are assessed on all water recharged into the basin and except for the surface water loss which is considered evaporation, all other amounts are considered a benefit to the basin.

Uncertainties and Preliminary Adaptive Management Strategies

Project Uncertainties:

MBK performed uncertainty analyses related to the potential future (WSIP 2070) climate change, including Project performance during critical droughts and the California WaterFix. This uncertainty analysis is included in the MBK Engineers Technical Memorandum, August, 2017.

Climate Change:

MBK Engineers performed the climate change analysis using the WSIP 2070 dataset that reflects future climate and sea level conditions for a 30 year period centered at year 2070. As summarized in Table 2, the Project benefits diminish slightly due to a reduction in available water supply when the 2070 WSIP results are compared to the 2030 WSIP results. Average annual recharge is reduced by 0.4 TAF or approximately 7% as compared to 2030 conditions. The frequency of ecosystem pulses is reduced from six years under 2030 conditions, to five years under 2070 climate conditions. Water supply benefits also diminish slightly by approximately 0.3 TAF (7%) on an average annual basis. Though the Project performance is reduced with WISP 2070 climate conditions, they are similar to the WISP 2030 baseline.

California Water Fix:

MBK Engineers also performed analysis on the California WaterFix using the CalSim II model developed by DWR and Reclamation for the Biological Assessment for California WaterFix. The California WaterFix CalSim II model includes the 2025 Early Long Term climate change assumptions that are different from the WSIP 2030 climate change assumptions. Results, summarized in Table 2 below, indicate a substantial increase in Project yields with the California WaterFix when compared to without the California WaterFix. Average annual Project recharge is approximately 11 TAF with California WaterFix, nearly 6 TAF greater than DWR Early Long Term climate change without California WaterFix. Increases in the ability to recharge water with California WaterFix increase the frequency of ecosystem pulses from four years to seven and Project yields to IRWD and Rosedale are increased by approximately 4 TAF.

Table 2: Summary of Uncertainty Analysis

Model	Alternative	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
CalSim II (1)	WSIP 2030	6.1	6	1.3	2.0	2.5
CalSim II (1)	WSIP 2070	5.7	5	1.1	1.9	2.2
CalSim II (1)	*Change WISP 2070 -WISP 2030*	*0.4*	*1.0*	*0.2*	*0.1*	*0.3*
Calsim II ELT (2)	Without California Fix	5.2	4	0.9	1.8	1.9
Calsim II ELT (2)	With California Fix	10.7	7	1.5	3.9	3.9
Calsim II ELT (2)	*Change (With - Without California Fix)*	*5.5*	*3.0*	*0.6*	*2.1*	*2.0*

(1) Water Storage Investment Program (WSIP) CalSim II model (11/2/16)
(2) Division of Water Resources and Bureau of Reclamation for Biological Assessment with 2025 Early Long Term climate change.

Preliminary Adaptive Management Strategies:

Based on the MBK and CFS work, IRWD and Rosedale have prepared draft preliminary performance objectives for the Kern Fan Project and proposed draft methods for monitoring the operations to ensure public benefits are realized. The followed presents draft strategies for each of the Ecosystem Priorities claimed by the project.

Ecosystem Priority 2:

Pursuant to information from CFS, the natural resource management entities (DWR, National Marine Fisheries Service (NMFS), California Department of Fish and Wildlife (CDFW), U.S. Fish and Wildlife Service (USFWS), U.S. Bureau of Reclamation (USBR)) regularly conduct survival studies on outmigration of juvenile Chinook salmon and steelhead. A relevant performance metric for the proposed Kern Fan Project would be an observed flow-survival relationships consistent with the predicted flow-survival relationships described by NMFS (2017) and were utilized in the Project analysis (CFS 2017). New information on the patterns of flow-survival or emigration timing for spring-run and winter-run Chinook juveniles may suggest changes in the timing or magnitude of flow pulses provided by the Project. CFS states that IRWD and Rosedale may participate in and support flow-survival studies relevant to evaluating performance of the flow pulses in achieving expected ecosystem benefits.

Ecosystem Priority 12:

Pursuant to information provided by CFS, natural resource management entities (DWR, NMFS, CDFW, USFWS, and USBR) conduct regular monitoring and special studies of adult green sturgeon passage and spawning success in the Feather River. As indicated in the CFS report, adult green sturgeon are expected to benefit from the proposed project, but insufficient information is currently available to quantify those expected benefits or to set performance measures associated with the action. Changes in the timing and magnitude of project flow pulses to benefit green sturgeon will be considered as new information becomes available. IRWD and Rosedale may participate in and support monitoring programs which assess flow effects on green sturgeon passage on the Feather River.

Ecosystem Priority 14:

IRWD and Rosedale will work with the CDFW to develop an adaptive management and monitoring program that meets the requirements of the program regulations. In order to measure performance of the public benefit provided by the project, IRWD and Rosedale intend to conduct bird surveys during the years in which recharge activity occurs. In addition, IRWD and Rosedale may coordinate monitoring programs with local agencies near the project that manage wetland habitats

File: Tab 6-A2_IRWD_Preliminary Operations Excel_Final.xlsx

UNCERTAINTY WORKSHEET

Water Supply and Use Sensitivity Analysis (AF/yr)

Model	Alternative	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)	Check: Loss (TAF)	Check: Total (TAF)
CalSim II (1)	WSIP 2030	6.1	6	1.3	2.0	2.5	0.3	6.1
CalSim II (1)	WSIP 2070	5.7	5	1.1	1.9	2.2	0.5	5.7
CalSim II (1)	*Change WISP 2070 -WISP 2030*	*0.4*	*1.0*	*0.2*	*0.1*	*0.3*	*-0.2*	*0.4*
Calsim II ELT (2)	Without California Fix	5.2	4	0.9	1.8	1.9	0.6	5.2
Calsim II ELT (2)	With California Fix	10.7	7	1.5	3.9	3.9	1.4	10.7
Calsim II ELT (2)	*Change (With - Without California Fix)*	*5.5*	*3.0*	*0.6*	*2.1*	*2.0*	*0.8*	*5.5*

(1) Water Storage Investment Program (WSIP) CalSim II model (11/2/16)

(2) Division of Water Resources and Bureau of Reclamation for Biological Assessment with 2025 Early Long Term climate change.

MBK RESULTS WORKSHEET

Year Type	Project Recharge (TAF)	Number of Pulses (Years)	Ecosystem Water Supply (TAF)	IRWD Water Supply (TAF)	Rosedale Water Supply (TAF)
Wet	11	0	0	0	0
Above Normal	13	0	0	1	0
Below Normal	5	0	0	4	6
Dry	0	5	5	4	6
Critical	0	1	2	2	1
All Years	**6.1**	**6**	**1.3**	**2**	**2.5**

WATER ALLOCATION WORKSHEET

Item	Ownership
% to IRWD/DRWD	38%
% to Rosedale/KCWA	38%
% to Environmental	25%
% Total	100%

Benefit Calculation, Monetization, and Resiliency Tab

A.3 Monetized Benefits Analysis

Attach the analysis of all public and non-public monetized benefits. Identify at least one program ecosystem or water quality priority for any ecosystem or water quality benefit public benefit quantified. For each public and non-public benefit, describe the methods used to derive the physical and economic benefits and impacts at a level of detail that allows reviewers to verify your analysis.

Description must include:

The physical changes that are being monetized, consistent with information requested in the Physical Public Benefits Tab, and
describing linkages between physical benefits and monetized benefits. See regulations sections 6004(a)(3) and 6004(a)(4); and
The monetization method and sources for data used. See regulations section 6004(a)(4).

File: Tab6-A3_IRWD_MCubed_WSIP Project Economic Benefits TechMemo_FINAL.pdf

POLICY ANALYSIS FOR THE PUBLIC AND PRIVATE SECTORS

M.CUBED

August 13, 2017

To: **Fiona Sanchez, Irvine Ranch Water District**

From: **Richard McCann, Partner**

RE: **Estimate of Benefits from the Kern Fan Groundwater Storage Project**

Introduction

This technical memo outlines the data and methodological approach for calculating the economic benefits of Irvine Ranch Water District's (IRWD) and Rosedale Rio Bravo Water Storage District's (Rosedale) proposed Kern Fan Groundwater Storage Project in support of a grant application for the Water Storage Investment Program (WSIP).

Overview

The Kern Fan Integrated Groundwater Storage Project (Project) will provide ecosystem and water quality benefits for the Delta and its tributaries by recharging and storing up to 100,000 acre-feet (AF) of unallocated State Water Project (SWP) Article 21 water in the Kern County groundwater basin for subsequent extraction and recovery to offset SWP Table A demands during periods of need. Deliveries of unallocated Article 21 water would be made on behalf of Irvine Ranch Water District (IRWD) as a landowner in Dudley Ridge Water District (DRWD) and Rosedale as a sub-unit of the Kern County Water Agency. During droughts or times of need when available supplies are reduced, stored groundwater will be recovered from the Project via 12 new extraction wells and conveyed to points of use in DRWD, IRWD and Rosedale's service areas. Approximately 25 percent of the stored water would be held as SWP system water that would be used for ecosystem benefit purposes. This 25 percent of the water would be made available for ecosystem benefits through operational exchanges which would be facilitated through a Coordinated Operating Agreement that would executed between the project partners and DWR. The project will provide several public and non-public benefits, including water supply, groundwater improvement, environmental benefits, and emergency response benefits. Based on guidelines provided in the California Water Commission's WSIP Technical Reference and project information provided by IRWD, Cramer Fish Sciences and MBK Engineers, M.Cubed completed estimates of the economic benefits in these four benefit categories. Estimates of the net present value (NPV) of total benefits in 2015 dollars are outlined in Table 1.

Table 1. Summary of Benefit Estimates

Category	Type of Benefit	NPV of Benefits (2015$ millions)
Non-public Benefits	Water Supply Benefits	$47.7
	Groundwater	$4.3
Public Benefits	Environmental Benefits—Salmon recovery	$21.0

	Environmental Benefits—Incidental Wetland Habitat	$39.8
	Emergency Response—Extended drought	$5.1
	Emergency Response—Delta failure	$59.9
Total Benefits		$177.8

Project benefits are expected to begin in 2026, and continue throughout the 50-year life of the project, through 2075. We calculate net present value at the project start in 2026. The net present value calculation uses a discount rate of 3.5%, as directed in the WSIP Technical Reference.

Benefits

Non-Public Benefits--Water Supply

Water Supply benefits are non-public benefits that will accrue to IRWD, Rosedale, and Dudley Ridge, and their service area customers. According to modeling by MBK Engineers, the project will provide an annual expected value of 4,500 acre-feet of additional water supply in the 2030 future condition, and 4,100 acre-feet in the 2070 future condition. IRWD and Rosedale estimate that approximately two-thirds of all storage will be used for non-emergency water supply, and will be called on in below normal, dry, and critical water years. Three-quarters of the total water supply will be available to Rosedale and Dudley Ridge, and the remaining one-quarter will be available to IRWD.

We use the alternative cost approach to estimate the water supply benefits of the project. The water supply benefit is divided between agricultural (75%) and urban users (25%), which face different alternative costs of water. We use the Delta Export unit value provided in the Technical Reference as the value of an alternative water supply for Rosedale and Dudley Ridge. Delta export values are provided for 2030 and 2045, which we re-weight according to the water year types during which IRWD and Rosedale are expected to recover stored groundwater according to MBK Engineers. These weights are available for 2030 and 2070. We therefore use water cost anchor points of 2030, 2045, and 2070—2030 unit values weighted at 2030 recovery levels, 2045 unit values weighted at 2030 recovery levels and 2045 unit values weighted at 2070 recovery levels. We interpolate between these points to find unit values for 2026 to 2075, according to the methodology laid out in the Technical Reference. For IRWD, the alternative supply cost is the Tier 1 untreated rate from Metropolitan Water District, which was $676 per AF in 2015. To be conservative, we use the 2015 rate as the 2030 future condition and inflate the rate according to the escalation of Delta Export values from 2026 to 2070. Applying the 3.5% discount rate to the stream of alternative water supply costs, we arrive at the total net present value of water supply benefits of $47.7 million.

Non-Public Benefits--Groundwater

To evaluate the groundwater benefit, we use the alternative cost approach to estimate how much it would cost to purchase the same volume of water for groundwater recharge in Kern County as that provided by the project.

According to groundwater policy in Kern County, a portion of banked groundwater is not recovered by the banking entity, but remains in the ground and bolsters local groundwater levels. In Kern County, 12.5% of groundwater stored is not recovered, and 60% of that amount is estimated to be recharge, net of evaporative losses. For the purpose of recharging groundwater, we consider the alternative cost to be the Delta Export costs provided in the WSIP Technical Guidance. We weight those costs according to water year type frequency according to the San Joaquin River Water Year Index to arrive at 2030 and 2070 future condition values. Interpolating between these points, we find a net present value of $4.3 million at the project start, in 2015 dollars.

Public Benefits--Environmental—Salmon Recovery

We use the benefit value for two runs of Chinook Salmon provided in the WSIP Technical Guidance to calculate the environmental benefit of salmon recovery based on a willingness-to-pay valuation.

The project will create increased environmental flows in dry and critical years by offsetting State Water Project Table A water demands and making that water available for instream flows from Lake Oroville, along the Feather and Sacramento Rivers, and in the Delta estuary. Based on water modelling carried out by MBK Engineers, Cramer Fish Sciences recommended pulse flows on the Feather River to maximize benefits to Winter and Spring run Chinook Salmon. Cramer Fish Sciences modelled the number of fish that would be restored in the 2030 and 2070 future conditions. To avoid double counting of benefits, we adjusted these number downward by one-sixth to account for MBK Engineer's finding that using 20,000 acre-feet of water in response to a Delta Emergency in year 30 of the project life would reduce water available for environmental flows from 6 pulses to 5 pulses over the life of the project. We calculate the annual expected number of additional Chinook for 2030 and 2070, and interpolate between the two points, and extrapolate backwards to 2026. The WSIP Technical reference recommends a benefit of $100,000 per fish per year for Winter and Spring-run Chinook. We apply this value to the stream of future additional Chinook to calculate a net present value of $23.1 million.

We also used the alternative cost approach to calculate the environmental benefit of Salmon recovery. This approach is based on the cost of procuring a similar volume of water in dry and critical years for environmental flows. In order to provide similar environmental flows in the absence of the project, IRWD and Rosedale would need to purchase replacement water for urban and agricultural use, respectively, to exchange for SWP Table A water that would not be stored and available without the project. For this purpose, Metropolitan's Tier 1 rate is the reasonable alternative cost of urban water. We hold IRWD's current Tier 1 rate of $676 per acre-foot constant through 2030 then inflate the rate using the change in Delta export costs. For agricultural water, the reasonable alternative is Delta deliveries. We use the Delta export unit values from the Technical Reference, weighted for the hydrologic year types (dry and critical) when environmental pulses are expected to take place. Using the alternative cost approach, we find a benefit of $21.0 million.

According to the Technical Guidance, the lesser value from the willingness-to-pay approach and the alternative cost approach should be used as the final benefit calculation. In this case, the two estimates are very close, which lends some confidence to the estimate. We use the lesser benefit estimate of $21.0 million from the alternative cost approach as the final benefit number.

Public Benefits--Environmental—Incidental Wetland Habitat

The water storage project will provide incidental wetland habitat for migratory birds during the years that IRWD takes and stores Article 21 water. During those years, the 1,280 acres that comprise the project will be inundated with water to percolate into the groundwater basin. The ponds will provide temporary habitat to migratory bird species along the Pacific Flyway.

To estimate the benefits associated with this habitat, we used the alternative cost approach. Providing similar habitat in Kern County would require purchasing 1,280 acres of land, building the infrastructure to inundate the property, and providing the same volume of water to flood the fields. To estimate the land value we use the actual price of land that has been provided by assessors to IRWD for the project--$24,000 per acre. This is a current estimate, so we deflate that price to 2015 dollars using a Consumer Price Index for California from the California Department of Finance, to get a land value of $22,771 in 2015 dollars. This is in line with agricultural land values published in the American Society of Farm Managers and Rural Appraisers' *Trends in Agricultural Land and Lease Values*,[1] which vary from $22,000 to $26,000 for

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[1] California AFSMRA, *2016 Trends in Agricultural Land & Lease Value*, http://www.calasfmra.com/db_trends/CaASFMRA-Trends2016-web.pdf, retrieved August 9, 2017.

cropland in northeast and central Kern County in 2016. To be conservative and avoid the risk of double counting benefits, we do not include the cost of the infrastructure to bring water from SWP turnouts to the project site. The alternative source of water for providing temporary wetland habitat in the area is Delta export water. Since the project would only take Article 21 water in wet years, we use the Delta Export unit value for wet years provided in the WSIP Technical Guidance, which ranges from $204 in 2030 to $414 in 2045. We interpolate between these values and leave prices beyond 2045 at $414 to be conservative. Taking the net present value of this stream of benefits results in a total benefit of $39.8 million at the project start.

Public Benefits--Emergency Response—Extended Drought

A major benefit of the project is that it provides water to IRWD, Rosedale, and Dudley Ridge in the event of extreme drought, when other water resources are at their most expensive. Groundwater stored as part of the project will be available to call on during a drought emergency or as an alternative supply in the case of a local supply outage. The WSIP technical Guidance outlines that emergency response benefits should be monetized using avoided costs or alternative costs. Here we use the alternative cost approach. According to the Technical Guidance an emergency is defined as a critical year that occurs in the 3rd or later year of consecutive drought.

One-third of the water supply created by the project will be dedicated to emergency response. Using the 4,500 acre-feet per year of expected water in the 2030 future condition and the 4,100 acre-feet per year of expected water in the 2070 future condition, we calculate the water supply expected to be dedicated to emergency response in 2030 and 2070. Interpolating between these two points and extrapolating to the beginning of the project in 2026, we arrive at the volume of water supply available for emergency response in each year of the project life. Alternative costs are based on the lowest cost alternative agricultural water for Rosedale and Dudley Ridge, and urban water for IRWD. According to Rosedale, $800 was a typical price for an acre-foot of water during the recent multi-year drought. Prices for agricultural water have reached as high as $2,000 in the Central Valley in the recent drought,[2] however, to be conservative, we use the $800 value provided by Rosedale. For the urban supply, the alternative source is imported water from Metropolitan Water District. However, in addition to the normal Tier 1 rate of $676 per acre-foot, IRWD would have to pay a $1,480 per acre-foot penalty for exceeding their allocation in an emergency scenario, bringing the total cost to $2,156 per acre-foot. To be conservative we apply this 2015 rate to emergency water supplies for years from the start of the project through 2030. After 2030, we inflate the water supply according to the Delta Export Unit Values provided in the technical guidance. Applying the agricultural emergency rate to the 75% of the emergency water supply available to Rosedale and Dudley Ridge and the urban emergency rate to the 25% of the emergency water supply available to IRWD, we arrive at annual emergency supply alternative costs. However, according to historical hydrologic year data provided by MBK Engineering, a critical year in the 3rd year or later of a multi-year drought has only occurred in 6 of the 81 years on record-- a 7% probability of occurrence. We apply this probability to the entire stream of alternative costs and take the net present value at the project start to arrive at a benefit of $5.0 million.

Public Benefits--Emergency Response—Delta Failure

A separate emergency response benefit of the project is the water supply it can provide in the event of a levee failure in the Delta that curtails water project deliveries. We analyze this benefit using an alternative cost approach.

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[2] Lisa Kreiger, "California drought: High-bidding farmers battle in water auctions," San Jose Mercury News, http://www.mercurynews.com/2014/07/19/california-drought-high-bidding-farmers-battle-in-water-auctions/, July 19, 2014.

The WSIP Technical Guidance explains that an emergency response to Delta Failure should be assumed to occur once, 30 years into the project operation period—2056 for this project. In the event of interrupted flows through the Delta, IRWD's alternative supply will be water purchases from Metropolitan Water District. We also assume that the alternative cost of water to agricultural users in Rosedale and Dudley Ridge would be the urban rate because agricultural users would need to outbid urban suppliers for available agricultural water. We therefore use Metropolitan's Tier 1 rate of $676 per acre-foot in addition to a $2,960 penalty for water use over 115% of IRWD's allocation. To be conservative, we use current water costs in the year 2030 and inflate those costs in step with the unit values provided in the technical guidance, assuming that costs will increase by a factor of 2.3 on average from 2030 to 2045. Costs are held constant after 2045. According to analysis carried out by MBK Engineers, according to historical hydrology, the project is likely to have 20,000 acre-feet of water available for emergency response after 30 years of operation. Multiplying the 20,000 acre-feet by the urban emergency water rate in 2056, we arrive at a total benefit estimate. The net present value of this benefit in 2026 is $59.9 million.

MBK Engineering also explored how using the 20,000 acre-feet of water 30 years into the project life would affect other project benefits. They found that the only impact is that environmental pulse flows north of the Delta would be reduced from 6 pulses over the life of the project, to 5. To avoid double counting of benefits, we adjusted the environmental benefit to account for this change.

Benefit Calculation, Monetization, and Resiliency Tab

A.4 Mitigation and Compliance Obligation

For each net public benefit claimed, where applicable, identify any existing environmental mitigation or compliance obligations that are accounted for in each net public benefit as of the date of the CalSim-II model product in section 6004(a)(1).

Applicants that use the CalSim-II and DSM2 models to analyze their projects can indicate "within models" for any existing environmental mitigation and compliance obligations contained in those models.

If applicable to their claimed net public benefit such projects shall also list and account for the non-flow related mitigation and compliance obligations of the State Water Project and Central Valley Project.

File: Tab6-A4_IRWD_EnviroMitigation_FINAL.pdf

Tab 6

A.4 For each net public benefit claimed, identify any existing environmental mitigation or compliance obligation that are accounted for in each net public benefit as of November 2016.

MBK's analysis of the availability of water for the ecosystem benefits that will be provided by the Kern Fan Project as well as the water available for emergency water supply benefits during extended droughts and periods of Delta levee failures were modeled using CalSim II. The CalSim II modeling work incorporates existing environmental compliance obligations. For a detailed description of the approach and results of the modeling see **Attachment 1** (MBK Engineers, August 10, 2017).

The frequency and magnitude of Project recharge events that will create incidental wetlands at the Phase 1 and 2 recharge ponds were also identified as a result of MBK's modeling work that was performed using CalSim II which incorporates existing environmental compliance obligations. Future mitigation requirements for the construction and operation of the Phase 1 facilities were identified in the EIR for the Stockdale Integrated Banking Project which contemplated the Project Phase 1 site as what was called the Stockdale third site. This third site was evaluated on a programmatic level. These mitigation measures will be incorporated into a Supplemental EIR that will provide a project specific environmental review of both the construction and operation of the Phase 1 and Phase 2 facilities.

The Kern Fan Project includes the construction and operation of a new conveyance canal. The construction of the canal will require obtaining easements and habitat conservation plan (HCP) mitigation credits for approximately 100 acres within the Kern Water Bank Authority (KWBA) Permit Area. The cost of the mitigation credits needed for the proposed Project canal is included in the cost estimate for the Project that was prepared by Dee Jaspar and Associates, and therefore there is no need to reduce the expected public and non-public benefits associated with the Project.

Benefit Calculation, Monetization, and Resiliency Tab

A.5 Quantification Support

Provide additional information that supports the physical and monetary quantification of the public and non-public benefits and impacts of the project as required by subsection 6004(a)(4) of the regulations. This includes data, assumptions, analytical methods and modeling results, calculations and relevant sources of information. For reference documents or studies relied upon, applicants may provide links to an existing website in lieu of attaching those documents to the application.

File: Tab 6-A5 IRWD_WSIP_Econ Benefits_081117_FINAL.xlsx

<u>Worksheets included in Workbook:</u>
-Summary of Total Benefits
-Annual Benefits
-Physical and Economic Summary
-Input from Technical Reference
-SJR WY Index
-Input from Cramer Fish
-Input from MBK Eng
-CA DOF CPI
-WSIP

Workbook: Economic Benefits.
Worksheet 1: Summary of Total Benefits

Summary of Benefits	NPV in 2026 of benefits @ 3.5% discount	primary approach (2015 $)		secondary approach (2015 $)	
Non-public Benefits	Water Supply Benefits	$ 47,745,447	(alternative cost)		
	Groundwater	$ 4,296,189	(alternative cost)		
Public Benefits	Environmental Benefits--Salmon	$ 20,978,395	(alternative cost)	$ 23,080,736	(willingness to pay)
	Environmental Benefits--Incidental wetland habitat	$ 39,796,319	(alternative cost)		
	Emergency Response--Extended drought	$ 5,062,067	(alternative cost)		
	Emergency Response--Delta failure	$ 59,924,484	(alternative cost)		
	TOTAL Benefits	**$ 177,802,900**			

Workbook: Economic Benefits.
Worksheet 2: Annual Benefits (Page 1 of 2)

Environmental Benefit--Salmon--Willingness to pay approach #1

	Additional Spring-run Chinook over 50-year period	Additional Winter-run Chinook over 50-year period		value of winter-run and spring-run Chinook	NPV Total benefit (2015 $)
2030	586	41		$ 100,000	$23,080,736.34
2070	428	32			$ 45,222,083
	Additional Spring-run Chinook over 50-year	Additional Winter-run Chinook over 50-year			
2030	488	34			
2070	357	27	Total:	452	

Environmental Benefit--Salmon--Alternative cost approach #2

	environmental flows, expected value, all years (AF)		2030--Delta Export	2045--Delta Export	water year weights--SJ WY	adjusted weights based on	adjusted weights based on		Metropolitan Water District water rates	-2040	NPV Total benefit (2015 $)
2030	1,322	wet	$ 204	$ 414	29%	0%	0%	full service Tie	$ 582.00		$20,978,395.07
2070	1,102	above norr	$ 256	$ 519	20%	0%	0%	DWR variable	$ 23.30		$ 47,646,123
		below norr	$ 267	$ 633	16%	0%	0%	Actual PG&E p	$ 71.06		
		dry	$ 285	$ 674	16%	93%	100%	Total	$ 676.36	$ 1,372.61	
		critical	$ 360	$ 1,056	20%	7%	0%				

Water Supply Benefit (non-public)--alternative cost approach

	Annual Expected Water Supply, to	rate of change between 2030 and 2045 (ratio)		2030--Delta Export cost of water ($/AF)	2045--Delta Export cost of water ($/AF)	water year weights--	adjusted weights based on	adjusted weights based on	NPV Total benefit (2015 $)
2030	4,500	2.03	wet	$ 204	$ 414	29%	0%	8%	$47,745,446.54
2070	4,100	2.03	above normal	$ 256	$ 519	20%	0%	5%	$ 107,972,007
		2.37	below normal	$ 267	$ 633	16%	42%	38%	
portion of water on non-	67%	2.36	dry	$ 285	$ 674	16%	42%	42%	
		2.93	critical	$ 360	$ 1,056	20%	16%	0%	
	weighted	2.31							

project life year	year		EV [Additional Spring-run Chinook]	EV [Additional Winter-run Chinook]	expected additional spring and	Total environmental benefit ($)	EV [Environmental flows due to project) (AF)	water unit cost based on Delta	unit values based on Met tier 1 rates,	Total supply benefit--avoided cost	Annual expected water supply (AF)	annual cost of water (2015 $) (applied to 75%	annual cost of water (2015 $) (applied to 25% of	Total supply benefit--avoided cost
	2017								$ 676					
	2018								$ 676					
	2019	Phase I starts							$ 676					
	2020								$ 676					
	2021				0	$ -			$ 676					
	2022				0	$ -			$ 676					
	2023				0	$ -			$ 676					
	2024	Ph I ends, Ph II starts			0	$ -			$ 676					
	2025	Ph II ends			0	$ -			$ 676					
1	2026	project life begins Jan 1	10	1	11	$ 1,072,833	1,344	$ 181	$ 676	$ 409,604	3,027	$ 175	$ 676	$ 909,456
2	2027		10	1	11	$ 1,065,875	1,339	$ 208	$ 676	$ 435,379	3,020	$ 204	$ 676	$ 971,950
3	2028		10	1	11	$ 1,058,917	1,333	$ 235	$ 676	$ 460,928	3,013	$ 232	$ 676	$ 1,034,160
4	2029		10	1	11	$ 1,051,958	1,328	$ 263	$ 676	$ 486,251	3,007	$ 261	$ 676	$ 1,096,084
5	2030		10	1	10.5	$ 1,045,000	1,322	$ 290	$ 676	$ 511,348	3,000	$ 289	$ 676	$ 1,157,725
6	2031		10	1	10	$ 1,038,042	1,317	$ 317	$ 740	$ 557,200	2,993	$ 318	$ 736	$ 1,263,374
7	2032		10	1	10	$ 1,031,083	1,311	$ 345	$ 804	$ 602,650	2,987	$ 346	$ 795	$ 1,368,541
8	2033		10	1	10	$ 1,024,125	1,306	$ 372	$ 868	$ 647,699	2,980	$ 375	$ 854	$ 1,473,226
9	2034		10	1	10	$ 1,017,167	1,300	$ 400	$ 931	$ 692,346	2,973	$ 403	$ 913	$ 1,577,430
10	2035		9	1	10	$ 1,010,208	1,295	$ 427	$ 995	$ 736,591	2,967	$ 431	$ 972	$ 1,681,151
11	2036		9	1	10	$ 1,003,250	1,289	$ 454	$ 1,059	$ 780,435	2,960	$ 460	$ 1,032	$ 1,784,390
12	2037		9	1	10	$ 996,292	1,284	$ 482	$ 1,122	$ 823,878	2,953	$ 488	$ 1,091	$ 1,887,147
13	2038		9	1	10	$ 989,333	1,278	$ 509	$ 1,186	$ 866,919	2,947	$ 517	$ 1,150	$ 1,989,422
14	2039		9	1	10	$ 982,375	1,273	$ 536	$ 1,250	$ 909,558	2,940	$ 545	$ 1,209	$ 2,091,215
15	2040		9	1	10	$ 975,417	1,267	$ 564	$ 1,314	$ 951,796	2,933	$ 574	$ 1,268	$ 2,192,525
16	2041		9	1	10	$ 968,458	1,262	$ 591	$ 1,377	$ 993,633	2,927	$ 602	$ 1,327	$ 2,293,354
17	2042		9	1	10	$ 961,500	1,256	$ 618	$ 1,441	$ 1,035,068	2,920	$ 631	$ 1,387	$ 2,393,701
18	2043		9	1	10	$ 954,542	1,251	$ 646	$ 1,504.87	$ 1,076,101	2,913	$ 659	$ 1,446	$ 2,493,565
19	2044		9	1	9	$ 947,583	1,245	$ 673	$ 1,569	$ 1,116,733	2,907	$ 688	$ 1,505	$ 2,592,948
20	2045		9	1	9	$ 940,625	1,240	$ 700	$ 1,632.33	$ 1,156,964	2,900	$ 716	$ 1,564	$ 2,691,849
21	2046		9	1	9	$ 933,667	1,234	$ 700	$ 1,632	$ 1,151,822	2,893	$ 711	$ 1,564	$ 2,674,197
22	2047		9	1	9	$ 926,708	1,229	$ 700	$ 1,632.33	$ 1,146,680	2,887	$ 706	$ 1,564	$ 2,656,598
23	2048		9	1	9	$ 919,750	1,223	$ 700	$ 1,632	$ 1,141,538	2,880	$ 700	$ 1,564	$ 2,639,052
24	2049		9	1	9	$ 912,792	1,218	$ 700	$ 1,632	$ 1,136,396	2,873	$ 695	$ 1,564	$ 2,621,559
25	2050		8	1	9	$ 905,833	1,212	$ 700	$ 1,632	$ 1,131,254	2,867	$ 690	$ 1,564	$ 2,604,119
26	2051		8	1	9	$ 898,875	1,207	$ 700	$ 1,632	$ 1,126,112	2,860	$ 685	$ 1,564	$ 2,586,731
27	2052		8	1	9	$ 891,917	1,201	$ 700	$ 1,632	$ 1,120,970	2,853	$ 679	$ 1,564	$ 2,569,396
28	2053		8	1	9	$ 884,958	1,196	$ 700	$ 1,632	$ 1,115,828	2,847	$ 674	$ 1,564	$ 2,552,114
29	2054		8	1	9	$ 878,000	1,190	$ 700	$ 1,632	$ 1,110,686	2,840	$ 669	$ 1,564	$ 2,534,885
30	2055		8	1	9	$ 871,042	1,185	$ 700	$ 1,632	$ 1,105,544	2,833	$ 663	$ 1,564	$ 2,517,709
31	2056		8	1	9	$ 864,083	1,179	$ 700	$ 1,632	$ 1,100,402	2,827	$ 658	$ 1,564	$ 2,500,586
32	2057		8	1	9	$ 857,125	1,174	$ 700	$ 1,632	$ 1,095,261	2,820	$ 653	$ 1,564	$ 2,483,515
33	2058		8	1	9	$ 850,167	1,168	$ 700	$ 1,632	$ 1,090,119	2,813	$ 648	$ 1,564	$ 2,466,497
34	2059		8	1	8	$ 843,208	1,163	$ 700	$ 1,632	$ 1,084,977	2,807	$ 642	$ 1,564	$ 2,449,532
35	2060		8	1	8	$ 836,250	1,157	$ 700	$ 1,632	$ 1,079,835	2,800	$ 637	$ 1,564	$ 2,432,620
36	2061		8	1	8	$ 829,292	1,152	$ 700	$ 1,632	$ 1,074,693	2,793	$ 632	$ 1,564	$ 2,415,761
37	2062		8	1	8	$ 822,333	1,146	$ 700	$ 1,632	$ 1,069,551	2,787	$ 626	$ 1,564	$ 2,398,955
38	2063		8	1	8	$ 815,375	1,140	$ 700	$ 1,632	$ 1,064,409	2,780	$ 621	$ 1,564	$ 2,382,201
39	2064		8	1	8	$ 808,417	1,135	$ 700	$ 1,632	$ 1,059,267	2,773	$ 616	$ 1,564	$ 2,365,500
40	2065		7	1	8	$ 801,458	1,129	$ 700	$ 1,632	$ 1,054,125	2,767	$ 611	$ 1,564	$ 2,348,852
41	2066		7	1	8	$ 794,500	1,124	$ 700	$ 1,632	$ 1,048,983	2,760	$ 605	$ 1,564	$ 2,332,257
42	2067		7	1	8	$ 787,542	1,118	$ 700	$ 1,632	$ 1,043,841	2,753	$ 600	$ 1,564	$ 2,315,715
43	2068		7	1	8	$ 780,583.33	1,113	$ 700	$ 1,632	$ 1,038,699	2,747	$ 595	$ 1,564	$ 2,299,225
44	2069		7	1	8	$ 773,625	1,107	$ 700	$ 1,632	$ 1,033,557	2,740	$ 589	$ 1,564	$ 2,282,789
45	2070		7	1	8	$ 766,667	1102	$ 700	$ 1,632	$ 1,028,415	2,733	$ 584	$ 1,564	$ 2,266,405
46	2071		7	1	8	$ 766,667	1102	$ 700	$ 1,632	$ 1,028,415	2,733	$ 584	$ 1,564	$ 2,266,405
47	2072		7	1	8	$ 766,667	1102	$ 700	$ 1,632	$ 1,028,415	2,733	$ 584	$ 1,564	$ 2,266,405
48	2073		7	1	8	$ 766,667	1102	$ 700	$ 1,632	$ 1,028,415	2,733	$ 584	$ 1,564	$ 2,266,405
49	2074		7	1	8	$ 766,667	1102	$ 700	$ 1,632	$ 1,028,415	2,733	$ 584	$ 1,564	$ 2,266,405
50	2075		7	1	8	$ 766,667	1102	$ 700	$ 1,632	$ 1,028,415	2,733	$ 584	$ 1,564	$ 2,266,405

	2030			2070		
	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]						
4. Annual Economic Be	$ 1,045,000	0	$ 1,045,000	$ 766,667	0	$ 766,667

2030			2070		
With Project	Without Project	Difference	With Project	Without Project	Difference
$ 511,348	0	$ 511,348	$ 1,028,415	0	$ 1,028,415

2030			2070		
With Project	Without Project	Difference	With Project	Without Project	Difference
$ 1,157,725	0	######	#####	0	$ 2,266,405

Workbook: Economic Benefits.
Worksheet 2: Annual Benefits (Page 2 of 2)

Groundwater Recharge Benefits (non-public)--alternative cost approach

	Annual Expected Groundwater Supply (AF)	NPV Total benefit (2015 $)
2030	385.7	$4,296,188.77
2070	351.4	$ 9,918,188

% of GW storage not recovered	12.50%
share of unrecovered water going to GW recharge	60%

Emergency Response (Public Benefit)--Extended drought--alternative cost approach

	Annual Expected Water Supply, to IRWD, DRWD		Met Water Shortage Allocation	NPV Total benefit (2015 $)
2030	4,500	water use 100-1	$ 1,480	$5,062,066.79
2070	4,100	water use over 1	$ 2,960	$ 11,470,022

portion of water on non-emergency supply	67%
portion of water on non-emergency supply	33%
probability of a 3rd or	7%

Dudley Ridge		2045
2015 cost of	$ 800	$ 2,346.67

Emergency Response (Public Benefit)--Delta Failure--alternative cost approach

Water supplies available at 30 years into	NPV Total benefit (2015 $)	
20,000	$59,924,484	$59,924,484

Environmental Benefit--Wetland Habitat--alternative cost approach

Acres of land inundated as seasonal	Value of land (2017 $)	Value of land (2015 $)	probability of inundation	NPV Total benefit (2015 $)
1,280	$ 24,000	$ 22,770.91	20%	$39,796,319

Groundwater Recharge

Annual expected groundwater recharge (AF)	annual cost of water (2015 $)	Total GW benefit--avoided cost (2015 $)
389.1	$ 169	$ 65,846
388.3	$ 194	$ 75,234
387.4	$ 218	$ 84,580
386.6	$ 243	$ 93,884
385.7	$ 267	$ 103,146
384.9	$ 292	$ 112,365
384.0	$ 317	$ 121,543
383.1	$ 341	$ 130,679
382.3	$ 366	$ 139,772
381.4	$ 390	$ 148,824
380.6	$ 415	$ 157,833
379.7	$ 439	$ 166,800
378.9	$ 464	$ 175,726
378.0	$ 488	$ 184,609
377.1	$ 513	$ 193,450
376.3	$ 537	$ 202,249
375.4	$ 562	$ 211,006
374.6	$ 587	$ 219,720
373.7	$ 611	$ 228,393
372.9	$ 636	$ 237,023
372.0	$ 636	$ 236,479
371.1	$ 636	$ 235,934
370.3	$ 636	$ 235,389
369.4	$ 636	$ 234,844
368.6	$ 636	$ 234,299
367.7	$ 636	$ 233,754
366.9	$ 636	$ 233,209
366.0	$ 636	$ 232,664
365.1	$ 636	$ 232,120
364.3	$ 636	$ 231,575
363.4	$ 636	$ 231,030
362.6	$ 636	$ 230,485
361.7	$ 636	$ 229,940
360.9	$ 636	$ 229,395
360.0	$ 636	$ 228,850
359.1	$ 636	$ 228,305
358.3	$ 636	$ 227,760
357.4	$ 636	$ 227,216
356.6	$ 636	$ 226,671
355.7	$ 636	$ 226,126
354.9	$ 636	$ 225,581
354.0	$ 636	$ 225,036
353.1	$ 636	$ 224,491
352.3	$ 636	$ 223,946
351.4	$ 636	$ 223,401
351.4	$ 636	$ 223,401
351.4	$ 636	$ 223,401
351.4	$ 636	$ 223,401
351.4	$ 636	$ 223,401
351.4	$ 636	$ 223,401

Extended drought

Annual expected emergency GW supply (AF)	annual cost of water (2015 $) (applied to 75%	annual cost of water (2015 $) (applied to 25%	Total GW benefit--avoided cost (2015 $)
1,513	$ 800	$ 2,156.36	$ 126,133
1,510	$ 800	$ 2,156.36	$ 125,856
1,507	$ 800	$ 2,156.36	$ 125,578
1,503	$ 800	$ 2,156.36	$ 125,300
1,500	$ 800	$ 2,156.36	$ 125,022
1,497	$ 903	$ 2,220.09	$ 134,958
1,493	$ 1,006	$ 2,283.82	$ 144,849
1,490	$ 1,109	$ 2,347.55	$ 154,693
1,487	$ 1,212	$ 2,411.29	$ 164,493
1,483	$ 1,316	$ 2,475.02	$ 174,247
1,480	$ 1,419	$ 2,538.75	$ 183,955
1,477	$ 1,522	$ 2,602.48	$ 193,618
1,473	$ 1,625	$ 2,666.21	$ 203,236
1,470	$ 1,728	$ 2,729.94	$ 212,808
1,467	$ 1,831	$ 2,793.68	$ 222,334
1,463	$ 1,934	$ 2,857.41	$ 231,815
1,460	$ 2,037	$ 2,921.14	$ 241,251
1,457	$ 2,140	$ 2,984.87	$ 250,641
1,453	$ 2,244	$ 3,048.60	$ 259,985
1,450	$ 2,347	$ 3,112.33	$ 269,284
1,447	$ 2,347	$ 3,112.33	$ 268,665
1,443	$ 2,347	$ 3,112.33	$ 268,046
1,440	$ 2,347	$ 3,112.33	$ 267,427
1,437	$ 2,347	$ 3,112.33	$ 266,808
1,433	$ 2,347	$ 3,112.33	$ 266,189
1,430	$ 2,347	$ 3,112.33	$ 265,570
1,427	$ 2,347	$ 3,112.33	$ 264,951
1,423	$ 2,347	$ 3,112.33	$ 264,332
1,420	$ 2,347	$ 3,112.33	$ 263,713
1,417	$ 2,347	$ 3,112.33	$ 263,094
1,413	$ 2,347	$ 3,112.33	$ 262,475
1,410	$ 2,347	$ 3,112.33	$ 261,856
1,407	$ 2,347	$ 3,112.33	$ 261,237
1,403	$ 2,347	$ 3,112.33	$ 260,618
1,400	$ 2,347	$ 3,112.33	$ 259,999
1,397	$ 2,347	$ 3,112.33	$ 259,380
1,393	$ 2,347	$ 3,112.33	$ 258,761
1,390	$ 2,347	$ 3,112.33	$ 258,142
1,387	$ 2,347	$ 3,112.33	$ 257,523
1,383	$ 2,347	$ 3,112.33	$ 256,904
1,380	$ 2,347	$ 3,112.33	$ 256,285
1,377	$ 2,347	$ 3,112.33	$ 255,665
1,373	$ 2,347	$ 3,112.33	$ 255,046
1,370	$ 2,347	$ 3,112.33	$ 254,427
1,367	$ 2,347	$ 3,112.33	$ 253,808
1,367	$ 2,347	$ 3,112.33	$ 253,808
1,367	$ 2,347	$ 3,112.33	$ 253,808
1,367	$ 2,347	$ 3,112.33	$ 253,808
1,367	$ 2,347	$ 3,112.33	$ 253,808
1,367	$ 2,347	$ 3,112.33	$ 253,808

Delta Failure

Water supplies available at assumed Delta	Cost of alternative water supply to		
		0	0
		0	0
		0	0
		0	0
	$ 3,636	0	0
	$ 3,955	0	0
	$ 4,273	0	0
	$ 4,591	0	0
	$ 4,909	0	0
	$ 5,228	0	0
	$ 5,546	0	0
	$ 5,864	0	0
	$ 6,182	0	0
	$ 6,500	0	0
	$ 6,819	0	0
	$ 7,137	0	0
	$ 7,455	0	0
	$ 7,773	0	0
	$ 8,092	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
20,000	$ 8,410	$ 168,195,663	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	$ 272,257,400
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0
	$ 8,410	0	0

Wetland Habitat

Acres of land inundated as seasonal	value of land	probability of inundation in any year	volume of water created by project, used	Cost of delta export water in wet years (2015	Value of seasonal wetland in
1,280	$ 22,771	20%	4,540	148	$ 6,429,305
			4,530	162	$ 733,860
			4,520	176	$ 795,520
			4,510	190	$ 856,900
			4,500	$ 204	$ 918,000
			4,490	218	$ 978,820
			4,480	232	$ 1,039,360
			4,470	246	$ 1,099,620
			4,460	260	$ 1,159,600
			4,450	274	$ 1,219,300
			4,440	288	$ 1,278,720
			4,430	302	$ 1,337,860
			4,420	316	$ 1,396,720
			4,410	330	$ 1,455,300
			4,400	344	$ 1,513,600
			4,390	358	$ 1,571,620
			4,380	372	$ 1,629,360
			4,370	386	$ 1,686,820
			4,360	400	$ 1,744,000
			4,350	$ 414	$ 1,800,900
			4,340	$ 414	$ 1,796,760
			4,330	$ 414	$ 1,792,620
			4,320	$ 414	$ 1,788,480
			4,310	$ 414	$ 1,784,340
			4,300	$ 414	$ 1,780,200
			4,290	$ 414	$ 1,776,060
			4,280	$ 414	$ 1,771,920
			4,270	$ 414	$ 1,767,780
			4,260	$ 414	$ 1,763,640
			4,250	$ 414	$ 1,759,500
			4,240	$ 414	$ 1,755,360
			4,230	$ 414	$ 1,751,220
			4,220	$ 414	$ 1,747,080
			4,210	$ 414	$ 1,742,940
			4,200	$ 414	$ 1,738,800
			4,190	$ 414	$ 1,734,660
			4,180	$ 414	$ 1,730,520
			4,170	$ 414	$ 1,726,380
			4,160	$ 414	$ 1,722,240
			4,150	$ 414	$ 1,718,100
			4,140	$ 414	$ 1,713,960
			4,130	$ 414	$ 1,709,820
			4,120	$ 414	$ 1,705,680
			4,110	$ 414	$ 1,701,540
			4,100	$ 414	$ 1,697,400
			4,100	$ 414	$ 1,697,400
			4,100	$ 414	$ 1,697,400
			4,100	$ 414	$ 1,697,400
			4,100	$ 414	$ 1,697,400
			4,100	$ 414	$ 1,697,400

Summary

	2030			2070		
	With Project	Without Project	Difference	With Project	Without Project	Difference
Groundwater Recharge	######	0	$ 103,146	$ 223,401	0	$ 223,401
Extended drought	######	0	$ 125,022	$ 253,808	0	$ 253,808
Delta Failure	$ -	0	$ -	$ -	0	$ -
Wetland Habitat	$ 918,000	0	$ 918,000	$ 1,697,400	0	$ 1,697,400

Workbook: Economic Benefits.
Worksheet 3 Physical & Economic Summary

Physical and Economic Benefits Summary

November 2016

Part 1. Physical and Economic Benefits. Repeat this block for each category of public or non-public benefit quantified

Enter Benefit Category here [1]	Non-Public Benefit						
Repeat Rows 1 through 4 for every quantified physical benefit in this benefit category							
1. Physical Benefit Name: Water Supply Benefits				Notes: 2/3 of non-ecosystem water allocated to water supply. Weighted by hydrology and costs of water for ag and urban. See Benefit Calculation Tab Attachment 3 and Attachment 5 for detail.			
2. Physical Benefit Measurement Units: Acre-Feet				Notes:			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		3015	0	3015	2747	0	2747
4. Annual Economic Benefit, 2015 $ Million/Yr		$ 1,157,725	$ -	$ 1,157,725	$ 2,266,405	$ -	$ 2,266,405
1. Physical Benefit Name: Groundwater Level Improvement				Notes:			
2. Physical Benefit Measurement Units: Acre-Feet				Notes:			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		385.7	0	385.7	351.4	0	351.4
4. Annual Economic Benefit, 2015 $ Million/Yr		$ 103,146	$ -	$ 103,146	$ 223,401	$ -	$ 223,401
5. Total Annual Monetized Benefit for the Category (sum of all row 4s.)		$ 1,260,870	$ -	$ 1,260,870	$ 2,489,806	$ -	$ 2,489,806

Enter Benefit Category here [1]	Ecosystem Benefit						
Repeat Rows 1 through 4 for every quantified physical benefit in this benefit category							
1. Physical Benefit Name:Ecosystem				Notes:			
2. Physical Benefit Measurement Units: Number of Salmon Surviving to Adulthood				Notes: Spring Run Chinook and Winter Run Chinook over 50 year period. See Physical Public Benefit Tab Attachment 2 and Benefit Calculation Tab Attachment 3 and Attachment 5 for details.			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		545	0	545	460	0	460
4. Annual Economic Benefit, 2015 $ Million/Yr		$ 511,348	$ -	$ 511,348	$ 1,028,415	$ -	$ 1,028,415
1. Physical Benefit Name: Incidental wetland habitat				Notes:			
2. Physical Benefit Measurement Units: Acres				Notes: Probability of incidental wetland 20% over 50 year period			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		1280	0	1280	1280	0	1280

4. Annual Economic Benefit, 2015 $ Million/Yr		$ 918,000	$ -	$ 918,000	$ 1,697,400	$ -	$ 1,697,400
5. Total Annual Monetized Benefit for the Category (sum of all row 4s.)		$ 1,429,348	$ -	$ 1,429,348	$ 2,725,815	$ -	$ 2,725,815

Enter Benefit Category here [1]	Emergency Response						
Repeat Rows 1 through 4 for every quantified physical benefit in this benefit category							
1. Physical Benefit Name: Extended Drought				Notes:			
2. Physical Benefit Measurement Units: Acre-Feet				Notes: 1/3 of non-ecosystem water allocated to emergency drought water supply. Weighted by hydrology and costs of water for ag and urban, and incorporates 7% probability of extended drought. See Benefit Calculation Tab Attachment 3 and Attachment 5 for detail.			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		1485	0	1485	1353	0	1353
4. Annual Economic Benefit, 2015 $ Million/Yr		$ 125,022	$ -	$ 125,022	$ 253,808	$ -	$ 253,808
1. Physical Benefit Name: Delta Failure				Notes: WSIP Technical Guidance stated that Delta Failure should be assumed to occur once, 30 years into project period - 2056 for this project. The equivalent alternative cost-based benefit in 2070 that would yield the same NPV as an event in 2056 is given below.			
2. Physical Benefit Measurement Units: Acre-Feet				Notes:			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		20000	0	20000	20000	0	20000
4. Annual Economic Benefit, 2015 $ Million/Yr					$ 272,257,400	$ -	$ 272,257,400
5. Total Annual Monetized Benefit for the Category (sum of all row 4s.)		$ 125,022	$ -	$ 125,022	$ 272,511,208	$ -	$ 272,511,208

[1] Enter one of these benefits: Ecosystem, Water Quality, Flood Control, Emergency Response, Recreation, or Non-public benefit

[2] Net of any non-mitigated physical effects

Part 2. Total Economic Net Benefits and Allocated Cost by Benefit Category in 2015 $ Million

Sum of annual economic net benefits by type	Enter Page Number from Application	Ecosystem	Water Quality	Flood Control	Emergency Response	Recreation	Total Public Benefits	Non-Public Benefits	Total public and non-public benefits[1]
Sum of 2030 benefits from Part 1, Row 5		$ 1,429,348			$ 125,022		$ 1,554,370	$ 1,260,870	$ 2,815,240
Sum of 2070 benefits from Part 1, Row 5		$ 2,725,815			$ 272,511,208		$ 275,237,024	$ 2,489,806	$ 277,726,830
Present Value of Benefits over Planning Horizon using 3.5% Discount Rate		$ 60,774,714			$ 64,986,550		$ 125,761,264	$ 52,041,635	$ 177,802,900
Present Value of Total Project Costs Allocated to each Benefit Category									
Capital Costs Allocated to Each Benefit Category									
Total Requested Program Cost Share									

[1] Present value of total public and non-public benefits, total project costs, and total Program funding request must match numbers in Part 3

Part 3. Present Value of Project Costs, Cost-Effectiveness Measure, and Public Benefit Ratio, Million 2015 $ Present Value

	Enter Page Number of Application	2015 $ Million Present Value
Project Costs		
Capital costs as defined in Program regulations		
Interest during construction		
Replacement costs		
Future environmental mitigation or compliance obligation costs		
Operations, maintenance and repair (OM&R) costs		
Other costs (describe)		
Present Value of Total Project Costs[1]		
Present Value of Cost of Least-Cost Alternative that Provides the Same Total Physical Benefits		$ 177,802,900
Present Value of All Public and Non-public Benefits[1]		$ 177,802,900
Ratio of Present Value of Total Monetized Net Benefits to the Total Project Costs		
Present Value of Public Benefits[1]		$ 125,761,264
Total Requested Program Cost Share[1]		
Public Benefit Ratio: Ratio of Present Value of Monetized Net Public Benefits to the Total Requested Program Cost Share		

[1] Must match numbers in Part 2

Workbook: Economic Benefits.
Worksheet 4 Input from Technical Reference

WSIP Grant BCA_Technical Reference
Ch 5 input variables

planning horizon — project life, or 100 years, whichever is less — *constant 2015 dollars*

Discount rate — 3.50%

Unit Values of Water for WSIP
2030 conditions (2015 dollars)

Water Year Type (Sacramento Valley 40-30-30 or San Joaquin Valley 60-20-20 Index)	Sacramento Valley (in $/AF of consumptive use)	Delta Export (in $/AF of applied water)	Eastside San Joaquin Basin (in $/AF of consumptive use)	Friant Service Area (in $/AF of consumptive use)
Wet	$ 145	$ 204	$ 106	$ 200
Above Normal	$ 191	$ 256	$ 133	$ 251
Below Normal	$ 255	$ 267	$ 189	$ 261
Dry	$ 275	$ 285	$ 201	$ 278
Critical	$ 345	$ 360	$ 375	$ 324

2045 and later conditions with SGMA (2015 dollars)

Water Year Type (Sacramento Valley 40-30-30 or San Joaquin Valley 60-20-20 Index)	Sacramento Valley (in $/AF of consumptive use)	Delta Export (in $/AF of applied water)	Eastside San Joaquin Basin (in $/AF of consumptive use)	Friant Service Area (in $/AF of consumptive use)
Wet	$ 150	$ 414	$ 309	$ 256
Above Normal	$ 198	$ 519	$ 388	$ 321
Below Normal	$ 264	$ 633	$ 437	$ 461
Dry	$ 283	$ 674	$ 466	$ 512
Critical	$ 354	$ 1,056	$ 728	$ 1,105

Applicants may also use their own unit values or other benefit methods if careful explanation and justification are provided. If using the unit values in Table 5-5, values between 2030 and 2045 shall be developed by interpolation. The unit values shall not be increased past 2045 unless applicants provide justification based on independently published information.

fall-run Chinook salmon in CA (for non-listed salmon species) — $ 2,500 — economic value per adult fish entering fresh water — *Layton, et al., 1999*

winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead trout — $ 100,000.00 — *Based on 2 studies*

Workbook: Economic Benefits.
Worksheet 5: SJR WY Index

SJ Valley Index http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST

orig data	year	SJ Valley WY Index	
1906 12.57 12.92 26.71 11.76 W 2.53 9.24 12.43 6.70 W	1906	11.76	W
1907 18.96 13.45 33.70 14.07 W 3.67 7.61 11.82 6.20 W	1907	14.07	W
1908 8.29 5.60 14.77 7.73 BN 0.98 2.17 3.32 2.40 D	1908	7.73	D
1909 20.61 8.98 30.68 12.10 W 2.85 5.91 8.97 4.59 W	1909	12.1	W
1910 13.12 6.11 20.12 9.38 W 2.87 3.62 6.64 3.65 AN	1910	9.38	AN
1911 12.27 13.12 26.38 11.74 W 3.63 7.52 11.48 5.97 W	1911	11.74	W
1912 4.84 5.65 11.41 6.71 BN 0.54 2.57 3.21 2.55 BN	1912	6.71	BN
1913 5.72 6.29 12.85 6.24 D 0.44 2.34 3.00 2.00 C	1913	6.24	C
1914 16.72 10.08 27.81 10.92 W 2.72 5.67 8.69 4.35 W	1914	10.92	W
1915 11.41 11.42 23.86 10.99 W 1.29 4.95 6.40 4.10 W	1915	10.99	W
1916 14.25 8.89 24.14 10.83 W 2.67 5.50 8.38 4.65 W	1916	10.83	W
1917 7.25 9.14 17.26 8.83 AN 1.66 4.84 6.66 4.13 W	1917	8.83	W
1918 5.27 4.89 10.99 6.19 D 1.07 3.40 4.59 3.08 BN	1918	6.19	BN
1919 8.12 6.77 15.66 7.00 BN 1.06 2.99 4.09 2.62 BN	1919	7	BN
1920 3.63 4.91 9.20 5.15 C 0.72 3.29 4.09 2.64 BN	1920	5.15	BN
1921 15.47 7.52 23.80 9.20 AN 1.97 3.84 5.90 3.23 AN	1921	9.2	AN
1922 6.63 10.57 17.98 8.97 AN 1.51 5.99 7.68 4.54 W	1922	8.97	W
1923 6.21 6.27 13.21 7.06 BN 1.39 3.95 5.51 3.55 AN	1923	7.06	AN
1924 3.27 1.94 5.74 3.87 C 0.45 1.03 1.50 1.42 C	1924	3.87	C
1925 8.76 6.51 15.99 6.39 D 1.45 3.93 5.51 2.93 BN	1925	6.39	BN
1926 6.37 4.79 11.76 5.75 D 0.89 2.56 3.49 2.30 D	1926	5.75	D
1927 14.34 8.75 23.83 9.52 W 1.80 4.56 6.50 3.56 AN	1927	9.52	AN
1928 10.24 5.86 16.76 8.27 AN 1.69 2.64 4.37 2.63 BN	1928	8.27	BN
1929 4.00 3.84 8.40 5.22 C 0.52 2.29 2.84 2.00 C	1929	5.22	C
1930 8.24 4.65 13.52 5.90 D 0.76 2.44 3.25 2.02 C	1930	5.9	C
1931 3.52 2.09 6.10 3.66 C 0.46 1.18 1.66 1.20 C	1931	3.66	C
1932 6.28 6.24 13.12 5.48 D 1.79 4.69 6.63 3.41 AN	1932	5.48	AN
1933 3.73 4.66 8.94 4.63 C 0.49 2.77 3.34 2.44 D	1933	4.63	D
1934 5.68 2.45 8.63 4.07 C 0.98 1.26 2.28 1.44 C	1934	4.07	C
1935 6.27 9.69 16.59 6.98 BN 1.26 5.03 6.41 3.56 AN	1935	6.98	AN
1936 10.32 6.41 17.35 7.75 BN 2.00 4.38 6.49 3.74 AN	1936	7.75	AN
1937 5.50 7.24 13.33 6.87 BN 1.78 4.66 6.53 3.90 W	1937	6.87	W
1938 17.96 12.93 31.83 12.62 W 3.58 7.33 11.24 5.89 W	1938	12.62	W
1939 4.56 3.04 8.18 5.58 D 1.00 1.83 2.90 2.20 D	1939	5.58	D
1940 14.78 6.93 22.43 8.88 AN 2.49 4.04 6.59 3.36 AN	1940	8.88	AN
1941 16.32 9.77 27.08 11.47 W 2.22 5.51 7.93 4.43 W	1941	11.47	W
1942 14.33 9.93 25.24 11.27 W 1.93 5.28 7.38 4.44 W	1942	11.27	W
1943 13.37 6.90 21.13 9.77 W 2.86 4.28 7.28 4.03 W	1943	9.77	W
1944 4.81 4.93 10.43 6.35 D 0.87 2.97 3.92 2.76 BN	1944	6.35	BN
1945 8.42 5.92 15.06 6.80 BN 2.07 4.37 6.60 3.59 AN	1945	6.8	AN
1946 10.89 5.97 17.62 7.70 BN 1.99 3.65 5.73 3.30 AN	1946	7.7	AN
1947 5.90 3.83 10.39 5.61 D 1.26 2.12 3.42 2.18 D	1947	5.61	D
1948 5.39 9.55 15.75 7.12 BN 0.56 3.58 4.21 2.70 BN	1948	7.12	BN
1949 5.73 5.59 11.97 6.09 D 0.62 3.12 3.79 2.53 BN	1949	6.09	BN
1950 7.01 6.72 14.44 6.62 BN 1.02 3.57 4.65 2.85 BN	1950	6.62	BN
1951 16.77 5.42 22.95 9.18 AN 4.35 2.83 7.25 3.14 AN	1951	9.18	AN
1952 13.86 13.68 28.60 12.38 W 2.18 6.84 9.30 5.17 W	1952	12.38	W
1953 10.84 8.26 20.09 9.55 W 1.07 3.18 4.35 3.03 BN	1953	9.55	BN
1954 9.74 6.81 17.43 8.51 AN 1.10 3.16 4.30 2.72 BN	1954	8.51	BN
1955 5.19 5.07 10.98 6.14 D 0.78 2.67 3.50 2.30 D	1955	6.14	D
1956 20.32 8.60 29.89 11.38 W 4.14 5.29 9.67 4.46 W	1956	11.38	W
1957 7.72 6.29 14.89 7.83 AN 1.02 3.19 4.29 3.01 BN	1957	7.83	BN
1958 16.37 12.24 29.71 12.16 W 1.67 6.40 8.36 4.77 W	1958	12.16	W
1959 7.40 3.84 12.05 6.75 BN 0.98 1.85 2.98 2.21 D	1959	6.75	D
1960 7.72 4.65 13.06 6.20 D 0.85 2.07 2.96 1.85 C	1960	6.2	C
1961 6.87 4.39 11.97 5.68 D 0.54 1.50 2.10 1.38 C	1961	5.68	C
1962 8.17 6.23 15.11 6.65 BN 1.26 4.24 5.61 3.07 BN	1962	6.65	BN

15-year avg	7.13	1.1306
110 year avg	8.06	

W	24	29.3%
AN	16	19.5%
BN	13	15.9%
D	13	15.9%
C	16	19.5%

1963 12.01 10.09 22.99 9.63 W 1.68 4.37 6.24 3.57 AN
1964 5.90 4.37 10.92 6.41 D 0.93 2.14 3.14 2.19 D
1965 16.59 8.13 25.64 10.15 W 3.20 4.55 8.13 3.81 W
1966 7.42 4.84 12.95 7.16 BN 1.49 2.42 3.98 2.51 BN
1967 12.14 11.01 24.06 10.20 W 2.46 7.09 9.98 5.25 W
1968 8.66 4.12 13.64 7.24 BN 1.02 1.85 2.94 2.21 D
1969 15.33 10.68 26.98 11.05 W 3.84 8.14 12.29 6.09 W
1970 18.87 4.35 24.06 10.40 W 2.55 2.96 5.61 3.18 AN
1971 12.71 8.90 22.57 10.37 W 1.56 3.23 4.91 2.89 BN
1972 7.61 5.02 13.43 7.29 BN 1.25 2.22 3.57 2.16 D
1973 12.80 6.38 20.05 8.58 AN 1.87 4.48 6.47 3.50 AN
1974 21.69 9.78 32.50 12.99 W 2.43 4.53 7.12 3.90 W
1975 9.24 8.95 19.23 9.35 W 1.37 4.65 6.18 3.85 W
1976 4.63 2.75 8.20 5.29 C 0.78 1.07 1.97 1.57 C
1977 2.49 1.93 5.12 3.11 C 0.22 0.80 1.05 0.84 C
1978 14.90 8.12 23.92 8.65 AN 2.57 6.50 9.65 4.58 W
1979 6.06 5.64 12.41 6.67 BN 1.87 3.99 5.98 3.67 AN
1980 15.49 6.00 22.33 9.04 AN 3.74 5.41 9.47 4.73 W
1981 6.81 3.63 11.10 6.21 D 0.85 2.29 3.22 2.44 D
1982 20.56 11.82 33.41 12.76 W 3.78 7.00 11.41 5.45 W
1983 22.75 13.66 37.68 15.29 W 5.42 8.73 15.01 7.22 W
1984 15.98 5.52 22.35 10.00 W 3.51 3.48 7.13 3.69 AN
1985 6.24 4.00 11.04 6.47 D 1.11 2.41 3.60 2.40 D
1986 19.45 5.45 25.83 9.96 W 4.36 4.92 9.50 4.31 W
1987 5.85 2.80 9.27 5.86 D 0.55 1.48 2.08 1.86 C
1988 5.78 2.90 9.23 4.65 C 0.86 1.55 2.48 1.48 C
1989 9.03 5.07 14.82 6.13 D 1.07 2.42 3.56 1.96 C
1990 4.94 3.72 9.26 4.81 C 0.83 1.59 2.46 1.51 C
1991 3.90 4.01 8.44 4.21 C 0.56 2.57 3.20 1.96 C
1992 5.41 2.93 8.87 4.06 C 0.86 1.66 2.58 1.56 C
1993 12.44 8.98 22.21 8.54 AN 2.49 5.65 8.38 4.20 W
1994 4.55 2.73 7.81 5.02 C 0.66 1.80 2.54 2.05 C
1995 19.83 13.60 34.55 12.89 W 3.67 8.01 12.32 5.95 W
1996 13.05 8.37 22.29 10.26 W 2.57 4.51 7.22 4.12 W
1997 20.22 4.39 25.42 10.82 W 5.75 3.59 9.51 4.13 W
1998 17.65 12.54 31.40 13.31 W 2.82 7.11 10.43 5.65 W
1999 12.97 7.26 21.19 9.80 W 1.90 3.85 5.91 3.59 AN
2000 12.06 5.96 18.90 8.94 AN 1.98 3.78 5.90 3.38 AN
2001 5.64 3.46 9.81 5.76 D 0.92 2.23 3.18 2.20 D
2002 9.32 4.57 14.60 6.35 D 1.27 2.75 4.06 2.34 D
2003 10.71 7.74 19.31 8.21 AN 1.25 3.49 4.87 2.81 BN
2004 10.95 4.40 16.04 7.51 BN 1.51 2.25 3.81 2.21 D
2005 8.40 9.28 18.55 8.49 AN 2.73 6.28 9.21 4.75 W
2006 18.06 13.09 32.09 13.20 W 2.86 7.37 10.44 5.90 W
2007 6.59 3.04 10.28 6.19 D 0.99 1.46 2.51 1.97 C
2008 5.90 3.82 10.28 5.16 C 0.99 2.45 3.49 2.06 C
2009 7.05 5.30 13.02 5.78 D 1.51 3.35 4.94 2.72 BN
2010 7.45 7.78 16.01 7.08 BN 1.43 4.53 6.08 3.55 AN
2011 12.68 11.53 25.21 10.54 W 3.68 6.90 10.99 5.58 W
2012 5.69 5.46 11.84 6.89 BN 0.83 1.86 2.76 2.18 D
2013 8.52 3.01 12.19 5.83 D 1.33 1.67 3.05 1.71 C
2014 4.29 2.59 7.46 4.07 C 0.46 1.21 1.72 1.16 C
2015 6.95 1.77 9.27 4.01 C 0.66 0.74 1.43 0.81 C

1963	9.63	AN
1964	6.41	D
1965	10.15	W
1966	7.16	BN
1967	10.2	W
1968	7.24	D
1969	11.05	W
1970	10.4	AN
1971	10.37	BN
1972	7.29	D
1973	8.58	AN
1974	12.99	W
1975	9.35	W
1976	5.29	C
1977	3.11	C
1978	8.65	W
1979	6.67	AN
1980	9.04	W
1981	6.21	D
1982	12.76	W
1983	15.29	W
1984	10	AN
1985	6.47	D
1986	9.96	W
1987	5.86	C
1988	4.65	C
1989	6.13	C
1990	4.81	C
1991	4.21	C
1992	4.06	C
1993	8.54	W
1994	5.02	C
1995	12.89	W
1996	10.26	W
1997	10.82	W
1998	13.31	W
1999	9.8	AN
2000	8.94	AN
2001	5.76	D
2002	6.35	D
2003	8.21	BN
2004	7.51	D
2005	8.49	W
2006	13.2	W
2007	6.19	C
2008	5.16	C
2009	5.78	BN
2010	7.08	AN
2011	10.54	W
2012	6.89	D
2013	5.83	C
2014	4.07	C
2015	4.01	C

Workbook: Economic Benefits.
Worksheet 6: Input from Cramer Fish

Additional Adult Chinook from 50 years of Project Operations
Smolt to Adult Return Rate

	Spring-Run	Winter-run
2030	586	41
2070	428	32
	all 81 years	
2030	950	

Workbook: Economic Benefits.
Worksheet 7: Input from MBK Eng

2030 Water Supply Impacts

Year Type	Recharge (TAF)	# of pulses (years)	Eco. Water Supply (TAF)	IRWD Water Supply (TAF)	RRBWSD Water Supply (TAF)	Adjusted water year weights based on water supply: water year type frequency based on SJRiver Index	Expected value of additional water supplies	adjusted water year weights based on project supplies	Adjusted water year weights based on eco water impacts: Expected value of additional eco water supply	adjusted water year weights based on project supplies
Wet	11	0	0	0	0	29%	0.000	0%	0	0%
Above Normal	13	0	0	0	0	20%	0.000	0%	0	0%
Below Normal	5	0	0	4	6	16%	1.585	42%	0	0%
Dry	0	5	5	4	6	16%	1.585	42%	7.926829	93%
Critical	0	1	1	2	1	20%	0.585	16%	0.585366	7%
All years	6.1	6	1.32231	2	2.5		3.756		8.512195	

2070 water supply impacts

Year Type	Recharge (TAF)	# of pulses (years)	Eco. Water Supply (TAF)	IRWD Water Supply (TAF)	RRBWSD Water Supply (TAF)					
Wet	12	0	0	1	0	29%	0.293	8%	0	0%
Above Normal	12	0	0	1	0	20%	0.195	5%	0	0%
Below Normal	1	0	0	4	5	16%	1.427	38%	0	0%
Dry	0	5	5	4	6	16%	1.585	42%	7.926829	100%
Critical	0	0	0	0	0	20%	0.000	0%	0	0%
All years	5.7	5	1.10193	1.9	2.2	0%	3.500		7.926829	
Change	-0.04	-1	-0.2	0	-0.3					

Workbook: Economic Benefits.
Worksheet 8: CA DOF CPI

Source: CA DOF http://www.dof.ca.gov/Forecasting/Economics/Indicators/Inflation/

CONSUMER PRICE INDICES, UNITED STATES AND CALIFORNIA
CALENDAR YEAR AVERAGES, (1982-84=100)

	United States		California		
	Index	% change	Index		% change
All Urban Consumers					
1970	38.8	--	37.9		--
1971	40.5	4.4	39.3		3.7
1972	41.8	3.2	40.6		3.3
1973	44.4	6.2	43.0		5.9
1974	49.3	11.0	47.4		10.2
1975	53.8	9.1	52.3		10.3
1976	56.9	5.8	55.6		6.3
1977	60.6	6.5	59.5		7.0
1978	65.2	7.6	64.4		8.2
1979	72.6	11.3	71.3		10.7
1980	82.4	13.5	82.4		15.6
1981	90.9	10.3	91.4		10.9
1982	96.5	6.2	97.3		6.5
1983	99.6	3.2	98.9		1.6
1984	103.9	4.3	103.8		5.0
1985	107.6	3.6	108.6		4.6
1986	109.6	1.9	112.0		3.1
1987	113.6	3.6	116.5		4.0
1988	118.3	4.1	121.9		4.6
1989	124.0	4.8	128.0		5.0
1990	130.7	5.4	135.0		5.5
1991	136.2	4.2	140.6		4.1
1992	140.3	3.0	145.6		3.6
1993	144.5	3.0	149.4		2.6
1994	148.2	2.6	151.5		1.4
1995	152.4	2.8	154.0		1.7
1996	156.9	3.0	157.1		2.0
1997	160.5	2.3	160.5		2.2
1998	163.0	1.6	163.7	r/	2.0
1999	166.6	2.2	168.5		2.9
2000	172.2	3.4	174.8		3.7
2001	177.1	2.8	181.7		3.9
2002	179.9	1.6	186.1		2.4
2003	184.0	2.3	190.4		2.3
2004	188.9	2.7	195.4		2.6
2005	195.3	3.4	202.6		3.7
2006	201.6	3.2	210.5		3.9
2007	207.342	2.8	217.424		3.3
2008	215.303	3.8	224.807		3.4

CONSUMER PRICE INDICES, UNITED STATES AND CALIFORNIA
CALENDAR YEAR AVERAGES, (1982-84=100)

	United States		California	
	Index	% change	Index	% change
2009	214.537	-0.4	224.110	-0.3
2010	218.056	1.6	226.919	1.3
2011	224.939	3.2	232.931	2.6
2012	229.594	2.1	238.155	2.2
2013	232.957	1.5	241.623	1.5
2014	236.736	1.6	246.055	1.8
2015	237.017	0.1	249.636	1.5
2016	240.007	1.3	255.329	2.3
2017 f/	245.567	2.3	263.110	3.0
2018 f/	251.228	2.3	270.829	2.9
2019 f/	256.884	2.3	278.662	2.9
2020 f/	262.449	2.2	286.627	2.9
Urban Wage Earners and Clerical Workers				
1970	39.0	--	38.2	--
1971	40.7	4.4	39.6	3.7
1972	42.1	3.4	40.9	3.3
1973	44.7	6.2	43.3	5.9
1974	49.6	11.0	47.7	10.2
1975	54.1	9.1	52.6	10.3
1976	57.2	5.7	55.9	6.3
1977	60.9	6.5	59.9	7.2
1978	65.6	7.7	64.7	8.0
1979	73.1	11.4	72.1	11.4
1980	82.9	13.4	83.6	16.0
1981	91.4	10.3	92.7	10.9
1982	96.9	6.0	98.5	6.3
1983	99.8	3.0	99.0	0.5
1984	103.3	3.5	102.5	3.5
1985	106.9	3.5	106.7	4.1
1986	108.6	1.6	109.6	2.7
1987	112.5	3.6	113.9	3.9
1988	117.0	4.0	118.9	4.4
1989	122.6	4.8	124.9	5.0
1990	129.0	5.2	131.5	5.3
1991	134.3	4.1	136.7	4.0
1992	138.2	2.9	141.4	3.4
1993	142.1	2.8	144.7	2.3
1994	145.6	2.5	146.6	1.3
1995	149.8	2.8	149.1	1.7
1996	154.1	2.9	152.0	1.9
1997	157.6	2.3	155.0	1.9
1998	159.7	1.3	157.6 r/	1.7
1999	163.2	2.2	162.2	2.9
2000	168.9	3.5	168.1	3.6

CONSUMER PRICE INDICES, UNITED STATES AND CALIFORNIA
CALENDAR YEAR AVERAGES, (1982-84=100)

	United States		California	
	Index	% change	Index	% change
2001	173.5	2.7	174.7	3.9
2002	175.9	1.4	179.0	2.5
2003	179.8	2.2	183.8	2.7
2004	184.5	2.6	188.9	2.8
2005	191.0	3.5	195.9	3.7
2006	197.1	3.2	203.3	3.8
2007	202.767	2.9	209.876	3.2
2008	211.053	4.1	217.648	3.7
2009	209.630	-0.7	216.293	-0.6
2010	213.967	2.1	219.714	1.6
2011	221.575	3.6	226.364	3.0
2012	226.229	2.1	231.611	2.3
2013	229.324	1.4	234.948	1.4
2014	232.771	1.5	238.960	1.7
2015	231.810	-0.4	241.618	1.1
2016	234.076	1.0	246.195	1.9
2017 f/	239.591	2.4	253.647	3.0
2018 f/	245.259	2.4	261.314	3.0
2019 f/	250.829	2.3	268.969	2.9
2020 f/	256.342	2.2	276.777	2.9

f/ May Revision Forecast, April 2017

NOTE: Beginning with the January 2007 data, indices published by the Bureau of Labor Statistics
The California indices conform to this change.
r/ CA CPI revised by DIR
All Urban Consumers: Includes, in addition to wage earners and clerical workers, groups such as
and technical workers, the self-employed, short-term workers, the unemployed, and retirees, and
San Francisco CMSA: Includes the counties of Alameda, Contra Costa, Marin, Napa, San Francis
San Mateo, Santa Clara, Santa Cruz, Solano, & Sonoma
Los Angeles CMSA: Includes the counties of Los Angeles, Orange, Riverside, San Bernardino, &
California: Weighted average of San Francisco CMSA, Los Angeles CMSA and (from 1965-1986)
Sources:
San Francisco CMSA, Los Angeles CMSA and San Diego county, United States -- US Bureau of L
California -- Calculated by the CA Department of Finance using a formula developed by the CA De
Forecasts -- CA Department of Finance (percent changes calculated from unrounded data)

Updated: May 11, 2017 Filename: bbcycpi

Workbook: Economic Benefits.
Worksheet 9: WSIP

Summary

Year Type	WSIP 2030 Recharge (TAF/year)	WSIP 2070 Recharge (TAF/year)
Wet	11	12
Above Normal	13	12
Below Normal	5	1
Dry	0	0
Critical	0	0
All Years	6.1	5.7

number of times 3rd or higher year of drought occurs: 6

Probability of 3rd or higher year of drought occuring in period of record: 7%

Sacramento Vall	Water Year	WSIP 2030 Recharge (TAF/year)	WSIP 2070 Recharge (TAF/year)	Year of emergency drought conditions (criical year 3rd or later year of multi-year drought)
Above Normal	1922	0	0	
Below Normal	1923	0	0	
Critical	1924	0	0	0
Dry	1925	0	0	0
Dry	1926	0	0	0
Wet	1927	0	0	
Above Normal	1928	0	0	
Critical	1929	0	0	0
Dry	1930	0	0	0
Critical	1931	0	0	1
Dry	1932	0	0	0
Critical	1933	0	0	1
Critical	1934	0	0	1
Below Normal	1935	0	0	
Below Normal	1936	24	0	
Below Normal	1937	24	19	
Wet	1938	45	69	
Dry	1939	0	0	0
Above Normal	1940	0	0	
Wet	1941	0	0	
Wet	1942	0	0	
Wet	1943	24	0	
Dry	1944	0	0	0
Below Normal	1945	24	0	
Below Normal	1946	0	0	
Dry	1947	0	0	0
Below Normal	1948	0	0	
Dry	1949	0	0	0
Below Normal	1950	0	0	
Above Normal	1951	10	24	
Wet	1952	0	0	
Wet	1953	0	0	
Above Normal	1954	0	0	
Dry	1955	0	0	0
Wet	1956	46	46	

Above Normal	1957	0	0	
Wet	1958	23	23	
Below Normal	1959	0	0	
Dry	1960	0	0	0
Dry	1961	0	0	0
Below Normal	1962	0	0	
Wet	1963	0	0	
Dry	1964	0	0	0
Wet	1965	0	0	
Below Normal	1966	0	0	
Wet	1967	0	4	
Below Normal	1968	0	0	
Wet	1969	45	48	
Wet	1970	0	0	
Wet	1971	0	0	
Below Normal	1972	0	0	
Above Normal	1973	24	0	
Wet	1974	0	0	
Wet	1975	0	0	
Critical	1976	0	0	0
Critical	1977	0	0	0
Above Normal	1978	48	49	
Below Normal	1979	0	0	
Above Normal	1980	70	70	
Dry	1981	0	0	0
Wet	1982	47	47	
Wet	1983	22	47	
Wet	1984	0	3	
Dry	1985	0	0	0
Wet	1986	24	19	
Dry	1987	0	0	0
Critical	1988	0	0	0
Dry	1989	0	0	0
Critical	1990	0	0	1
Critical	1991	0	0	1
Critical	1992	0	0	1
Above Normal	1993	0	0	
Critical	1994	0	0	0
Wet	1995	0	0	
Wet	1996	0	0	
Wet	1997	0	0	
Wet	1998	0	0	
Wet	1999	0	0	
Above Normal	2000	0	0	
Dry	2001	0	0	
Dry	2002	0	0	
Above Normal	2003	0	0	

Benefit Calculation, Monetization, and Resiliency Tab

A.6 Monetization Table

Attach a table displaying each future economic benefit in 2015 dollars for each year of the planning horizon as required by section 6004(a)(4)(A) of the regulations.

File: Tab 6-A6_IRWD_Future Annual Economic Benefit_FINAL.pdf

Tab 6

A.6 Provide a table displaying each future economic benefit in 2015 $ for each year of planning horizon.

For a detailed table displaying each future economic benefit in 2015 dollars for each year of the planning horizon, see the monetary quantification of benefits in Tab 6, Attachment 5, annual benefits worksheet.

Benefit Calculation, Monetization, and Resiliency Tab

A.8 Total Project Cost Estimate

Attach an estimate of the total project costs that includes construction cost, interest during construction, land acquisition, monitoring, environmental mitigation or compliance obligations, operations and maintenance, repair, and replacement costs during the planning horizon using methods described in TR section 6. If the project costs are located in another attachment, identify the location.

The project cost estimates must be reviewed, approved and signed by an engineer licensed by the California Board for Professional Engineers, Land Surveyors, and Geologists.

File: Tab 6-A8_IRWD_Total Project Cost_FINAL.pdf

Tab 6

<u>A.8 Attach an estimate of the total project costs that includes construction cost, interest during construction, land acquisition, monitoring, environmental mitigation or compliance obligations, operations and maintenance, repair, and replacement costs during the planning horizon using methods described in TR section 6. If the project costs are located in another attachment, identify the location.</u>
<u>The project cost estimates must be reviewed, approved and signed by an engineer licensed by the California Board for Professional Engineers, Land Surveyors, and Geologists.</u>

A Class 4 Feasibility Level Cost Estimate was developed for the Kern Fan Groundwater Storage Project by Dee Jaspar and Associates. A copy of the Draft Concept Study cost estimate that is stamped and signed by a California licensed Professional Engineer is presented in the Feasibility and Implementation Tab, Attachment 1, Dee Jaspar and Associates, August 10, 2017, Appendix A.

Benefit Calculation, Monetization, and Resiliency Tab

A.9 Benefit and Cost Analysis

Attach the benefit and cost analysis for the proposed project. If the analysis is located in another document, identify the location. See regulations section 6004(a)(6).

File: Tab 6-A9-A10_IRWD_Benefit-Cost_Analysis_Cost_Allocation.xlsx

<u>Worksheets included in Workbook:</u>

-Benefit Ratios
-Cost_Allocation
-Dashboard
-Capital_Cost_PV
-Property_Residual_PV
-Facilities_Residual_PV
-DJA_O&M_PV
-DJA_Replacement_PV
-DJA_O&M_Cost_Estimate
-DJA_Const_Cost_Estimate

BENEFIT RATIOS

Key Data from Other Worksheets

$171,321,859	Project capital cost
$152,846,940	PV of project capital costs at year 1 of construction
$50,854,986	PV of residual land value after 50 years of operations
$11,636,750	PV of residual facility value (earthwork and interbasin structures) after 50 years
$90,355,204	PV of capital less residual land value and facility value
$18,809,076	PV of O&M(@2030)
$17,993,034	PV of O&M (@2070)
$10,476,475	PV of replacement
$119,640,756	*Total Project Cost* - PV of adjusted capital, O&M, and replacement (@2030)

	Future Conditions	
Benefit Type	*2030 w/Climate Change*	*2070 w/Climate Change*
Non-Public		
Water Supply Benefits	$47,745,446.54	$47,745,446.54
Groundwater	$4,296,188.77	$4,296,188.77
Subtotal	$52,041,635.31	$52,041,635.31
Public		
Ecosystem Benefit - Salmon	$20,978,395.07	$20,978,395.07
Ecosystem Benefit - Wetlands	$39,796,318.99	$39,796,318.99
Emergency Response - Extended Drought	$5,062,066.79	$5,062,066.79
Emergency Response - Delta Failure	$59,924,483.60	$59,924,483.60
Subtotal	$125,761,264.45	$125,761,264.45
Total Benefits	**$177,802,899.77**	**$177,802,899.77**
Public Benefit Ratio	**1.47**	**1.47**
Benefit-Cost Ratio*	**1.49**	**1.50**

*The Benefit-Cost ratio was calculated using an adjusted project cost based on the present value of capital costs at year one of construction, less the present residual value of land and facilities at the end of the 50-year operating horizon. IRWD and Rosedale believe these adjustments are justified due to the high potential for land appreciation in the Kern County - Bakersfield area and the value of site improvements at the end of project operations.

COST ALLOCATION

Cost Shares

$85,660,930	WSIP funds requested
$42,830,465	Portion funded by IRWD
$42,830,465	Portion funded by RRBWSD

	Beneficiary		
	State of California	*IRWD*	*RRBWSD*
Public Benefits			
Ecosystem	$60,774,714	$0	$0
Emergency Response	$64,986,550	$0	$0
Non-Public Benefits			
Water Supply	$0	$23,872,723	$23,872,723
Groundwater	$0	$2,148,094	$2,148,094
Total Benefits	**$125,761,264**	**$26,020,818**	**$26,020,818**
Cost Share Category			
Ecosystem	$42,830,465	$0	$0
Emergency Response	$42,830,465	$0	$0
Water Supply	$0	$39,294,685	$39,294,685
Groundwater	$0	$3,535,780	$3,535,780
Total Cost Share	**$85,660,930**	**$42,830,465**	**$42,830,465**
Benefit to Cost Share Ratio*	**1.47**	**0.61**	**0.61**

*While the benefit to cost share ratio for IRWD and RRBWSD is below 1.0, IRWD and RRBWSD additionally plan to utilize their share of the project facilites for other future groundwater storage and recovery programs. This would result in an increased benefit to IRWD and RRBWSD in excess of the benefits demonstrated for the Kern Fan Groundwater Storage Project, as discussed in application Tab 3, Question 6 (project affect on groundwater basins).

KERN FAN GROUNDWATER STORAGE PROJECT - ECONOMIC ANALYSIS

Planning level estimate of costs and benefits

Key Parameters

50	Project operations horizon/period *(years)*
2021	Construction start year
2025	Construction complete year
2024	Phase 1 online year
2025	Phase 2 online year
2075	Operations horizon end year
$171,321,859	Estimated capital cost *(dollars)*
$85,660,930	Estimated grant funding amount *(dollars)*
$42,830,465	Estimated IRWD capital contribution *(dollars)*
$42,830,465	Estimated RRBWSD capital contribution *(dollars)*
3.5%	Discount rate *(CA cost of borrowing from CWC Technical Reference Appendix G; aligns well with IRWD cost of capital @3.47%)*
4.5%	Bakersfield long term land value appreciation rate (per Mike Ming, ARA FRICS)

PV OF CAPITAL

Calendar Year	*Capital Costs**	
2015	-	
2016	-	
2017	-	
2018	-	
2019	$39,585,000.00	<- *Construction Starts*
2020	$5,880,000.00	
2021	$21,886,143.20	
2022	$71,541,108.00	
2023	$23,568,606.00	
2024	$7,951,002.00	
2025	$910,000.00	<- *Construction Completed*
	$152,846,940.33	<- NPV of Capital

*Since the capital costs would occur over a 6 -year construction period, a present value of capital at year one of construction was calculated. This was incorporated into the benefit-cost ratio calculation to accurately reflect the time value of capital costs incurred.

RESIDUAL VALUE OF REAL PROPERTY

Operations Year	*Calendar Year*	*Estimated Land Value**	*Cash Flow*
-	2015		-
-	2016		-
-	2017		-
-	2018		-
-	2019	$30,720,000.00	$0.00
-	2020	$32,102,400.00	$0.00
-	2021	$33,547,008.00	$0.00
-	2022	$35,056,623.36	$0.00
-	2023	$36,634,171.41	$0.00
-	2024	$38,282,709.12	$0.00
-	2025	$40,005,431.04	$0.00
1	2026	$41,805,675.43	$0.00
2	2027	$43,686,930.83	$0.00
3	2028	$45,652,842.71	$0.00
4	2029	$47,707,220.64	$0.00
5	2030	$49,854,045.56	$0.00
6	2031	$52,097,477.61	$0.00
7	2032	$54,441,864.11	$0.00
8	2033	$56,891,747.99	$0.00
9	2034	$59,451,876.65	$0.00
10	2035	$62,127,211.10	$0.00
11	2036	$64,922,935.60	$0.00
12	2037	$67,844,467.70	$0.00
13	2038	$70,897,468.75	$0.00
14	2039	$74,087,854.84	$0.00
15	2040	$77,421,808.31	$0.00
16	2041	$80,905,789.68	$0.00
17	2042	$84,546,550.22	$0.00
18	2043	$88,351,144.98	$0.00
19	2044	$92,326,946.50	$0.00
20	2045	$96,481,659.10	$0.00
21	2046	$100,823,333.76	$0.00
22	2047	$105,360,383.78	$0.00
23	2048	$110,101,601.05	$0.00
24	2049	$115,056,173.09	$0.00
25	2050	$120,233,700.88	$0.00
26	2051	$125,644,217.42	$0.00
27	2052	$131,298,207.21	$0.00
28	2053	$137,206,626.53	$0.00
29	2054	$143,380,924.72	$0.00
30	2055	$149,833,066.34	$0.00
31	2056	$156,575,554.32	$0.00
32	2057	$163,621,454.27	$0.00
33	2058	$170,984,419.71	$0.00
34	2059	$178,678,718.59	$0.00

35	2060	$186,719,260.93	$0.00
36	2061	$195,121,627.67	$0.00
37	2062	$203,902,100.92	$0.00
38	2063	$213,077,695.46	$0.00
39	2064	$222,666,191.76	$0.00
40	2065	$232,686,170.39	$0.00
41	2066	$243,157,048.05	$0.00
42	2067	$254,099,115.21	$0.00
43	2068	$265,533,575.40	$0.00
44	2069	$277,482,586.29	$0.00
45	2070	$289,969,302.68	$0.00
46	2071	$303,017,921.30	$0.00
47	2072	$316,653,727.75	$0.00
48	2073	$330,903,145.50	$0.00
49	2074	$345,793,787.05	$0.00
50	2075	$361,354,507.47	$361,354,507.47
		Residual value of land (NPV of land value)->	**$50,854,985.90**

*Land value was escalated at 4.5% per year based on information provided by IRWD's Kern County appraiser, Mike Ming. Given a 50-year time horizon, it was estimated that annual appreciation would be 4-5 percent for lands utilized for the proposed project.

RESIDUAL VALUE OF EQUIPMENT

Item	Resicual Value Options: Selection Components On (1), off (0)	Sensitivity to Residual Values: Everything except West Basins & Goose Lake	Aqueduct + Lift Stations	Aqueduct Only	Aqueduct and Basin Earthwork and Interbasin structures
Aqueduct	1	1	1	1	1
Lift Stations	0	1	1	0	0
West Basin	0	0	0	0	0
Phase II Facilities except earthwork & interbasin structures	0	1	0	0	0
Phase II Earthwork and Interbasin Structures	1	1	0	0	1
Goose Lake	0	0	0	0	0
Phase I Facilities except earthwork & interbasin structures	0	1	0	0	0
Phase I Earthwork and Interbasin Structures	1	1	0	0	1
Equipment Cost (current)	$64,990,400.00	$99,998,216.00	$71,117,500.00	$59,200,000.00	$64,990,400.00
Equipment Cost (NPV)	**$11,636,750.43**	$136,287,352.23	$96,925,900.83	$80,683,571.62	$88,575,292.46

Irvine Ranch Water District

Canal Alignment along KWB to West Basins

Item No.	Item Description	Unit	Quantity	Unit Cost	Extended Cost	Phase	Equipment Recovery Calculations: Recover (0=No, 1=Yes)	Recovery Value ($)
1	Mobilization, Demobilization, & Cleanup	LS	1	$ 1,820,000.00	$ 1,820,000.00	1	1	1,820,000.00
2	Aqueduct Cofferdam & Dewatering	LS	1	$ 250,000.00	$ 250,000.00	1	1	250,000.00
3	Aqueduct Turnout Excavation	LS	1	$ 55,000.00	$ 55,000.00	1	1	55,000.00
4	Aqueduct Reinforced Concrete Structure	LS	1	$ 200,000.00	$ 200,000.00	1	1	200,000.00
5	Aqueduct Backfill and Compaction	LS	1	$ 50,000.00	$ 50,000.00	1	1	50,000.00
6	Aqueduct Miscellaneous Steel	LS	1	$ 55,000.00	$ 55,000.00	1	1	55,000.00
7	Aqueduct Metering	EA	2	$ 90,000.00	$ 180,000.00	1	1	180,000.00
8	Aqueduct Slide Gate & Actuator	EA	2	$ 37,500.00	$ 75,000.00	1	1	75,000.00
9	Aqueduct Electrical, Controls, & Lighting	LS	1	$ 300,000.00	$ 300,000.00	1	1	300,000.00
10	Aqueduct Liner Repair	LS	1	$ 20,000.00	$ 20,000.00	1	1	20,000.00
11	Canal Earthwork	CY	1,650,000	$ 10.00	$ 16,500,000.00	1	1	16,500,000.00
12	Concrete Canal Lining	SF	2,640,000	$ 6.00	$ 15,840,000.00	1	1	15,840,000.00
13	Canal Appurtenances	LS	1	$ 250,000.00	$ 250,000.00	1	1	250,000.00
14	Canal Fencing	LF	110,000	$ 7.50	$ 825,000.00	1	1	825,000.00
15	Levee Road Aggregate Base Ground Cover	LS	1	$ 650,000.00	$ 650,000.00	1	1	650,000.00
16	East Canal Crossing Siphon & Appurtenances	LS	1	$ 1,000,000.00	$ 1,000,000.00	1	1	1,000,000.00
17	Main Canal Crossing Siphon & Appurtenances	LS	1	$ 500,000.00	$ 500,000.00	1	1	500,000.00
18	WKWD Pipeline Crossing Siphon & Appurtenances	LS	1	$ 250,000.00	$ 250,000.00	1	1	250,000.00
19	Stockdale Hwy Crossing Siphon & Appurtenances	LS	1	$ 1,000,000.00	$ 1,000,000.00	1	1	1,000,000.00
20	I-5 Crossing Siphon & Appurtenances	LS	1	$ 1,500,000.00	$ 1,500,000.00	1	1	1,500,000.00
21	Farm Road Siphon & Appurtenances	EA	3	$ 600,000.00	$ 1,800,000.00	1	1	1,800,000.00
22	84" Siphon Piping	LF	10,720	$ 1,500.00	$ 16,080,000.00	1	1	16,080,000.00
23	Lift Station Excavation	LS	3	$ 60,000.00	$ 180,000.00	1	0	-
24	Lift Station Reinforced Concrete Structure	LS	3	$ 650,000.00	$ 1,950,000.00	1	0	-
25	Lift Station Pumps - 67 cfs to 83 cfs	EA	18	$ 150,000.00	$ 2,700,000.00	1	0	-
26	Lift Station Motors - 300 hp to 400 hp	EA	18	$ 95,000.00	$ 1,710,000.00	1	0	-
27	Lift Station Discharge Piping & Appurtenances	LS	3	$ 750,000.00	$ 2,250,000.00	1	0	-

RESIDUAL VALUE OF EQUIPMENT

Operations Year	*Calendar Year*	*Estimated Equipment Value*	*Cash Flow*
-	2015	$64,990,400.00	-
-	2016	$64,990,400.00	-
-	2017	$64,990,400.00	-
-	2018	$64,990,400.00	-
-	2019	$64,990,400.00	$0.00
-	2020	$64,990,400.00	$0.00
-	2021	$64,990,400.00	$0.00
-	2022	$64,990,400.00	$0.00
-	2023	$64,990,400.00	$0.00
-	2024	$64,990,400.00	$0.00
-	2025	$64,990,400.00	$0.00
1	2026	$64,990,400.00	$0.00
2	2027	$64,990,400.00	$0.00
3	2028	$64,990,400.00	$0.00
4	2029	$64,990,400.00	$0.00
5	2030	$64,990,400.00	$0.00
6	2031	$64,990,400.00	$0.00
7	2032	$64,990,400.00	$0.00
8	2033	$64,990,400.00	$0.00
9	2034	$64,990,400.00	$0.00
10	2035	$64,990,400.00	$0.00
11	2036	$64,990,400.00	$0.00
12	2037	$64,990,400.00	$0.00
13	2038	$64,990,400.00	$0.00
14	2039	$64,990,400.00	$0.00
15	2040	$64,990,400.00	$0.00
16	2041	$64,990,400.00	$0.00
17	2042	$64,990,400.00	$0.00

28	Lift Station VFD's	EA	18	$ 50,000.00	$ 900,000.00	1	0	-
29	Lift Station Electrical, Controls, & Lighting	LS	3	$ 500,000.00	$ 1,500,000.00	1	0	-
30	Lift Station Backfill & Compaction	LS	3	$ 65,000.00	$ 195,000.00	1	0	-
31	Lift Station Slide Gates	EA	3	$ 37,500.00	$ 112,500.00	1	0	-
32	Lift Station Miscellaneous Steel	LS	3	$ 80,000.00	$ 240,000.00	1	0	-
33	Lift Station Site Fencing	LS	1	$ 135,000.00	$ 135,000.00	1	0	-
34	Lift Station Ground Cover	LS	1	$ 45,000.00	$ 45,000.00	1	0	-
35	West Basins Turnout Structure Excavation	LS	1	$ 50,000.00	$ 50,000.00	1	0	-
36	West Basins Turnout Reinforced Concrete Structure	LS	1	$ 200,000.00	$ 200,000.00	1	0	-
37	West Basins Structure Backfill & Compaction	LS	1	$ 50,000.00	$ 50,000.00	1	0	-
38	West Basins Turnout Miscellaneous Steel	LS	1	$ 35,000.00	$ 35,000.00	1	0	-
39	West Basins Metering	EA	3	$ 90,000.00	$ 270,000.00	1	0	-
40	West Basins Turnout Slide Gate	EA	3	$ 55,000.00	$ 165,000.00	1	0	-
41	West Basins Turnout Electrical	LS	1	$ 150,000.00	$ 150,000.00	1	0	-
42	Phase II 640 Acres Turnout Structure Excavation	LS	1	$ 55,000.00	$ 55,000.00	2	0	-
43	Phase II 640 Acres Turnout Reinforced Concrete Structure	LS	1	$ 150,000.00	$ 150,000.00	2	0	-
44	Phase II 640 Acres Structure Backfill & Compaction	LS	1	$ 50,000.00	$ 50,000.00	2	0	-
45	Phase II 640 Acres Turnout Miscellaneous Steel	LS	1	$ 40,000.00	$ 40,000.00	2	0	-
46	Phase II 640 Acres Metering	EA	2	$ 90,000.00	$ 180,000.00	2	0	-
47	Phase II 640 Acres Turnout Slide Gate	EA	2	$ 37,500.00	$ 75,000.00	2	0	-
48	Phase II 640 Acres Turnout Electrical	LS	1	$ 150,000.00	$ 150,000.00	2	0	-
49	Phase II 640 Acres Earthwork and Interbasin Structures	LS	1	$ 2,895,200.00	$ 2,895,200.00	2	1	2,895,200.00
50	Phase II 640 Acres Well Drilling, Construction, & Development	EA	6	$ 798,901.00	$ 4,793,406.00	2	0	-
51	Phase II 640 Acres Well Equipping with Pumps, Motors, Discharge Piping, & Electrical	EA	6	$ 777,333.67	$ 4,664,002.00	2	0	-
52	Phase II 640 Acres Well Recovery Pipeline - 16" C905 PVC	LF	2800	$ 70.00	$ 196,000.00	2	0	-
53	Phase II 640 Acres Well Recovery Pipeline - 24" C905 PVC	LF	5500	$ 130.00	$ 715,000.00	2	0	-
54	Phase II 640 Acres Well Recovery Pipeline - 36" C905 PVC	LF	4200	$ 180.00	$ 756,000.00	2	0	-
55	Goose Lake Slough Turnout Structure Excavation	LS	1	$ 60,000.00	$ 60,000.00	1	0	-
56	Goose Lake Slough Turnout Reinforced Concrete Structure	LS	1	$ 650,000.00	$ 650,000.00	1	0	-
57	Goose Lake Slough Turnout Backfill & Compaction	LS	1	$ 60,000.00	$ 60,000.00	1	0	-
58	Goose Lake Slough Turnout Miscellaneous Steel	LS	1	$ 80,000.00	$ 80,000.00	1	0	-
59	Goose Lake Slough Lift Station Pumps - 60 cfs	EA	4	$ 140,000.00	$ 560,000.00	1	0	-
60	Goose Lake Slough Lift Station Motors - 300 hp	EA	4	$ 85,000.00	$ 340,000.00	1	0	-
61	Goose Lake Slough Lift Station Discharge Piping & Appurtenances	LS	1	$ 600,000.00	$ 600,000.00	1	0	-
62	Goose Lake Slough Metering	EA	2	$ 90,000.00	$ 180,000.00	1	0	-
63	Goose Lake Slough Turnout Slide Gate	EA	1	$ 37,500.00	$ 37,500.00	1	0	-
64	Goose Lake Slough Turnout Electrical	LS	1	$ 500,000.00	$ 500,000.00	1	0	-
65	Phase 1 640 Acres Conveyance Pipelines	LF	200	$ 1,500.00	$ 300,000.00	1	0	-
66	Phase 1 640 Acres Discharge Structure	LS	1	$ 55,000.00	$ 55,000.00	1	0	-
67	Goose Lake Slough Check Structure - Earthwork	LS	1	$ 35,000.00	$ 35,000.00	1	0	-
68	Goose Lake Slough Check Structure - Reinforced Concrete	LS	1	$ 200,000.00	$ 200,000.00	1	0	-
69	Goose Lake Slough Check Structure - Rip-Rap	LS	1	$ 30,000.00	$ 30,000.00	1	0	-
70	Goose Lake Slough Check Structure - Appurtenances, Weir Boards	LS	1	$ 25,000.00	$ 25,000.00	1	0	-
71	RRB Intake Canal Interconnection	LS	1	$ 250,000.00	$ 250,000.00	1	0	-
72	Phase 1 640 Acres Earthwork and Interbasin Structures	LS	1	$ 2,895,200.00	$ 2,895,200.00	1	1	2,895,200.00
73	Phase 1 640 Acres Well Drilling, Construction, & Development	EA	6	$ 798,901.00	$ 4,793,406.00	1	0	-
74	Phase 1 640 Acres Well Equipping with Pumps, Motors, Discharge Piping, & Electrical	EA	6	$ 777,333.67	$ 4,664,002.00	1	0	-
75	Phase 1 640 Acres Well Recovery Pipeline - 16" C905 PVC	LF	1350	$ 70.00	$ 94,500.00	1	0	-
76	Phase 1 640 Acres Well Recovery Pipeline - 24" C905 PVC	LF	4200	$ 130.00	$ 546,000.00	1	0	-
77	Phase 1 640 Acres Well Recovery Pipeline - 30" C905 PVC	LF	2800	$ 130.00	$ 364,000.00	1	0	-
78	Phase 1 640 Acres Well Recovery Pipeline - 36" C905 PVC	LF	2800	$ 180.00	$ 504,000.00	1	0	-
79	SCADA Communication & Appurtenances	LS	1	$ 300,000.00	$ 300,000.00	1	0	-

18	2043	$64,990,400.00	$0.00
19	2044	$64,990,400.00	$0.00
20	2045	$64,990,400.00	$0.00
21	2046	$64,990,400.00	$0.00
22	2047	$64,990,400.00	$0.00
23	2048	$64,990,400.00	$0.00
24	2049	$64,990,400.00	$0.00
25	2050	$64,990,400.00	$0.00
26	2051	$64,990,400.00	$0.00
27	2052	$64,990,400.00	$0.00
28	2053	$64,990,400.00	$0.00
29	2054	$64,990,400.00	$0.00
30	2055	$64,990,400.00	$0.00
31	2056	$64,990,400.00	$0.00
32	2057	$64,990,400.00	$0.00
33	2058	$64,990,400.00	$0.00
34	2059	$64,990,400.00	$0.00
35	2060	$64,990,400.00	$0.00
36	2061	$64,990,400.00	$0.00
37	2062	$64,990,400.00	$0.00
38	2063	$64,990,400.00	$0.00
39	2064	$64,990,400.00	$0.00
40	2065	$64,990,400.00	$0.00
41	2066	$64,990,400.00	$0.00
42	2067	$64,990,400.00	$0.00
43	2068	$64,990,400.00	$0.00
44	2069	$64,990,400.00	$0.00
45	2070	$64,990,400.00	$0.00
46	2071	$64,990,400.00	$0.00
47	2072	$64,990,400.00	$0.00
48	2073	$64,990,400.00	$0.00
49	2074	$64,990,400.00	$0.00
50	2075	$64,990,400.00	$64,990,400.00
			$11,636,750.43

Residual value of equipment (NPV of equipment value)->

Contract Cost:				*$ 104,880,716.00*
20% Construction Contingency:				*$ 20,976,143.20*
Property Acquisition - 640 acres	*AC*	*640*	*$ 26,500.00*	*$ 16,960,000.00*
Property Acquisition - 640 acres	*AC*	*640*	*$ 21,500.00*	*$ 13,760,000.00*
Temporary Easement	*AC*	*235*	*$ 3,750.00*	*$ 881,250.00*
Permanent Easement	*AC*	*165*	*$ 10,750.00*	*$ 1,773,750.00*
Aqueduct R/W & Compliance	*LS*	*1*	*$ 25,000.00*	*$ 25,000.00*
Habitat Credit Purchase	*AC*	*200*	*$ 16,000.00*	*$ 3,200,000.00*
Field Cost:				*$ 162,456,859.20*
Non-Contract Costs:				*$ 8,865,000.00*
Total Construction Cost:				***$171,321,859.20***

64,990,400.00

PHASE I WELL FIELD O&M COSTS

Year Type	*Monthly Cost*	*Annual Cost*
Dry Year (Pumping Wells)	$153,216.67	$1,838,600.00
Wet Year (Recharging Water)	$10,816.67	$129,800.00
Idle Year	$5,916.67	$71,000.00

PHASE I CANAL O&M COSTS

Year Type	*Monthly Cost*	*Annual Cost*
Dry Year (Pumping Wells)	$9,658.33	$115,900.00
Wet Year (Recharging Water)	$668,697.90	$8,024,374.86
Idle Year	$5,758.33	$69,100.00

PHASE I GOOSE LAKE SLOUGH TURNOUT O&M COSTS

Year Type	*Monthly Cost*	*Annual Cost*
Dry Year (Pumping Wells)	$1,852.78	$22,233.33
Wet Year (Recharging Water)	$64,052.78	$768,633.33
Idle Year	$1,352.78	$16,233.33

PHASE II WELL FIELD O&M COSTS

Year Type	*Monthly Cost*	*Annual Cost*
Dry Year (Pumping Wells)	$153,216.67	$1,838,600.00
Wet Year (Recharging Water)	$10,816.67	$129,800.00
Idle Year	$5,916.67	$71,000.00

DURATION OF OPERATIONS

Year Type	*2030 Conditions**	*2070 Conditions**
Dry Year (Pumping Wells)	8.42	7.42
Wet Year (Recharging Water)	1.92	2.00
Idle Year	71.67	72.58

*The values utilized for duration of operations for both the 2030 and 2070 condition were adjusted to reflect full years of operations. The data was adjusted from partial-year operations data provided by MBK Engineers. Since the modeled operations from MBK were over a 82 year hydrology, the proportions of idle, dry, and wet years were used to calculate a a weighted average annual O&M cost. This annual value was applied to the 50 years of expected operations to determine an appropriate present value of O&M costs.

WEIGHTED AVERAGE OF O&M COSTS

Year Type	*Total Cost*	*2030 Conditions*	*2070 Conditions*
Dry Year (Pumping Wells)	$3,815,333.33	8.42	7.42
Wet Year (Recharging Water)	$9,052,608.19	1.92	2.00
Idle Year	$227,333.33	71.67	72.58

2030 Condition Weighted Average Annual O&M: $801,900.70

2070 Condition Weighted Average Annual O&M: $767,109.79

O&M COSTS ESCALATED

Operations Year	*Calendar Year*	*Annual O&M Cost (@2030)*	*Annual O&M Cost (@2070)*
-	2015	-	-
-	2016	-	-
-	2017	-	-
-	2018	-	-
-	2019	$0.00	$0.00
-	2020	$0.00	$0.00
-	2021	$0.00	$0.00
-	2022	$0.00	$0.00
-	2023	$0.00	$0.00
-	2024	$0.00	$0.00
-	2025	$0.00	$0.00
1	2026	$801,900.70	$767,109.79
2	2027	$801,900.70	$767,109.79
3	2028	$801,900.70	$767,109.79
4	2029	$801,900.70	$767,109.79
5	2030	$801,900.70	$767,109.79
6	2031	$801,900.70	$767,109.79
7	2032	$801,900.70	$767,109.79
8	2033	$801,900.70	$767,109.79
9	2034	$801,900.70	$767,109.79
10	2035	$801,900.70	$767,109.79
11	2036	$801,900.70	$767,109.79
12	2037	$801,900.70	$767,109.79
13	2038	$801,900.70	$767,109.79
14	2039	$801,900.70	$767,109.79
15	2040	$801,900.70	$767,109.79
16	2041	$801,900.70	$767,109.79
17	2042	$801,900.70	$767,109.79
18	2043	$801,900.70	$767,109.79
19	2044	$801,900.70	$767,109.79
20	2045	$801,900.70	$767,109.79
21	2046	$801,900.70	$767,109.79
22	2047	$801,900.70	$767,109.79
23	2048	$801,900.70	$767,109.79
24	2049	$801,900.70	$767,109.79
25	2050	$801,900.70	$767,109.79
26	2051	$801,900.70	$767,109.79
27	2052	$801,900.70	$767,109.79
28	2053	$801,900.70	$767,109.79
29	2054	$801,900.70	$767,109.79
30	2055	$801,900.70	$767,109.79
31	2056	$801,900.70	$767,109.79
32	2057	$801,900.70	$767,109.79
33	2058	$801,900.70	$767,109.79
34	2059	$801,900.70	$767,109.79
35	2060	$801,900.70	$767,109.79
36	2061	$801,900.70	$767,109.79
37	2062	$801,900.70	$767,109.79
38	2063	$801,900.70	$767,109.79
39	2064	$801,900.70	$767,109.79
40	2065	$801,900.70	$767,109.79
41	2066	$801,900.70	$767,109.79
42	2067	$801,900.70	$767,109.79
43	2068	$801,900.70	$767,109.79
44	2069	$801,900.70	$767,109.79
45	2070	$801,900.70	$767,109.79
46	2071	$801,900.70	$767,109.79
47	2072	$801,900.70	$767,109.79
48	2073	$801,900.70	$767,109.79
49	2074	$801,900.70	$767,109.79
50	2075	$801,900.70	$767,109.79
	NPV of O&M->	**$18,809,076.35**	**$17,993,034.06**

ANNUALIZED REPLACEMENT COST ESTIMATES FROM DJA REPORT

Description	*Annualized Cost*
Canal Replacement	$30,500.00
Lift Station Replacement	$276,813.00
Aqueduct Turnout Replacement	$4,130.00
Phase II Turnout Replacement	$4,130.00
West Basin Turnout Replacement	$6,070.00
Phase I Well Site Replacement	$51,204.00
Goose Lake Slough Turnout Replacement	$22,600.00
Phase II Well Site Replacement	$51,204.00
Total Estimated Annual Replacement->	$446,651.00

RECPLACEMENT COSTS PV CALCULATION

Operations Year	*Calendar Year*	*Replacement Cost*
-	2015	-
-	2016	-
-	2017	-
-	2018	-
-	2019	$0.00
-	2020	$0.00
-	2021	$0.00
-	2022	$0.00
-	2023	$0.00
-	2024	$0.00
-	2025	$0.00
1	2026	$446,651.00
2	2027	$446,651.00
3	2028	$446,651.00
4	2029	$446,651.00
5	2030	$446,651.00
6	2031	$446,651.00
7	2032	$446,651.00
8	2033	$446,651.00
9	2034	$446,651.00
10	2035	$446,651.00
11	2036	$446,651.00
12	2037	$446,651.00
13	2038	$446,651.00
14	2039	$446,651.00
15	2040	$446,651.00
16	2041	$446,651.00
17	2042	$446,651.00
18	2043	$446,651.00
19	2044	$446,651.00
20	2045	$446,651.00
21	2046	$446,651.00
22	2047	$446,651.00
23	2048	$446,651.00
24	2049	$446,651.00
25	2050	$446,651.00
26	2051	$446,651.00
27	2052	$446,651.00
28	2053	$446,651.00
29	2054	$446,651.00
30	2055	$446,651.00
31	2056	$446,651.00
32	2057	$446,651.00
33	2058	$446,651.00
34	2059	$446,651.00
35	2060	$446,651.00
36	2061	$446,651.00
37	2062	$446,651.00
38	2063	$446,651.00
39	2064	$446,651.00
40	2065	$446,651.00
41	2066	$446,651.00
42	2067	$446,651.00
43	2068	$446,651.00
44	2069	$446,651.00
45	2070	$446,651.00
46	2071	$446,651.00
47	2072	$446,651.00
48	2073	$446,651.00
49	2074	$446,651.00
50	2075	$446,651.00
	NPV of Replacement->	**$10,476,475.18**

Irvine Ranch Water District

Operation & Maintenance Cost Estimate

Phase I Well Field Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	Monthly RRBWSD Recovery Charge[5]	DWR Conveyance Cost	Total Monthly Cost	Total Annual Cost if Utilized for 12 Months[6]	Average Cost per Ac-Ft[7]	
Dry Year (Pumping Wells)	$ 8,000.00	$ 144,900.00	$ 316.67	$ -	$ -	$ 153,216.67	$ 1,838,600.00	$ 73.54	95%
Wet Year (Recharging Wat	$ 9,000.00	$ 1,500.00	$ 316.67	$ -	$ -	$ 10,816.67	$ 88,150.00	$ 1.76	14%
Idle Year	$ 4,100.00	$ 1,500.00	$ 316.67	$ -	$ -	$ 5,916.67	$ 71,000.00		25%

1. Rosedale's operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent
2. Cost includes one additional piece of equipment for property
3. Monthly PG&E cost to operate(6) 400 hp wells
4. Average monthly cost for cellular service to (6) Mission Units
5. Assumed 35 cfs flow rate for a 30 day month for a total of 2,083 ac-ft of water recovered per month or 25,000 ac-ft/yr
6. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 3.5 months of recharging 56,250 ac-ft and 8.5 months at idle costs.
7. Dry year pumping 25,000 ac-ft and a wet year recharging 56,250 ac-ft.

Phase I Canal Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	Monthly RRBWSD Recovery Charge	DWR Conveyance Cost[5]	Total Monthly Cost	Total Annual Cost[6]	Average Cost per Ac-Ft[7]	
Dry Year (Pumping Wells)	$ 8,000.00	$ 1,500.00	$ 158.33	$ -	$ -	$ 9,658.33	$ 115,900.00	$ 4.64	16%
Wet Year (Recharging Wat	$ 9,000.00	$ 197,486.00	$ 158.33	$ -	$ 462,053.57	$ 668,697.90	$ 2,389,388.50	$ 23.89	30%
Idle Year	$ 4,100.00	$ 1,500.00	$ 158.33	$ -	$ -	$ 5,758.33	$ 69,100.00		26%

1. Rosedale's operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent
2. Cost includes one additional piece of equipment for canal
3. Monthly PG&E cost to operate (18) 300 hp lift pumps moving 500 cfs, Total 112,500 ac-ft / year
4. Average monthly cost for cellular service to (3) Mission Units
5. Article 21 water cost estimated at $23.00/AF for 112,500 ac-ft, however 37.5% of DWR water is already in the IRWD
6. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 3.5 months of conveying up to 112,500 ac-ft and 8.5 months at idle costs.
7. Dry year conveying 25,000 ac-ft to aqueduct and a wet year recharging 112,500 ac-ft.

Phase I Goose Lake Slough Turnout Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[3]	Monthly RRBWSD Recovery Charge	DWR Conveyance Cost	Total Monthly Cost	Total Annual Cost[4]	Average Cost per Ac-Ft[5]
Dry Year (Pumping Wells)	$ 1,500.00	$ 300.00	$ 52.78	$ -	$ -	$ 1,852.78	$ 22,233.33	$ 0.89
Wet Year (Recharging Wat	$ 4,000.00	$ 60,000.00	$ 52.78	$ -	$ -	$ 64,052.78	$ 235,683.33	$ 4.71
Idle Year	$ 1,000.00	$ 300.00	$ 52.78	$ -	$ -	$ 1,352.78	$ 16,233.33	

1. Rosedale's operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent
2. Monthly PG&E cost to operate (4) 300 hp lift pumps moving 240 cfs, Total 50,000 ac-ft / year
3. Average monthly cost for cellular service to (1) Mission Units
4. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 3.5 months of recharging 556,250 ac-ft and 8.5 months at idle costs.
5. Dry year pumping 25,000 ac-ft and a wet year recharging 56,250 ac-ft.

Phase II Well Field Operation Costs

Type of Year	Monthly RRBWSD Operation Cost[1,2]	Monthly PG&E Cost[3]	Monthly Mission Unit Cost[4]	Monthly RRBWSD Recovery Charge[5]	DWR Conveyance Cost	Total Monthly Cost	Total Annual Cost if Utilized for 12 Months[6]	Average Cost per Ac-Ft[7]
Dry Year (Pumping Wells)	$ 8,000.00	$ 144,900.00	$ 316.67	$ -	$ -	$ 153,216.67	$ 1,838,600.00	$ 73.54
Wet Year (Recharging Wat	$ 9,000.00	$ 1,500.00	$ 316.67	$ -	$ -	$ 10,816.67	$ 88,150.00	$ 1.76
Idle Year	$ 4,100.00	$ 1,500.00	$ 316.67	$ -	$ -	$ 5,916.67	$ 71,000.00	

1. Rosedale's operation cost includes pond maintenance, oil for reservoirs, field staff time, equipment cost, weed control cost, rodent
2. Cost includes one additional piece of equipment for property
3. Monthly PG&E cost to operate(6) 400 hp wells
4. Average monthly cost for cellular service to (6) Mission Units
5. Assumed 35 cfs flow rate for a 30 day month for a total of 2,083 ac-ft of water recovered per month or 25,000 ac-ft/yr
6. Dry year annual cost based on operating 12 months out of the year. Wet year annual cost based on 3.5 months of recharging 56,250 ac-ft and 8.5 months at idle costs.
7. Dry year pumping 25,000 ac-ft and a wet year recharging 56,250 ac-ft.

Irvine Ranch Water District								
Canal Alignment along KWB to West Basins							2025	910000
Item N	Item Description	Unit	Quantity	Unit Cost	Extended Cost	Phase	Year	
1	Mobilization, Demobilization, & Cleanup	LS	1	$ 1,820,000.00	$ 1,820,000.00	1	2021	910000
2	Aqueduct Cofferdam & Dewatering	LS	1	$ 250,000.00	$ 250,000.00	1	2022	
3	Aqueduct Turnout Excavation	LS	1	$ 55,000.00	$ 55,000.00	1	2022	
4	Aqueduct Reinforced Concrete Structure	LS	1	$ 200,000.00	$ 200,000.00	1	2022	
5	Aqueduct Backfill and Compaction	LS	1	$ 50,000.00	$ 50,000.00	1	2022	
6	Aqueduct Miscellaneous Steel	LS	1	$ 55,000.00	$ 55,000.00	1	2022	
7	Aqueduct Metering	EA	2	$ 90,000.00	$ 180,000.00	1	2022	
8	Aqueduct Slide Gate & Actuator	EA	2	$ 37,500.00	$ 75,000.00	1	2022	
9	Aqueduct Electrical, Controls, & Lighting	LS	1	$ 300,000.00	$ 300,000.00	1	2022	
10	Aqueduct Liner Repair	LS	1	$ 20,000.00	$ 20,000.00	1	2022	
11	Canal Earthwork	CY	1,650,000	$ 10.00	$ 16,500,000.00	1	2022	
12	Concrete Canal Lining	SF	2,640,000	$ 6.00	$ 15,840,000.00	1	2022	
13	Canal Appurtenances	LS	1	$ 250,000.00	$ 250,000.00	1	2022	
14	Canal Fencing	LF	110,000	$ 7.50	$ 825,000.00	1	2022	
15	Levee Road Aggregate Base Ground Cover	LS	1	$ 650,000.00	$ 650,000.00	1	2022	
16	East Canal Crossing Siphon & Appurtenances	LS	1	$ 1,000,000.00	$ 1,000,000.00	1	2022	
17	Main Canal Crossing Siphon & Appurtenances	LS	1	$ 500,000.00	$ 500,000.00	1	2022	
18	WKWD Pipeline Crossing Siphon & Appurtenances	LS	1	$ 250,000.00	$ 250,000.00	1	2022	
19	Stockdale Hwy Crossing Siphon & Appurtenances	LS	1	$ 1,000,000.00	$ 1,000,000.00	1	2022	
20	I-5 Crossing Siphon & Appurtenances	LS	1	$ 1,500,000.00	$ 1,500,000.00	1	2022	
21	Farm Road Siphon & Appurtenances	EA	3	$ 600,000.00	$ 1,800,000.00	1	2022	
22	84" Siphon Piping	LF	10,720	$ 1,500.00	$ 16,080,000.00	1	2022	
23	Lift Station Excavation	LS	3	$ 60,000.00	$ 180,000.00	1	2023	
24	Lift Station Reinforced Concrete Structure	LS	3	$ 650,000.00	$ 1,950,000.00	1	2023	
25	Lift Station Pumps - 67 cfs to 83 cfs	EA	18	$ 150,000.00	$ 2,700,000.00	1	2023	
26	Lift Station Motors - 300 hp to 400 hp	EA	18	$ 95,000.00	$ 1,710,000.00	1	2023	
27	Lift Station Discharge Piping & Appurtenances	LS	3	$ 750,000.00	$ 2,250,000.00	1	2023	
28	Lift Station VFD's	EA	18	$ 50,000.00	$ 900,000.00	1	2023	
29	Lift Station Electrical, Controls, & Lighting	LS	3	$ 500,000.00	$ 1,500,000.00	1	2023	
30	Lift Station Backfill & Compaction	LS	3	$ 65,000.00	$ 195,000.00	1	2023	
31	Lift Station Slide Gates	EA	3	$ 37,500.00	$ 112,500.00	1	2023	
32	Lift Station Miscellaneous Steel	LS	3	$ 80,000.00	$ 240,000.00	1	2023	
33	Lift Station Site Fencing	LS	1	$ 135,000.00	$ 135,000.00	1	2023	
34	Lift Station Ground Cover	LS	1	$ 45,000.00	$ 45,000.00	1	2023	
35	West Basins Turnout Structure Excavation	LS	1	$ 50,000.00	$ 50,000.00	1	2024	
36	West Basins Turnout Reinforced Concrete Structure	LS	1	$ 200,000.00	$ 200,000.00	1	2024	
37	West Basins Structure Backfill & Compaction	LS	1	$ 50,000.00	$ 50,000.00	1	2024	
38	West Basins Turnout Miscellaneous Steel	LS	1	$ 35,000.00	$ 35,000.00	1	2024	
39	West Basins Metering	EA	3	$ 90,000.00	$ 270,000.00	1	2024	
40	West Basins Turnout Slide Gate	EA	3	$ 55,000.00	$ 165,000.00	1	2024	
41	West Basins Turnout Electrical	LS	1	$ 150,000.00	$ 150,000.00	1	2024	
42	Phase II 640 Acres Turnout Structure Excavation	LS	1	$ 55,000.00	$ 55,000.00	2	2024	
43	Phase II 640 Acres Turnout Reinforced Concrete Structure	LS	1	$ 150,000.00	$ 150,000.00	2	2024	
44	Phase II 640 Acres Structure Backfill & Compaction	LS	1	$ 50,000.00	$ 50,000.00	2	2024	
45	Phase II 640 Acres Turnout Miscellaneous Steel	LS	1	$ 40,000.00	$ 40,000.00	2	2024	
46	Phase II 640 Acres Metering	EA	2	$ 90,000.00	$ 180,000.00	2	2024	
47	Phase II 640 Acres Turnout Slide Gate	EA	2	$ 37,500.00	$ 75,000.00	2	2024	
48	Phase II 640 Acres Turnout Electrical	LS	1	$ 150,000.00	$ 150,000.00	2	2024	

49	Phase II 640 Acres Earthwork and Interbasin Structures	LS	1	$ 2,895,200.00	$ 2,895,200.00	2	2023
50	Phase II 640 Acres Well Drilling, Construction, & Development	EA	6	$ 798,901.00	$ 4,793,406.00	2	2023
51	Phase II 640 Acres Well Equipping with Pumps, Motors, Discharge Piping, & Electrical	EA	6	$ 777,333.67	$ 4,664,002.00	2	2024
52	Phase II 640 Acres Well Recovery Pipeline - 16" C905 PVC	LF	2800	$ 70.00	$ 196,000.00	2	2024
53	Phase II 640 Acres Well Recovery Pipeline - 24" C905 PVC	LF	5500	$ 130.00	$ 715,000.00	2	2024
54	Phase II 640 Acres Well Recovery Pipeline - 36" C905 PVC	LF	4200	$ 180.00	$ 756,000.00	2	2024
55	Goose Lake Slough Turnout Structure Excavation	LS	1	$ 60,000.00	$ 60,000.00	1	2023
56	Goose Lake Slough Turnout Reinforced Concrete Structure	LS	1	$ 650,000.00	$ 650,000.00	1	2023
57	Goose Lake Slough Turnout Backfill & Compaction	LS	1	$ 60,000.00	$ 60,000.00	1	2023
58	Goose Lake Slough Turnout Miscellaneous Steel	LS	1	$ 80,000.00	$ 80,000.00	1	2023
59	Goose Lake Slough Lift Station Pumps - 60 cfs	EA	4	$ 140,000.00	$ 560,000.00	1	2023
60	Goose Lake Slough Lift Station Motors - 300 hp	EA	4	$ 85,000.00	$ 340,000.00	1	2023
61	Goose Lake Slough Lift Station Discharge Piping & Appurtenances	LS	1	$ 600,000.00	$ 600,000.00	1	2023
62	Goose Lake Slough Metering	EA	2	$ 90,000.00	$ 180,000.00	1	2023
63	Goose Lake Slough Turnout Slide Gate	EA	1	$ 37,500.00	$ 37,500.00	1	2023
64	Goose Lake Slough Turnout Electrical	LS	1	$ 500,000.00	$ 500,000.00	1	2023
65	Phase 1 640 Acres Conveyance Pipelines	LF	200	$ 1,500.00	$ 300,000.00	1	2023
66	Phase 1 640 Acres Discharge Structure	LS	1	$ 55,000.00	$ 55,000.00	1	2023
67	Goose Lake Slough Check Structure - Earthwork	LS	1	$ 35,000.00	$ 35,000.00	1	2023
68	Goose Lake Slough Check Structure - Reinforced Concrete	LS	1	$ 200,000.00	$ 200,000.00	1	2023
69	Goose Lake Slough Check Structure - Rip-Rap	LS	1	$ 30,000.00	$ 30,000.00	1	2023
70	Goose Lake Slough Check Structure - Appurtenances, Weir Boards	LS	1	$ 25,000.00	$ 25,000.00	1	2023
71	RRB Intake Canal Interconnection	LS	1	$ 250,000.00	$ 250,000.00	1	2023
72	Phase 1 640 Acres Earthwork and Interbasin Structures	LS	1	$ 2,895,200.00	$ 2,895,200.00	1	2022
73	Phase 1 640 Acres Well Drilling, Construction, & Development	EA	6	$ 798,901.00	$ 4,793,406.00	1	2022
74	Phase 1 640 Acres Well Equipping with Pumps, Motors, Discharge Piping, & Electrical	EA	6	$ 777,333.67	$ 4,664,002.00	1	2022
75	Phase 1 640 Acres Well Recovery Pipeline - 16" C905 PVC	LF	1350	$ 70.00	$ 94,500.00	1	2022
76	Phase 1 640 Acres Well Recovery Pipeline - 24" C905 PVC	LF	4200	$ 130.00	$ 546,000.00	1	2022
77	Phase 1 640 Acres Well Recovery Pipeline - 30" C905 PVC	LF	2800	$ 130.00	$ 364,000.00	1	2022
78	Phase 1 640 Acres Well Recovery Pipeline - 36" C905 PVC	LF	2800	$ 180.00	$ 504,000.00	1	2022
79	SCADA Communication & Appurtenances	LS	1	$ 300,000.00	$ 300,000.00	1	2022
	Contract Cost:				*$ 104,880,716.00*		
	20% Construction Contingency:				*$ 20,976,143.20*		2021
	Property Acquisition - 640 acres	*AC*	*640*	*$ 26,500.00*	*$ 16,960,000.00*		2019
	Property Acquisition - 640 acres	*AC*	*640*	*$ 21,500.00*	*$ 13,760,000.00*		2019
	Temporary Easement	*AC*	*235*	*$ 3,750.00*	*$ 881,250.00*		2020
	Permanent Easement	*AC*	*165*	*$ 10,750.00*	*$ 1,773,750.00*		2020
	Aqueduct R/W & Compliance	*LS*	*1*	*$ 25,000.00*	*$ 25,000.00*		2020
	Habitat Credit Purchase	*AC*	*200*	*$ 16,000.00*	*$ 3,200,000.00*		2020
	Field Cost:				*$ 162,456,859.20*		
	Non-Contract Costs:				*$ 8,865,000.00*		2019
	Total Construction Cost:				***$171,321,859.20***		

Benefit Calculation, Monetization, and Resiliency Tab

A.10 Cost Allocation

Provide a proposed allocation of total project costs to all project beneficiaries, including the Program, and an explanation of how the allocation was calculated, consistent with TR section 8 and section 6004(a)(7) of the regulations. If this information is included in another attachment, identify the location.

File: Tab 6-A10_IRWD_Allocation of Cost_FINAL.pdf

Tab 6

A.10 Provide a proposed allocation of total project costs to all beneficiaries, including the Program and an explanation of how the allocation was calculated.

The allocation of project costs and explanation is provided in the Benefit Calculation, Montetization and Resiliency Tab, Attachment 9 – Benefit and Cost Analysis.

Benefit Calculation, Monetization, and Resiliency Tab

A.11 Physical and Economic Summary Table

Attach the Physical and Economic Benefits Summary tables. These tables can be downloaded from the Commission website and uploaded with the application. See regulations section 6003(a)(1)(N).

File: Tab 6-A11_IRWD_Physical and Economic Benefits Summary Tables_FINAL.xlsx

Physical and Economic Benefits Summary

November 2016

Part 1. Physical and Economic Benefits. Repeat this block for each category of public or non-public benefit quantified							
Enter Benefit Category here [1]	Non-Public Benefit						
Repeat Rows 1 through 4 for every quantified physical benefit in this benefit category							
1. Physical Benefit Name: Water Supply Benefits				Notes: 2/3 of non-ecosystem water allocated to water supply. Weighted by hydrology and costs of water for ag and urban. See Benefit Calculation Tab Attachment 3 and Attachment 5 for detail.			
2. Physical Benefit Measurement Units: Acre-Feet				Notes:			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		3015	0	3015	2747	0	2747
4. Annual Economic Benefit, 2015 $ Million/Yr		$ 1,157,725	$ -	$ 1,157,725	$ 2,266,405	$ -	$ 2,266,405
1. Physical Benefit Name: Groundwater Level Improvement				Notes:			
2. Physical Benefit Measurement Units: Acre-Feet				Notes:			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		385.7	0	385.7	351.4	0	351.4
4. Annual Economic Benefit, 2015 $ Million/Yr		$ 103,146	$ -	$ 103,146	$ 223,401	$ -	$ 223,401
5. Total Annual Monetized Benefit for the Category (sum of all row 4s.)		$ 1,260,871	$ -	$ 1,260,871	$ 2,489,806	$ -	$ 2,489,806

Enter Benefit Category here [1]	Ecosystem Benefit						
Repeat Rows 1 through 4 for every quantified physical benefit in this benefit category							
1. Physical Benefit Name:Ecosystem				Notes:			
2. Physical Benefit Measurement Units: Number of Salmon Surviving to Adulthood				Notes: Spring Run Chinook and Winter Run Chinook over 50 year period. See Physical Public Benefit Tab Attachment 2 and Benefit Calculation Tab Attachment 3 and Attachment 5 for details.			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		545	0	545	460	0	460
4. Annual Economic Benefit, 2015 $ Million/Yr		$ 511,348	$ -	$ 511,348	$ 1,028,415	$ -	$ 1,028,415
1. Physical Benefit Name: Incidental wetland habitat				Notes:			
2. Physical Benefit Measurement Units: Acres				Notes: Probability of incidental wetland 20% over 50 year period			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		1280	0	1280	1280	0	1280
4. Annual Economic Benefit, 2015 $ Million/Yr		$ 918,000	$ -	$ 918,000	$ 1,697,400	$ -	$ 1,697,400

5. Total Annual Monetized Benefit for the Category (sum of all row 4s.)		$ 1,429,348	$ -	$ 1,429,348	$ 2,725,815	$ -	$ 2,725,815

Enter Benefit Category here [1]	Emergency Response						
Repeat Rows 1 through 4 for every quantified physical benefit in this benefit category							
1. Physical Benefit Name: Extended Drought				Notes:			
2. Physical Benefit Measurement Units: Acre-Feet				Notes: 1/3 of non-ecosystem water allocated to emergency drought water supply. Weighted by hydrology and costs of water for ag and urban, and incorporates 7% probability of extended drought. See Benefit Calculation Tab Attachment 3 and Attachment 5 for detail.			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		1485	0	1485	1353	0	1353
4. Annual Economic Benefit, 2015 $ Million/Yr		$ 125,022	$ -	$ 125,022	$ 253,808	$ -	$ 253,808
1. Physical Benefit Name: Delta Failure				Notes: WSIP Technical Guidance stated that Delta Failure should be assumed to occur once, 30 years into project period - 2056 for this project. The equivalent alternative cost-based benefit in 2070 that would yield the same NPV as an event in 2056 is given below.			
2. Physical Benefit Measurement Units: Acre-Feet				Notes:			
		2030			2070		
	Enter Page Number from Application	With Project	Without Project	Difference	With Project	Without Project	Difference
3. Net Physical Benefit Measurement[2]		20000	0	20000	20000	0	20000
4. Annual Economic Benefit, 2015 $ Million/Yr					$ 272,257,400	$ -	$ 272,257,400
5. Total Annual Monetized Benefit for the Category (sum of all row 4s.)		$ 125,022	$ -	$ 125,022	$ 272,511,208	$ -	$ 272,511,208

[1] Enter one of these benefits: Ecosystem, Water Quality, Flood Control, Emergency Response, Recreation, or Non-public benefit

[2] Net of any non-mitigated physical effects

Part 2. Total Economic Net Benefits and Allocated Cost by Benefit Category in 2015 $ Million

Sum of annual economic net benefits by type	Enter Page Number from Application	Ecosystem	Water Quality	Flood Control	Emergency Response	Recreation	Total Public Benefits	Non-Public Benefits	Total public and non-public benefits[1]
Sum of 2030 benefits from Part 1, Row 5		$ 1,429,348			$ 125,022		$ 1,554,370	$ 1,260,871	$ 2,815,241
Sum of 2070 benefits from Part 1, Row 5		$ 2,725,815			$ 272,511,208		$ 275,237,023	$ 2,489,806	$ 277,726,829
Present Value of Benefits over Planning Horizon using 3.5% Discount Rate		$ 60,774,714			$ 64,986,550		$ 125,761,264	$ 52,041,635	$ 177,802,899
Present Value of Total Project Costs Allocated to each Benefit Category*		$ 28,908,475			$ 30,911,903		$ 59,820,378	$ 59,820,378	$ 119,640,756
Capital Costs Allocated to Each Benefit Category		$ 42,830,465			$ 42,830,465		$ 85,660,930	$ 85,660,930	$ 171,321,859
Total Requested Program Cost Share		$ 42,830,465			$ 42,830,465		$ 85,660,930		

[1] Present value of total public and non-public benefits, total project costs, and total Program funding request must match numbers in Part 3

Part 3. Present Value of Project Costs, Cost-Effectiveness Measure, and Public Benefit Ratio, Million 2015 $ Present Value

	Enter Page Number of Application	2015 $ Million Present Value
Project Costs		
Capital costs as defined in Program regulations*		$ 90,355,204
Interest during construction		$ -
Replacement costs		$ 10,476,475
Future environmental mitigation or compliance obligation costs		$ -
Operations, maintenance and repair (OM&R) costs		$ 18,809,076
Other costs (describe)		$ -
Present Value of Total Project Costs[1]		$ 119,640,756
Present Value of Cost of Least-Cost Alternative that Provides the Same Total Physical Benefits		$ 177,802,900
Present Value of All Public and Non-public Benefits[1]		$ 177,802,899
Ratio of Present Value of Total Monetized Net Benefits to the Total Project Costs		1.49
Present Value of Public Benefits[1]		$ 125,761,264
Total Requested Program Cost Share[1]		$ 85,660,930
Public Benefit Ratio: Ratio of Present Value of Monetized Net Public Benefits to the Total Requested Program Cost Share		1.47

[1] Must match numbers in Part 2

*As part of the economic analysis, capital costs were adjusted for calculation of the benefit-cost ratio. Residual

Benefit Calculation, Monetization, and Resiliency Tab

A.12 Uncertainty Analysis:

Attach the uncertainty analysis. See regulations section 6004(a)(8).

File: Tab 6-A12_IRWD_Uncertainty Analysis_.FINAL.pdf

Tab 6

A.12 Attach the uncertainty analysis. See regulations section 6004(a)(8).

The Kern Fan Groundwater Storage Project's water supply analysis included an uncertainty analysis that evaluated project yields with 2030 and 2070 climate change, a 5 year drought with the 2070 climate change and the California WaterFix. For a detailed description of the approach and results of this uncertainty analysis see Feasibility and Implementation Risk Tab, Attachment 1 (MBK Engineers, August 10, 2017)

Program Requirements Tab

Program Requirements Tab

A.1 Delta or Tributary Measurable Improvement:

What measurable improvements to the Delta ecosystem or tributary to the Delta does the project provide? Where is the location of the improvement? If the project is not within the watershed of the Delta, what specific water rights or water contracts would be created or amended to ensure public benefits to the Delta ecosystem? Provide supporting documentation of the willingness of these water right or water contract holders to enter into such contracts or amendments. Explain how these changes would assure measurable improvements to the Delta ecosystem. See regulations section 6003(a)(1)(L).

Files: Tab 7_A1_IRWD_Delta Improvements_FINAL.pdf,
Tab 7_A1 Dudley RidgeWater District Letter.pdf

Tab 7

A1. Documentation, analytical methods and results that support, substantiate, and quantify all public and non-public claimed physical benefits, as further defined in section 6004, including measurable improvements to the Delta ecosystem or to the tributaries to the Delta. If a project is not within the watershed of the Delta, the applicant shall identify specific water rights or water contracts that would be created or amended to ensure public benefits to the Delta ecosystem and shall provide supporting documentation of the parties' willingness to enter into such contracts or amendments including an explanation of how these changes would assure measureable improvements to the Delta ecosystem. Section 6003(a)(1)(L). (4,000 characters max)

Analyses of the public and non-public benefits of the Kern Fan Integrated Groundwater Storage Project (Project) were conducted that show measureable ecosystem benefits for the Sacramento-San Joaquin Delta (Delta), Sacramento River, and Feather River. The Project will be located in Kern County and operated to support the State Water Project (SWP). During wet years, the Project will recharge and store, using Project facilities, up to 100,000 acre-feet per year (AFY) of unallocated SWP Article 21 water into the Kern County groundwater basin. These deliveries would be made on behalf of Irvine Ranch Water District (IRWD) as a landowner in Dudley Ridge Water District (DRWD) and Rosedale-Rio Bravo Water Storage District (Rosedale) as a sub-unit of the Kern County Water agency. During dry years and critical dry years, IRWD as a land owner in DRWD, DRWD and Rosedale would rely on the stored flows to provide non-public water supply benefits that improve water supply reliability.

Approximately 25 percent of the stored water would be held as <u>SWP system</u> water that would be used for ecosystem benefits purposes. This 25 percent of the water would be made available for ecosystem benefits through 1-for-1 exchanges that would occur when the water is extracted from the ground. The 1-for-1 exchanges would result in Table A water, that is held in Lake Oroville, being reclassified as SWP system water and the SWP system water being extracted from the ground, being reclassified as Table A water. The Table A water would be used to meet DRWD and Rosedale SWP Table A demands either directly or through operational exchanges. The SWP system water left in Oroville Reservoir would then be used to provide short-term ecosystem pulse flows to generate ecosystem benefits by improving habitat for fish in the Feather and Sacramento Rivers and Delta. The 1-for-1 exchanges would result in the water extracted from the ground and used by DRWD and Rosedale being classified as Table A water and the water left in Oroville Reservoir for use in providing ecosystem benefits being classified as SWP system water.

The California Department of Water Resources State Water Project Analysis Office (SWPAO) and SWP operations staff have been consulted with respect to the proposed 1-for-1 exchanges that would make water available for the public ecosystem benefits that would be derived from the pulse flows. SWPAO has identified that uncertainties and contractual issues would need to be worked through with the project partners. This work would begin immediately should the CWC select the Project for funding. It is expected that these efforts would result in a Coordinated Operating Agreement that would be executed between the project partners and DWR. The Project would not require any changes in water rights or State Water Project Contracts. The storage and recovery of water stored in the Project as described above would not impact groundwater rights or entitlements.

As project proponents that are submitting this application for WSIP funding, IRWD and Rosedale are expressing their willingness to participate in the project as a funding partner and as a party to the Coordinated Operating Agreement. Attached with the application is a letter from DRWD expressing its support for the project and its willingness to consider terms for participating in the project as a party to the Coordinated Operating Agreement.

DUDLEY RIDGE WATER DISTRICT

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JOSEPH D HUGHES

August 7, 2017

Joe Yun
Executive Officer
California Water Commission
P O. Box 942836
Sacramento, California 94236-0001

Subject: Support for the Proposed Kern Fan Groundwater Storage Project

Dear Mr. Yun:

Dudley Ridge Water District ("DRWD") has reviewed the proposal for the development of the Kern Fan Water Storage Project that Irvine Ranch Water District ("IRWD") and Rosedale-Rio Bravo Water Storage District ("Rosedale") are submitting to the California Water Commission ("CWC") for Proposition 1 funding through the Water Storage Investment Program. The proposed project would develop regional conveyance and water banking facilities in the Kern Fan Area to capture and store unallocated Article 21 water from the State Water Project during conditions when surface water is abundant for groundwater storage and later use in water short years.

This project is designed to improve the operation of the State water system and provide public ecosystem benefits in the Sacramento-San Joaquin River Delta and its tributaries while providing water supply benefits to DRWD, to IRWD as a landowner in DRWD, and to Rosedale as a sub-unit of the Kern County Water Agency. The project will also provide benefits to the Kern Fan Area by increasing regional groundwater levels which will benefit the region in addressing the requirements of the Sustainable Groundwater Management Act.

Should the proposed project be selected for funding by the CWC, DRWD is willing to consider terms for participation in the project as described in the project proposal. DRWD supports the proposed project concept and looks forward to the opportunity of working with IRWD and Rosedale in the development of this innovative and cost-effective water storage program.

Respectfully,

William D. Phillimore,
President

cc: DRWD Board of Directors
Dale Melville, DRWD
Paul Weghorst, IRWD

C:\Users\william.phillimore\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\MX3OC3HV\ltr of interest to CWC 8-2017 doc

Eric Averett, Rosedale-Rio Bravo WSD

Program Requirements Tab

A.2 Cost Effectiveness

Provide documentation indicating the proposed project is cost-effective. If there is at least one feasible alternative means of providing the same amount or more of the total public and non-public physical benefits as provided by the proposed project, calculate, display and document the least-cost of these alternative means and justify the proposed project by comparison.

File: Tab 7_A2_IRWD_Cost-Effectiveness_FINAL.pdf

Tab 7

A2. Provide documentation indicating the project is cost-effective. If there is at least one feasible alternative means of providing the total benefits, calculate, display and document the least-cost of these alternative means. Justify the proposed project by comparison.

M. Cubed provided an economic analysis using the alternative cost method to achieve the same level of total benefits. The methodology, based on the WSIP Technical Guidance, is documented in M. Cubed's Technical Memorandum, dated August 13, 2017, and is provided in the Benefit Calculation, Monetization and Resiliency Tab, Attachment 3. All of the supporting data, assumptions and calculations are provided in the Benefit Calculation, Monetization and Resiliency Tab, Attachment 5. The present value of the least-cost alternative that achieves the total project benefits is estimated at $177.8 million.

The project costs were based on the study by Dee Jaspar and Associates included in the Feasibility and Risk Tab, Attachment 1. All of the cost assumptions and calculations are provided in the Benefit Calculation, Monetization and Resiliency Tab, Attachment 9. The present values of the monetized benefits calculated by M. Cubed, were incorporated into the benefit cost analysis in order to calculate both the public benefit ratio and benefit-cost ratio. The calculated public benefit ratio and benefit-cost ratio was determined to be 1.47 and 1.49, respectively. Both of these ratios demonstrate that the expected benefits of the project exceed the expected costs, and therefore the project is cost-effective.

It should be noted that the allocated calculated benefit to cost share ratio for IRWD and Rosedale is below 1.0. IRWD and Rosedale would seek to develop both state wide and local partnerships to leverage the use of the Project facilities when not needed for Project purposes, which would result in an increased benefit to IRWD and Rosedale in excess of the benefits demonstrated for the Kern Fan Groundwater Storage Project, as discussed in Tab 3, Question 6. Since IRWD and Rosedale expect additional future benefits from other partnerships, the stated funding levels in the application are considered by both of the agencies to be cost-effective.