ANDERSON COTTONWOOD IRRIGATION DISTRICT

Dan Woolery, *President, Division 3*
James Rickert, *Vice President, Division 5*
Ronnean Lund, *Director, Division 1*
Audie Butcher, *Director, Division 2*
Ivar Amen, *Director, Division 4*
Daniel Ruiz, *General Manager*

Special Board Meeting

Agenda

March 25, 2025, 10:00 a.m.

1887 Howard Street, Anderson (Council Chambers)

1. **Call To Order**
2. **Flag Salute**
3. **Public Participation**

   Time set aside for members of the public that wish to address the Board regarding matters of the District within the jurisdiction of the Board. Individuals are requested to limit comments to a maximum of three minutes.
4. **Business Items**
   a. Update on the Bay-Delta Water Quality Control Plan and Healthy Rivers and Landscapes (Thad Bettner, SRSC Inc. to Present)
   b. Review and Discuss Draft Feasibility Report on ACID Water Supply and Fisheries Resiliency Project (Jeremy Kellog, PE, Jacobs to Present)
   c. Review and Approve Change Order 2 for Offseason Capital Improvement Project
5. **Closed Session**
   a. **Conference with Legal Counsel – Anticipated Litigation (Government Code § 54956.9(d)(2) or (3) One Case**
6. **Adjourn**

Sacramento River
SETTLEMENT CONTRACTORS

Thaddeus Bettner / Executive Director

SWRCB WQCP and Healthy Rivers and Landscapes Update

Anderson-Cottonwood Irrigation District

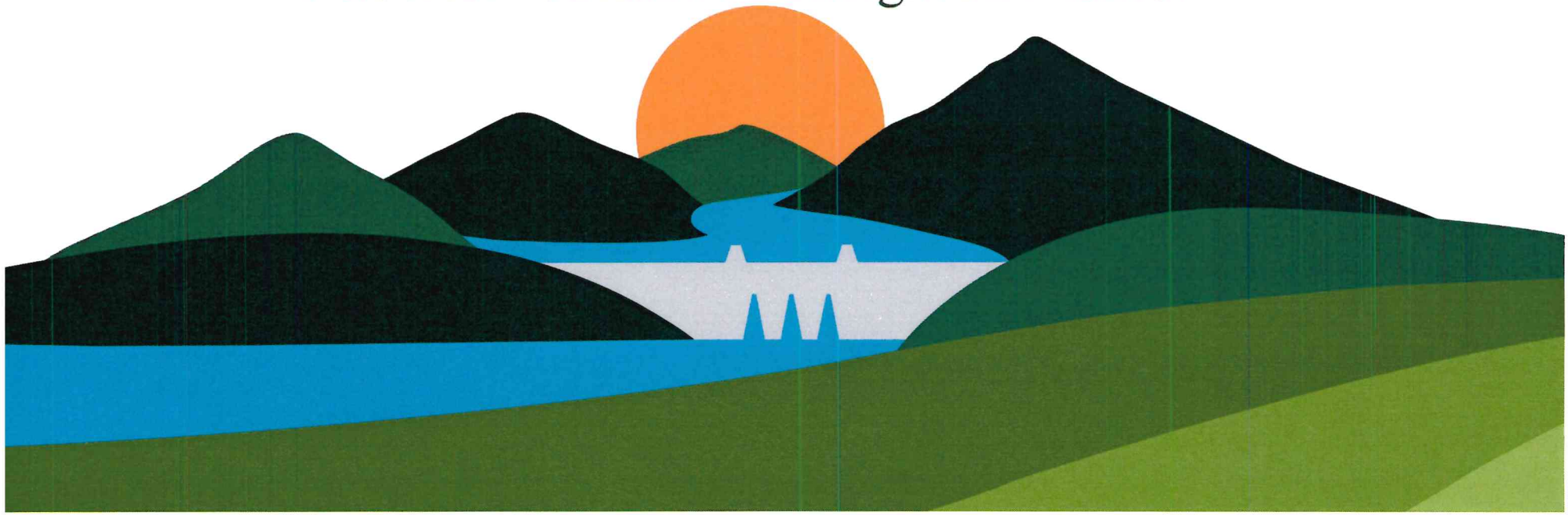



Photo by Thaddeus Bettner March 2025

Our Objective with Current Agreements

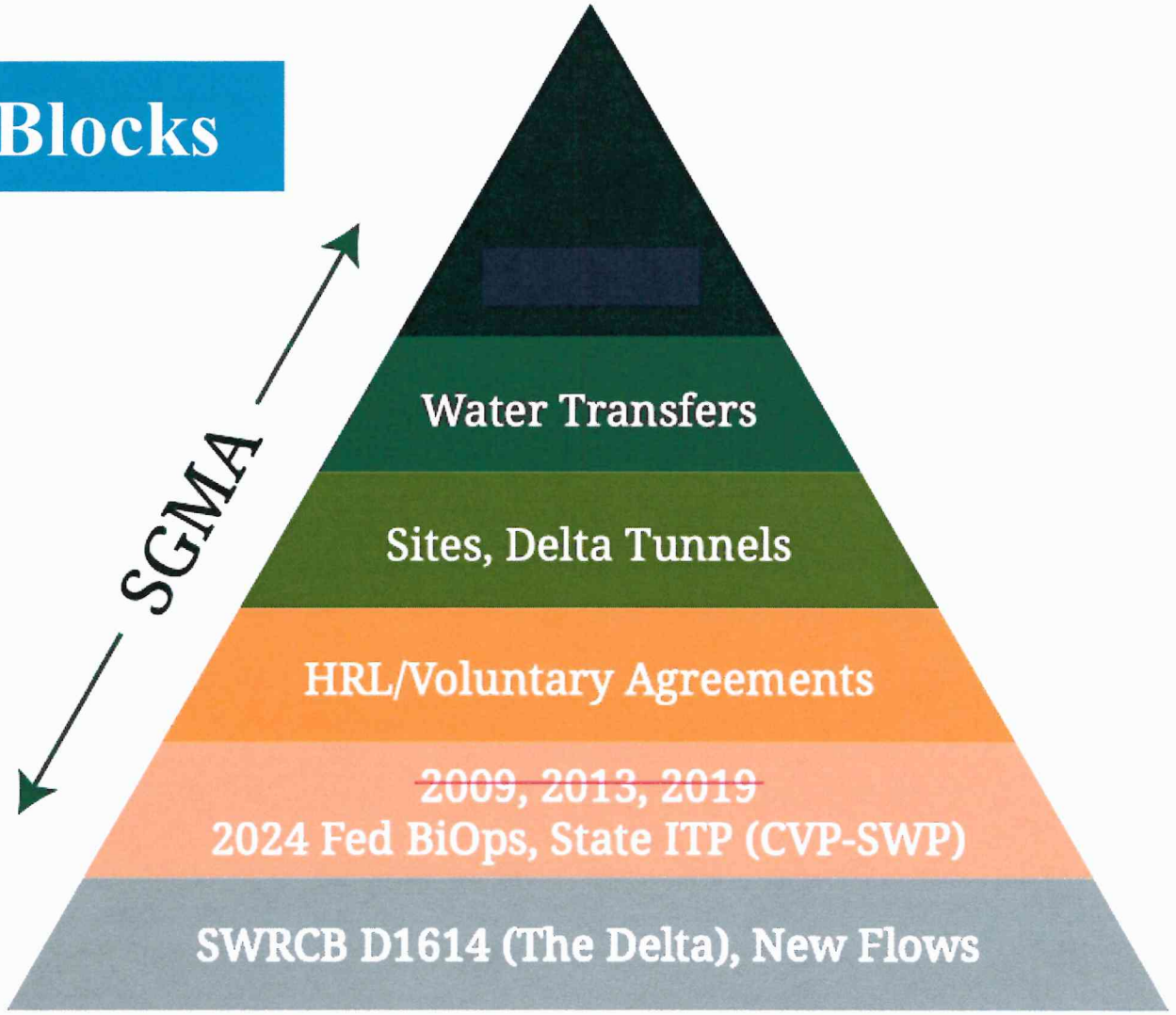
To maximize our water supplies for multiple benefits and provide certainty in surface water deliveries to SRSC members.

Sacramento River
SETTLEMENT CONTRACTORS



Balancing Water Needs for Multiple Benefits

Building Blocks



Sacramento River
SETTLEMENT CONTRACTORS

Drought Protection Program Update (DPP)

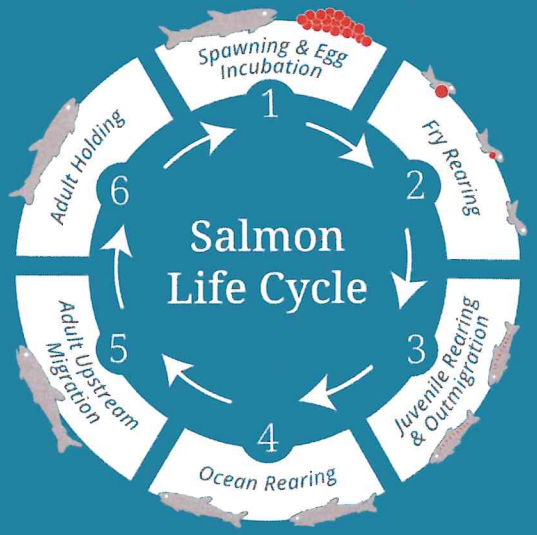
Part of the Updated Biological Opinions and Long Term Operations of the Central Valley Project

Drought Protection Program Update

- DPP Implementation Memo out and Onboarding SRSCs (thru July 31)
  - >93% of the Funding Disbursed
- Addressing DPP Litigation
- Implementing New Biological Opinion
  - Trinity River
  - Adaptive Management Framework
  - New Administration Direction
- Adding New Members to SRSC Corp
- Implementing Winter Run Action Plan

Sacramento River
SETTLEMENT CONTRACTORS

Winter-Run Action Plan (WRAP)





Sacramento River
SETTLEMENT CONTRACTORS

Agreements to Support Healthy Rivers and Landscapes

Bay-Delta Plan Update

SWRCB Bay Delta Plan Update

- The Board will adopt an Updated Plan in 2025
- Unimpaired Flow (UIF) has been staff's approach
  - Adopted 40% UIF on the San Joaquin River
- Healthy River and Landscapes would meet the UIF Requirements as an Alternative
  - 8 Year Term – Could be Renewed/Updated
  - Could Revert to UIF if not successful or Parties fail to Implement
  - Annual Workplans and 3-Year Triannual Reports on how the program is working

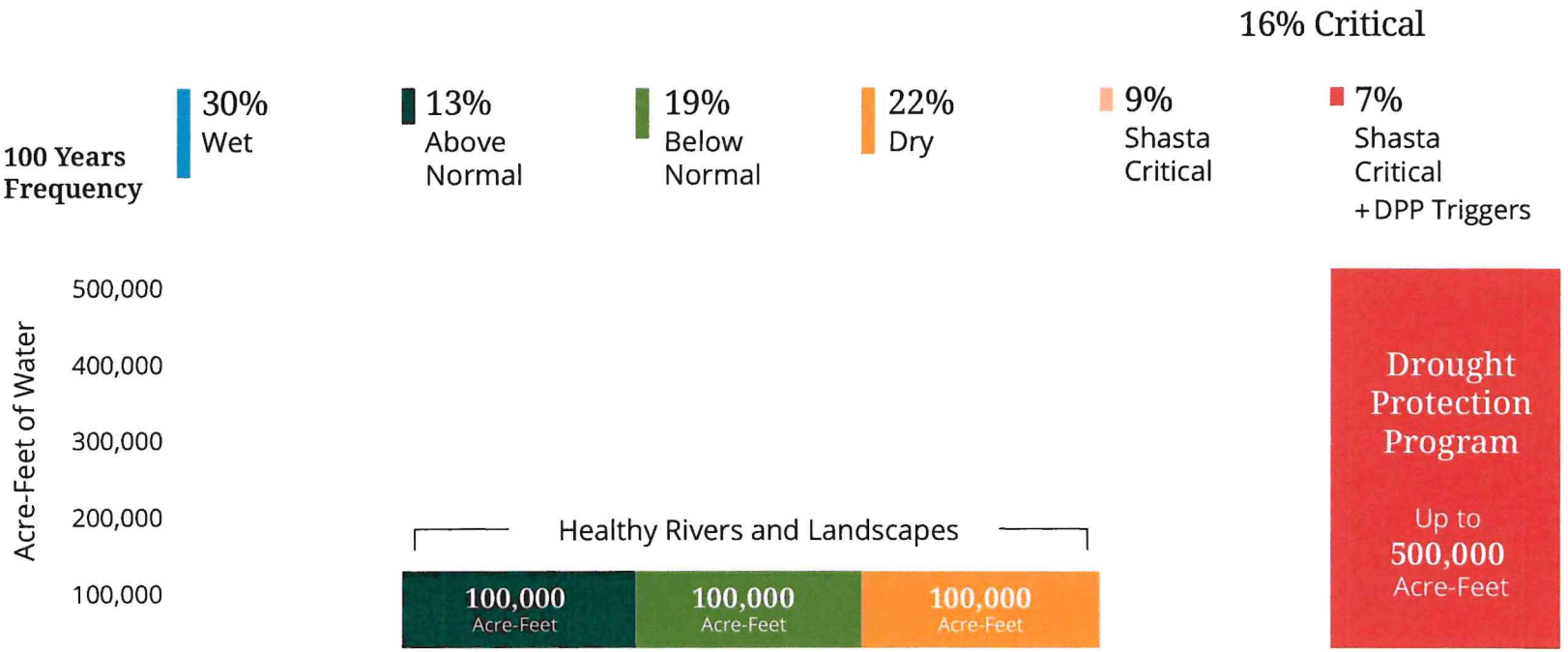
Sacramento River
SETTLEMENT CONTRACTORS

HRL Starting 2025 or 2026

100,000 acre-feet of surface water in **Above Normal**, **Below Normal** and **Dry years**

- Water made available through crop idling/shifting
- Up to 20% made available by groundwater substitution in alignment with local Groundwater Sustainability Plans
- Habitat creation

Water Held for the Environment
By Water Year Type



Note: Existing Shasta Critical Year reductions from 100% to 75% supply are not shown here.

Healthy Rivers and Landscapes Overview

- Bureau of Reclamation will operate Shasta to facilitate HRL
- SRSC continue deliveries to National Wildlife Refuges, cities, farms, and other working landscapes
- SRSC to continue measures and projects to improve wildlife conditions
- Payment to SRSC Members for water made available
- SRSC to pay into Water and Science Fund

A Holistic Approach to Healthy Rivers and Landscapes

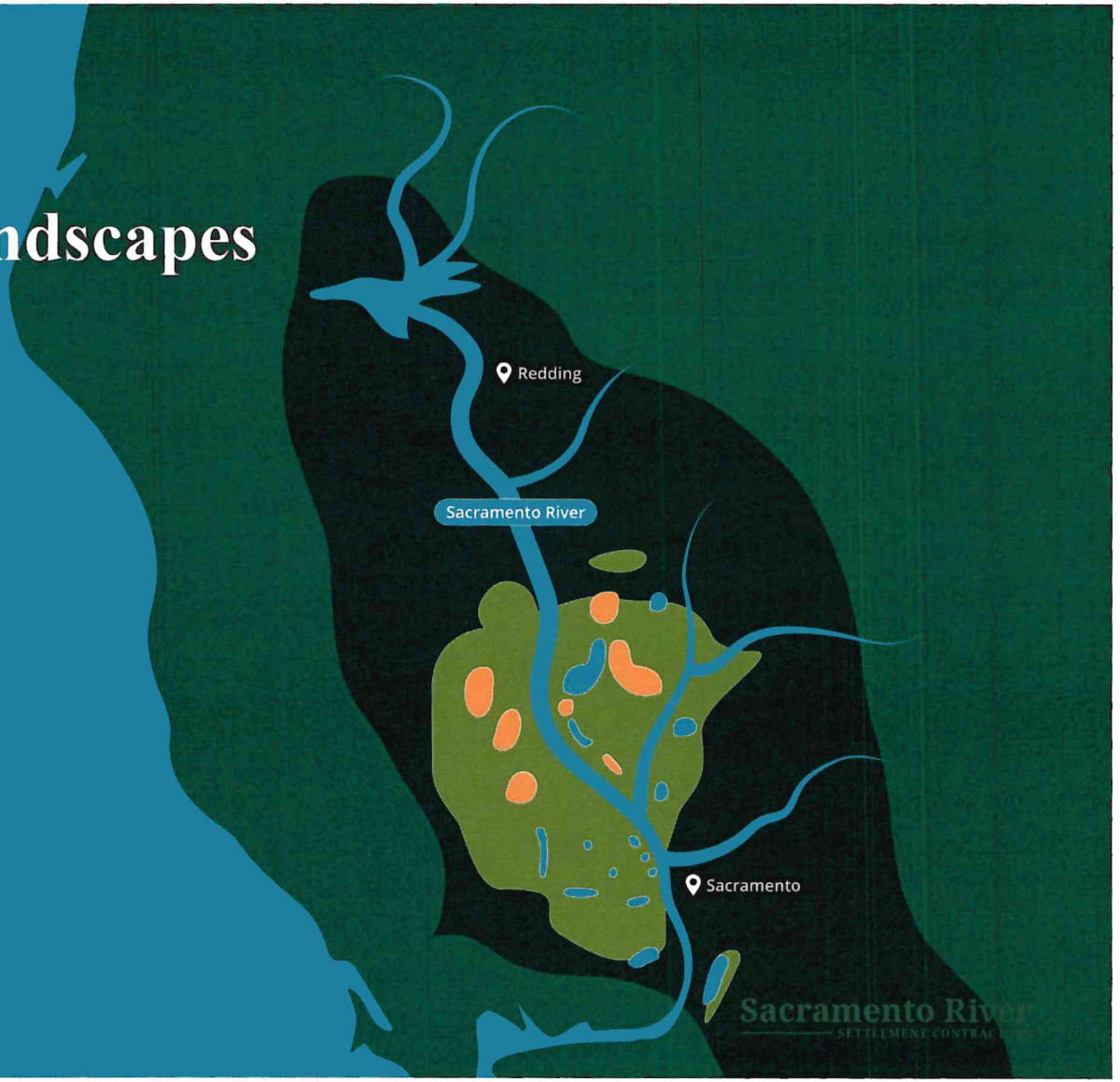
Critical Wintering Bird Habitat Along the Pacific Flyway

250k Shorebirds

4 Million Waterfowl

Approximately one billion birds annually migrate through the Sacramento Valley

- Ricelands
- Private Wetland Areas
- National and State Wildlife Refuges



HRL Impact to Contractors

Each contractor will take different actions to meet the water supply reduction measures.

- Reducing deliveries to landowners
- Cropland idling/shifting
- Shifting from historically planted higher-water-intensive crops to lower-water-using crops
- Implementing water conservation measures
- Relying on groundwater substitution

Sacramento River
SETTLEMENT CONTRACTORS

HRL Impact to Contractors

If contractor does not sign on to HRL:

The State Water Board could use its authorities and public processes as a backstop to require those entities to make adequate contributions to implementing the narrative objectives for salmon and fish viability.

Sacramento River
SETTLEMENT CONTRACTORS

HRL Key External Actions – Next Six Months

- Continue to Engage/Drive State Water Resources Control Board Planning Process to HRL Adoption
- Updating list of Early Implementation Projects
  - Floodplain Reactivation, Fish Food on Floodplain Farm Fields
- Resolve Remaining Items with Bureau of Reclamation
- Work with Tribes to gain participation in agreement

Sacramento River
SETTLEMENT CONTRACTORS

HRL Key Internal Actions – Next Six Months

- How to Allocate Funding and Water Responsibilities
- Review other Altneratives for Making Water Available (ACID, Davis-Woodland, City of Redding, Natomas)
- Address Non-Covered Parties throughout Watershed
- Habitat Commitments

Questions?

Sacramento River
SETTLEMENT CONTRACTORS

Jacobs

Draft Feasibility Report

Document No.: 250203142109_be8222b8
Revision: Draft

Anderson-Cottonwood Irrigation District
Sacramento River Settlement Contractors

ACID Water Supply & Fisheries Resiliency Project



Jacobs

Draft Feasibility Report

Client Name:	Anderson-Cottonwood Irrigation District		
Project Name:	ACID Water Supply & Fisheries Resiliency Project		
Client Reference:	Sacramento River Settlement Contractors	**Project No.:**	W8Y33000
Document No.:	250203142109_be8222b8	**Project Manager:**	Jeremy Kellogg, S.E.
Prepared by:	Jacobs Engineering Group, Inc.		

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Acronyms and Abbreviations

ACID	Anderson-Cottonwood Irrigation District
AFD	adjustable-frequency drive
ANSI/HI	American National Standards Institute/Hydraulic Institute
Caltrans	California Department of Transportation
CAPEX	capital expenditure
CCB	chlorine contact basin
CCR	*California Code of Regulations*
CCWWTP	Clear Creek Wastewater Treatment Plant
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFD	computational fluid dynamics
cfs	cubic feet per second
CPUC	California Public Utilities Commission
CVFPB	Central Valley Flood Protection Board
District	Anderson-Cottonwood Irrigation District
Diversion Dam	ACID Diversion Dam
E*NET	Renewable Resource Net-Metering Service
E*ZNE	Zero Net Energy Service
ESA	federal Endangered Species Act
FEMA	Federal Emergency Management Agency
fps	foot (feet) per second
HI	Hydraulic Institute
HP	horsepower
ITC	Investment Tax Credit
kW-DC	kilowatt direct current
kWh	kilowatt-hour

M	million
MVA	megavolt-amperes
MW	megawatt
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	operations and maintenance
OHWM	ordinary high water mark
OPEX	operational expenditure
PLC	programmable logic controller
PV	photovoltaic
Reclamation	U.S. Bureau of Reclamation
RES-BCT	Renewable Energy Self-Generation Bill Credit Transfer
REU	Redding Electric Utility
RMC	Redding Municipal Code
SCADA	supervisory control and data acquisition
SR	State Route
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service

1. Introduction

1.1 Scope and Purpose of Report

The purpose of this report is to explore alternatives that would mitigate upstream migration delays for anadromous fish, improve use of spawning habitat upstream of ACID's diversion facilities, and improve drought resiliency while ensuring the long-term reliability for continued water deliveries to ACID customers. To accomplish these objectives, the Diversion Dam would need to be decommissioned. Without a Diversion Dam, ACID would require a new diversion to deliver water into the Main Canal.

The results of this report will guide selection of a future project, which will include design and construction of the preferred alternative identified in this feasibility report. The current project consists of completing a feasibility study to evaluate a point of diversion change for ACID's main diversion. The project evaluates diversion site alternatives downstream of the existing facility to improve fish passage and drought resiliency for ACID customers. Downstream diversion will be provided with a proposed pump station and associated fish screen. ACID's proposed main diversion was evaluated for relocation at three potential sites. Preliminary pipeline alignment options were considered to connect the proposed Main Pump Station to ACID's Main Canal.

ACID currently diverts water by gravity. The proposed Main Pump Station will have a significant electrical demand to pump water from the river to the Main Canal. To offset electricity costs, the project includes an evaluation of options to install photovoltaic (PV) panels to produce electricity.

The Diversion Dam will become obsolete when the proposed Main Pump Station is constructed. Alternatives for decommissioning the Diversion Dam were explored and presented in the sections that follow.

The project includes evaluating replacement of the existing Churn Creek Pump Station. The proposed Churn Creek Pump Station and associated fish screen will be designed to meet current fish passage criteria and accommodate low river flows during dry critical water years.

1.2 Existing Conditions

Anderson-Cottonwood Irrigation District (ACID or District) diverts irrigation water from the Sacramento River in Redding, California, primarily from a gravity diversion in the river at the seasonal ACID Diversion Dam (Diversion Dam) near River Mile 299. The Diversion Dam is typically installed each year in April and removed in October. However, fluctuations in the dam installation and removal dates can vary by year depending on various factors such as agency coordination, river streamflow, water deliveries, or water curtailments. In addition, ACID operates the Churn Creek Pump Station near River Mile 292 to supply water to Churn Creek Bottom east of the river. The District does not currently provide water for municipal or industrial use.

ACID's service area encompasses approximately 32,000 acres within Shasta County and northern Tehama County. ACID's distribution system includes approximately 35 miles of Main Canal. The Main Canal flows through six inverted siphons to cross streams, such as Clear Creek, and three flume sections across smaller streams and lowland areas. The Main Canal, designed and constructed in the early 1900s, begins at the ACID Diversion Dam on the Sacramento River in Redding, California; traverses 15 miles to Anderson, California; another 12 miles to the Cottonwood Creek Siphon; and then becomes a lateral that serves the upper end of Tehama County. The distribution system includes unlined canals, short segments of lined canals, laterals, sublaterals, drains, inverted siphons, flumes, and pumping plants. Approximately 90% of

ACID's customers irrigate pasture for haying and livestock; however, some orchard and other food crops are also grown. In total, ACID's service area accounts for about two thirds of all irrigated pasture in the Redding Basin.

Figure 1-1 provides an overall view of the District. Over 75% of the water demands occur within the lower 40% of the Main Canal from Lateral 21 upstream of the Anderson Flume to Bobbin Flume. The only control structures in the Main Canal are the Radial Gate Headworks at the Redding Convention Center, approximately 3,500 feet downstream of the existing Fish Screen, and two fixed weir points at Mile Post 16 downstream of Anderson and at Mile Post 24.5, Bobbin Flume inlet. The Radial Gate Headworks is the only check structure used to measure and adjust Main Canal flows, to provide constant water levels, and to move water downstream to meet variable demands.

The Diversion Dam consists of a permanent concrete foundation and concrete piers spanning approximately 360 feet across the river and was constructed in 1917. When the dam is installed seasonally, steel frames are installed on the permanent concrete piers. Then flashboards are installed between the steel frames to a depth of approximately 14 feet. The Diversion Dam includes two fishways: the river right (southerly) pool-and-chute fishway and the river left (northerly) vertical slot fishway. Historical anecdotal observations indicate that fish passage is more successful when the Diversion Dam is not installed, particularly in low river flow conditions. Performance of the fishways has been observed to have operational challenges when evaluated across the wide flow range the river operates within during irrigation season. If ACID's main diversion were relocated downstream with a proposed pump station and fish screen, the Diversion Dam would no longer be necessary for water deliveries.

The existing Churn Creek Pump Station includes three vertical turbine pumps installed on a wooden pile-supported structure. Water enters the pump station forebay through cylindrical wedge wire fish screens. The forebay is constructed with a perimeter sheet pile wall. The existing Churn Creek Pump Station has challenges meeting current fisheries criteria and cannot sufficiently accommodate low river flows during dry critical water years.



Figure 1-1
ANDERSON-COTTONWOOD IRRIGATION DISTRICT MAP

JACOBS

1.3 District Operations

ACID typically provides water to their users based on a 14-day rotation schedule starting in April and ending in October. Irrigation water demand in April, September, and October is typically lower than during the peak summer months. ACID is required to maintain a constant water elevation in the canal for users that may require a constant flow through their turnouts, even during times of lower overall irrigation demand. With no existing control structures except for the radial gate near the upstream end, the only way to hold these elevations is to continue delivering high rates of flow, which can exceed actual demands. As a result, during these low-flow irrigation periods, water is ultimately spilled to adjacent waterways or lost to seepage. Thus, it is recommended to include at least one downstream control structure to optimize pump station operation and increase system efficiency.

1.4 Project Alternative Locations

The three potential sites for the proposed Main Pump Station are in the City of Redding and include Alternative 1 – Cypress Avenue Site (approximate River Mile 295), Alternative 2 – Breslauer Way Site (approximate River Mile 293.5), and Alternative 3 – Clear Creek Wastewater Treatment Plant (CCWWTP) Site (approximate River Mile 289). All sites are river right bank as shown on Figure 1-1. All sites are within publicly owned property, in areas with limited to no existing infrastructure. All sites are within the Redding Electric Utility (REU) service area.

1.5 Sacramento River Flow-Duration Analysis

A flow-duration analysis was performed using daily average streamflow data from the U.S. Geological Survey (USGS) stream gage 11370500 (Sacramento River at Keswick, CA) from water year 1981 through water year 2023.

The Keswick gage is near River Mile 301. No incremental inflows were included for tributaries between the USGS stream gage and the three potential sites. Municipal and industrial water diversions by the City of Redding and Bella Vista Water District were not accounted for in the flow-duration statistics. Site Alternative 3, CCWWTP, is downstream of the confluence of Clear Creek and the Sacramento River. River flow at Site Alternative 3 would be larger than the other site alternatives for the same Keswick release because of incoming water from Clear Creek and other small tributaries between site alternatives.

The period from 1981 through 2023 was used to develop flow-duration data in consideration of relatively recent Reclamation operation and management of the river system. The daily river-flow data for the 42-year period were parsed into monthly data sets to develop monthly exceedance flow values.

Table 1-1 shows exceedance flow values for each month. Each exceedance flow value represents a percent of time at which the river is above that flow during the month. These exceedance flow values were used to evaluate typical operational months April through October.

Table 1-1. U.S. Geological Survey 11370500 (Sacramento River at Keswick, CA) Flow Exceedance by Month

	Flow (cfs)											
PTE	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
100	3,160	2,910	2,900	2,850	2,850	2,360	2,510	3,310	3,850	4,480	4,310	3,860
99	3,440	2,990	2,990	3,080	2,980	2,530	2,550	3,590	4,050	4,510	4,520	4,060
95	3,870	3,370	3,160	3,180	3,120	2,970	3,100	6,070	7,290	7,430	7,230	5,040
90	4,240	3,750	3,310	3,260	3,220	3,180	3,250	6,840	8,040	9,550	8,160	6,000
80	4,990	4,100	3,700	3,340	3,310	3,310	3,830	7,670	9,310	10,500	9,170	6,800
50	6,130	5,140	4,830	4,410	4,060	4,580	6,100	9,400	11,100	13,100	10,800	7,920
25	7,080	5,990	5,930	6,240	6,890	10,200	8,700	11,300	13,300	14,700	12,400	9,040
15	7,610	6,970	9,690	12,800	23,000	23,000	11,300	12,900	14,200	15,000	13,700	9,530
10	7,850	7,480	13,900	16,600	32,400	30,800	14,600	13,800	14,500	15,100	14,200	10,100
5	8,510	13,500	19,100	29,700	49,900	45,600	25,200	16,500	15,000	15,300	14,800	11,100
2	8,880	14,800	35,500	45,300	59,000	53,000	36,600	22,400	15,600	15,400	15,000	11,800
1	12,200	18,200	38,200	49,500	70,200	60,100	39,600	26,900	17,000	15,500	15,100	13,100
0.0	12,500	21,400	60,200	77,900	79,000	74,800	50,100	39,100	20,700	16,800	15,300	14,500

Notes:

cfs = cubic feet per second
PTE = percent time exceeded

Flashboards are typically installed in the ACID Diversion Dam around April 1st (start of irrigation season) and removed around November 1st (end of irrigation season).
Exceedance values are based on average daily flows at USGS stream gage #11370500 for water year 1981 through 2023.

1.6 Sacramento River Flood Flows

The Federal Emergency Management Agency (FEMA) Flood Insurance Study for Shasta County, California, dated December 16, 2021, indicates that operations of Shasta Dam regulate the 10-, 50-, and 100-year floods to 79,000 cfs in the Redding area (Keswick to Clear Creek). River flow at the CCWWTP site is influenced by operations of Shasta Dam, Clear Creek flow, and flow from other minor tributaries. According to the USGS stream gage 11370500, located 0.8 mile downstream from Keswick Dam, the maximum discharge of record since regulation by Shasta Dam in 1943 was 83,000 cfs, which occurred on February 14, 2017.

The base flood elevation at the Alternative 1 site was taken from FEMA Flood Insurance Rate Map Number 06089C1539G near cross-section AV with an elevation of 471.0 feet referenced to North American Vertical Datum of 1988 (NAVD88).

The base flood elevation at the Alternative 2 site was taken from FEMA Flood Insurance Rate Map Number 06089C1545G near cross-section AQ with an elevation of 464.0 feet referenced to NAVD88.

The base flood elevation at the Alternative 3 site was taken from FEMA Flood Insurance Rate Map Number 06089C1930G near cross-section W with an elevation of 430.0 feet referenced to NAVD88.

The base flood elevation at the Churn Creek Pump Station site was taken from FEMA Flood Insurance Rate Map Number 06089C1561G near cross-section AJ with an elevation of 453.5 feet referenced to NAVD88.

1.7 Sacramento River Low River Stage

The Central Valley Floodplain Evaluation and Delineation Program developed a Sacramento River HEC-RAS hydraulic model for the reach applicable to the site alternatives. The hydraulic model was used to determine the low water surface elevation and bathymetry elevations for the study. The minimum Sacramento River flow used in this report for pump station and fish screen sizing is 6,000 cfs (herein after referred to as minimum Sacramento River flow). The available water depth at the minimum Sacramento River flow is estimated to range from 4 feet to 4.5 feet at the three potential sites.

Reclamation's proposed flow objective below Keswick Dam is 3,250 cfs, according to Table 1 of the NMFS June 4, 2009, Biological Opinion. However, the 1960 Memorandum of Agreement between Reclamation and CDFW as well as the State Water Resource Control Board Water Rights Orders 90-05 indicate minimum flow requirements of 2,000 cfs on the Sacramento River below Keswick Dam during a critically dry period.

The minimum Sacramento River flow was selected based on input from the Sacramento River Settlement Contractors, ACID, and historical releases during the irrigation season shown in Table 1-1. Future design phases must validate the design flow used in this report. Site Alternative 3 should also consider water contribution from tributaries, i.e., Clear Creek, in the design flow. See Section 6.1 for an additional discussion applicable to the Churn Creek Pump Station.

1.8 Main Pump Station Overview

The proposed diversion and Main Pump Station were preliminarily sized for 450 cfs pumping capacity at the minimum design Sacramento River flow. The 450-cfs diversion capacity was selected to match the diversion capacity of the existing ACID Fish Screen facility at the Diversion Dam. Additionally, the diversion aligns with ACID's current contract allotment with U.S. Bureau of Reclamation (Reclamation), Contract No.

14-06-200-3346A-R-1, including revision 14-06-200-3346-R-1-B, for the highest diversion occurring in the months of July and August, which allows for a total diversion of 24,000 acre-feet considering Base Supply (22,000 acre-feet) plus Project water (2,000 acre-feet), which equates to 390 cfs.

Historical ACID record diversion datasets were analyzed over the last 17 years, 2008 through 2024, at the Reclamation meter in the Main Canal. ACID provided data over the last 17 years based on available recorded flows and an understanding that this period is an adequate sample size of recent diversions for basis of design. It was determined that 450-cfs instantaneous diversion exceeds historical operations. Figure 1-2 displays recorded Main Canal diversions. Figure 1-2 does not have data for 2022 because ACID did not divert water in 2022 due to the Shasta Critical Year when Settlement Contractors received an 18% water supply from Reclamation. Churn Creek Pump Station has a flow meter to record diversions to Churn Creek Bottom. Future design phases should investigate instantaneous water right diversion capacity versus cumulative annual usage and summation of the Main Canal diversion and Churn Creek Pump Station diversion. Additionally, future design phases must ensure the existing Main Canal capacity can accommodate the Main Pump Station discharge.

With all three site alternatives, a portion of the Main Canal would no longer be used. This portion of the Main Canal has been observed to be a source of seepage loss due to high porosity of the existing gravel formations. Eliminating this porous section of the Main Canal would reduce losses, providing a greater water supply for irrigation at the same diversion rate at the downstream site alternatives. There is a potential to reduce the proposed diversion capacity while still maintaining water rights and meeting irrigation demands. The design diversion capacity directly influences the size and cost of the fish screen, pump station, and discharge pipe diameter; thus, optimizing the design diversion capacity from a water rights and operational perspective would optimize the size of the fish screen and pump station.

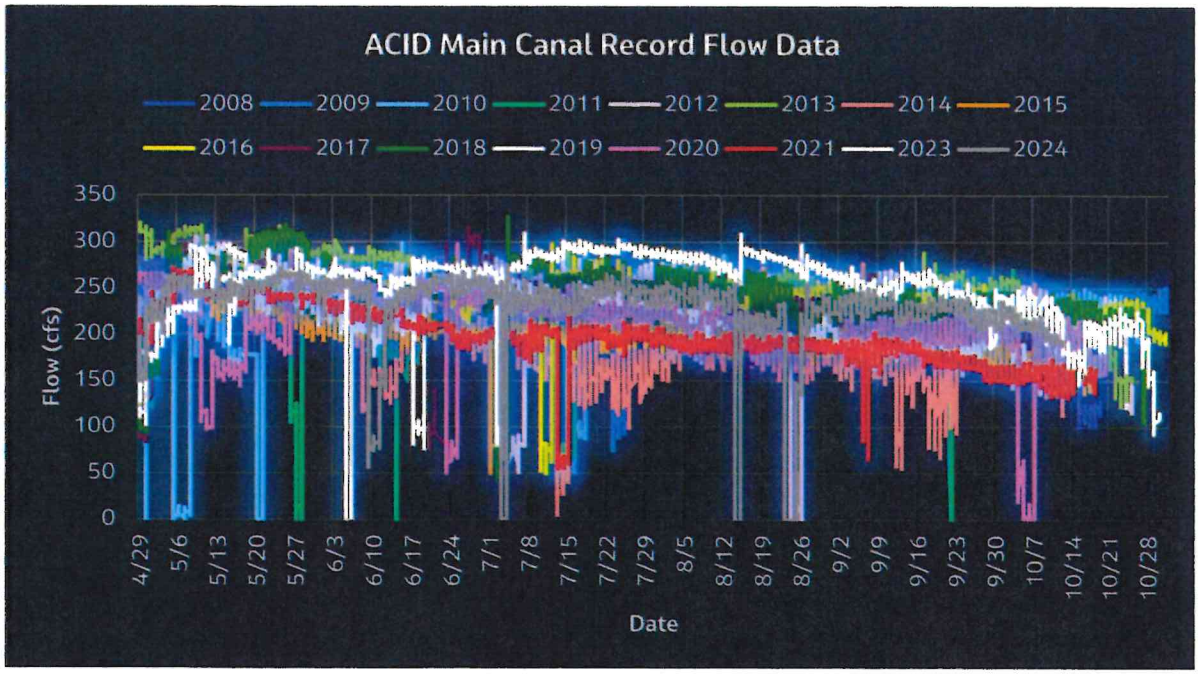


Figure 1-2. ACID Main Canal Record Flow Data

A flat-plate fish screen was assumed for each potential Main Pump Station site. The length of the flat-plate fish screen was preliminarily sized based on assumed usable water depth at the minimum Sacramento River flow. Water surface elevations used for preliminary design were determined from the

Central Valley Floodplain Evaluation and Delineation Program HEC-RAS model. Precise river bottom elevations were not available at the time of this feasibility study. Approximate river bottom elevations were determined from publicly available data. When a site is selected and the future project moves into detailed design, bathymetry surveys must be completed to determine actual river bottom elevations in advance of progressing facility layouts.

The fish screen design criteria and guidelines issued by California Department of Fish and Wildlife (CDFW) and National Oceanic and Atmospheric Administration (NOAA) – National Marine Fisheries Service (NMFS) for salmonids include guidance from NOAA Fisheries West Coast Region Anadromous Salmonid Passage Design Manual. These guidelines are generally supported by U.S. Fish and Wildlife Service (USFWS) and include the following:

- Approach velocity (water velocity perpendicular to the screen) – less than or equal to 0.40 foot per second (fps) where exposure time is limited to fewer than 60 seconds, or 0.33 fps where exposure time is greater than 60 seconds.
- Minimum sweeping velocity (water velocity parallel to the screen) – two times the approach velocity; between 0.8 and 3.0 fps is optimal.
- Screen slot opening size – 1.75 millimeters (0.069 inch).
- Screen porosity – 27% minimum open area.

The fish screen would be protected from floating debris with a proposed debris boom. The debris boom would consist of a floating pipe supported by piles and designed to float up and down with fluctuating river elevations.

The pump station would discharge into the existing Main Canal via a buried welded steel pipeline. The conveyance pipeline design must consider coordination with existing infrastructure and existing buried and overhead utilities. Site visits to each site alternative were completed to approximately map existing infrastructure and visible utilities. Future design phases must consider energy dissipation design at the pipeline discharge. At a minimum, concrete lining in the proximity of the discharge would be required.

Control and telemetry options at the sites include radio, cellular, satellite, and potentially hardwire. Coordination with ACID operations staff will be required during the design phase to ensure proper integration with their existing supervisory control and data acquisition (SCADA) system. Remote control of pumps and status information would be available at ACID's office. Typical SCADA information available to the office would include RUN control of the pumps, ON and FAIL status, WATER LEVELS, PUMP SPEED, WATER FLOW, and SITE SECURITY.

Future design phases must consider operations and maintenance (O&M) of the fish screen and pump station. Periodic maintenance of the fish screen panels includes lifting the panels out of the water for cleaning (pressure wash) and inspection. To accommodate this maintenance activity, a mobile crane is typically sized for the required lifting capacity and included with the project.

Future design phases must consider sediment buildup within the pump station forebay. The final geometry of the forebay will influence O&M sediment removal options. Preliminary options include using a long reach excavator from the finish grade surface around the forebay or incorporating a ramp into the forebay to provide better excavation access.

1.9 Churn Creek Pump Station Overview

The existing Churn Creek Pump Station is located on the left bank of the Sacramento River approximately at River Mile 292 at 4800 Sunnyhill Lane, Redding, California.

Preliminary layout of the Churn Creek Pump Station replacement includes two vertical mixed-flow irrigation pumps with a total diversion capacity of 60 cfs. 60 cfs matches the capacity of the existing pump station. The proposed Churn Creek Pump Station would discharge to the existing Churn Creek Lateral through two preliminarily sized 30-inch-diameter welded steel pipelines. Cylindrical tee screens with an integral brush cleaning system are recommended to comply with state and federal fish screen criteria. It is assumed that the proposed Churn Creek Pump Station would be pile-supported with a concrete deck extending over the river. Additional site improvements would be required to provide access to the proposed pump station deck.

1.10 Overview of Main Pump Station Alternatives

Three primary project alternative sites were selected for consideration in the feasibility study. The three alternatives are intended to represent a broad range of overall options for meeting long-term project goals. Figure 1-1 shows the river mile locations of the facilities for each alternative. A summary of the three site alternatives follows.

- **Alternative 1 - Cypress Avenue Site:** The Cypress Avenue site is located on the right bank of the Sacramento River approximately at River Mile 295 just downstream of the Cypress Avenue bridge at the City of Redding Parkview Riverfront Park and Trails. This site is the farthest north and is upstream of all existing ACID customers. This site offers the shortest distance between the river and existing Main Canal. The fish screen intake would be located at the end of straight section of river and along the outside bank of a bend in the river. The river current near the proposed site is noticeably higher than adjacent reaches, conceivably due to the gradient of the river, and the channel appears to be stable. The site must be evaluated with respect to river stability/geomorphology over the life of the proposed project in future design phases. The potential for migration of the river, sediment deposition, and erosion are key factors in selection of the site. This site is a favorable location with respect to river conditions and geometry for fish screen layout. Of the three alternatives, this is the smallest site which limits the ability to install a sufficient PV system. The design total differential head of the pump station for the maximum flow of 450 cfs is anticipated to be approximately 45 feet.
- **Alternative 2 - Breslauer Way Site:** The Breslauer Way site is located on the right bank of the Sacramento River a short distance south of River Mile 294 across the river from Riverview Country Club. This property is owned by Shasta County and contains the Shasta County Health and Human Services facilities and Juvenile Hall. The fish screen intake would be located along the outside bank of a bend in the river. The site must be evaluated with respect to river stability/geomorphology over the life of the proposed project in future design phases. The potential for migration of the river, sediment deposition, and erosion are key factors in selection of the site. This site is a favorable location with respect to river conditions and geometry for fish screen layout. This site is near the northern end of ACID's boundary. It is assumed to be reasonably feasible that this site would maintain service to the northern end of the District if a check structure were installed within the Main Canal. Field surveys and an analysis of canal hydraulics are required during future design phases to confirm this assumption. The design total differential head of the pump station for the maximum flow of 450 cfs is anticipated to be approximately 52 feet.
- **Alternative 3 - CCWWTP Site:** The CCWWTP site is located on the right bank of the Sacramento River approximately at River Mile 289 adjacent to the CCWWTP ponds. The proposed pump station facility

occupies a portion of what is currently Pond 10 at the CCWWTP. Coordination with treatment plant staff would be necessary to ensure the reduced volume of Pond 10 would not impact treatment plant operations. This site is the most southerly site of the three alternatives. The site is reasonably close to the existing Main Canal. However, the pipeline to the Main Canal must cross below the Union Pacific Railroad (UPRR) and State Route (SR) 273 (South Market Street). An analysis will need to be conducted to verify the ability of this site to maintain service to the customers at the northern end of the District through field surveys and hydraulic analysis. This site is rural and offers the largest open space for installation of a PV system. The design total differential head of the pump station for the maximum flow of 450 cfs is anticipated to be approximately 91 feet.

1.11 Future Design Considerations

ACID is not a drainage district. However, the existing Main Canal receives stormwater discharges throughout the system. Historically, ACID has maintained agreements with the City of Redding, City of Anderson, private landowners, and California Department of Transportation (Caltrans) to accept stormwater-related flows on an as-needed basis. With all three site alternatives, a portion of the Main Canal system would be abandoned. Stormwater must be maintained and managed within the abandoned portion of the canal. Future design phases must consider stormwater based on the selected site alternative. Additionally, responsibility for operations and maintenance of stormwater must be accounted for. Planning, design, and construction costs associated with stormwater modifications are not included in this report.

All three site alternatives are downstream of the existing river diversion. The existing diversion facilities and portions of the canal system between the existing diversion and proposed facilities would no longer be needed for District operations. Future design phases would need to consider how obsolete infrastructure is abandoned and/or demolished. Additionally, ACID owns property within the area of infrastructure that would become obsolete. ACID would need to consider if property should be maintained, sold, or potentially used in a land swap to acquire property at the proposed pump station site or to obtain easements.

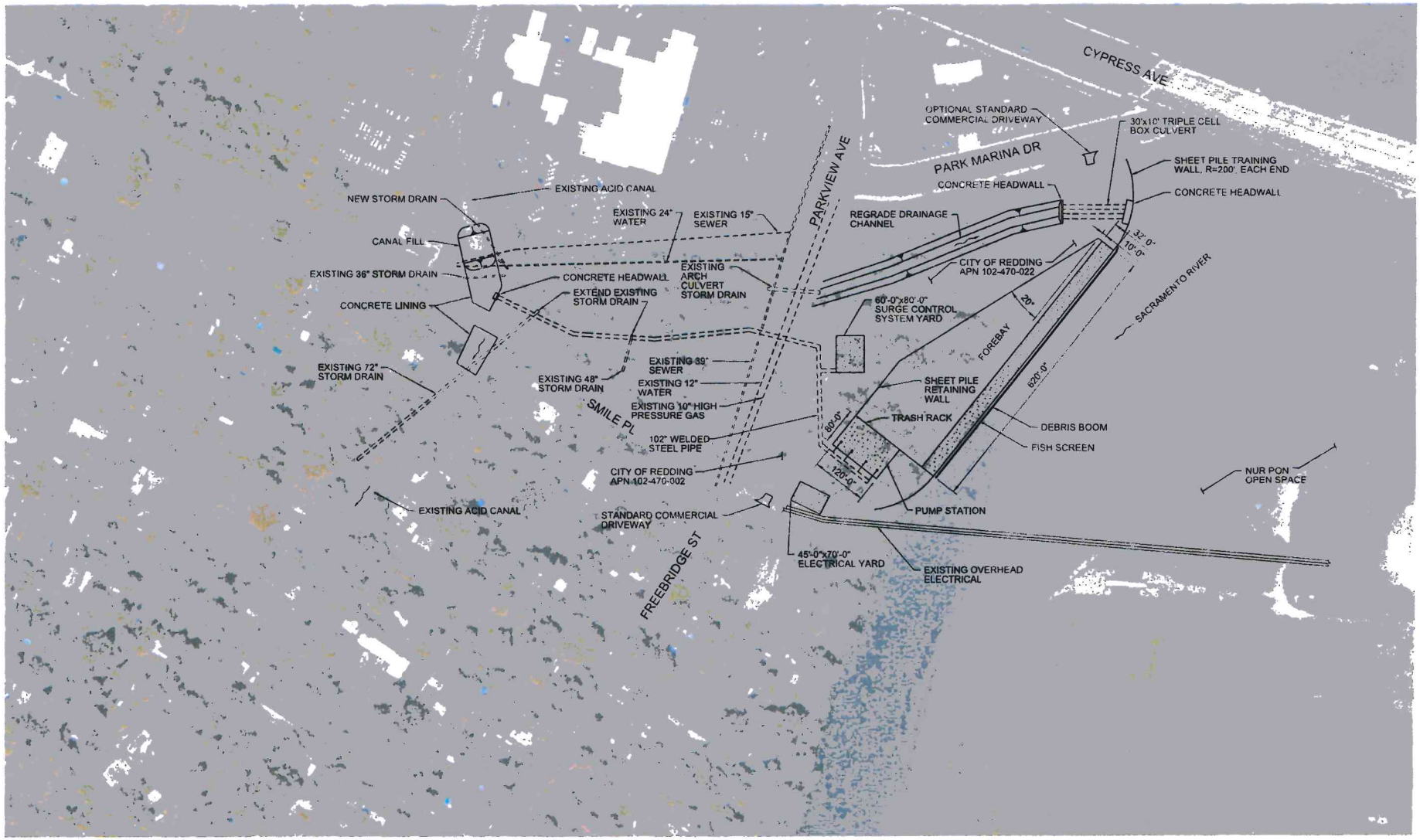
The Breslauer Way site and CCWWTP site are downstream of the most northern ACID customers. Reference Sections 3 and 4 for a more detailed description. Future design phases must evaluate how existing customers at the northern end of the District are served. Options include moving water north in the existing Main Canal and installing groundwater wells in strategic locations to maintain customer deliveries.

2. Alternative 1 – Cypress Avenue Site

2.1 Overview

This site was selected as an alternative for consideration because of its proximity to the existing Main Canal and available open space. This site is north of the District's boundary and would maintain all existing customers. The site is within the City of Redding's Parkview Riverfront Park. Most of the proposed facilities would be in the open area between the river and the existing fence that defines the eastern edge of the park. The existing park trails conflict with the proposed facilities and would require realignment to maintain public trail access. Park functionality would be maintained by realigning the trail around the proposed facilities. The proposed fish screen and pump station would consist of a single cast-in-place concrete structure located on the right bank of the Sacramento River. This is a small site, but it is anticipated that the footprint of the fish screen and pump station could be accommodated. This site is easily accessible and heavily used by the public. Future design phases must consider site security and fencing.

Figure 2-1 shows the facility layout site plan. Existing utilities were approximately located and shown on the site plan for coordination. The final design phase must accurately locate existing utilities and confirm all existing utilities are accounted for. The pipeline crossing at Parkview Avenue requires significant coordination with the existing utilities. The pipeline would cross high-pressure natural gas, water, sewer, and storm drain utilities. Construction of the crossing may require a temporary closure of Parkview Avenue during the crossing construction. The existing overhead electrical south of the proposed pump station constrains the fish screen location and associated sheet pile training wall. The southern end of the sheet pile training wall would be located to avoid construction activities below the existing overhead electrical.



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ACID WATER SUPPLY & FISHERIES RESILIENCY PROJECT
ANDERSON-COTTONWOOD IRRIGATION DISTRICT
ANDERSON, CALIFORNIA

FEASIBILITY REPORT ALTERNATIVE 1 CYPRESS AVE LOCATION PLAN

FIGURE 2-1

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2.2 Site Photographs

Figure 2-2 and Figure 2-3 are photographs of the potential site taken from the river. Photographs of the river were taken on July 12, 2024. According to the USGS stream gage 11370500, the river flow rate on July 12, 2024, was approximately 13,500 cfs. Figure 2-4 is a photograph of the Parkview Riverfront Park looking south where the trail crosses Linden Ditch. Figure 2-5 is a photograph of the Main Canal where ACID has an existing spill to drain the canal back to the river and where the proposed conveyance tie-in would be located.



Figure 2-2. Photograph of River Looking Upstream

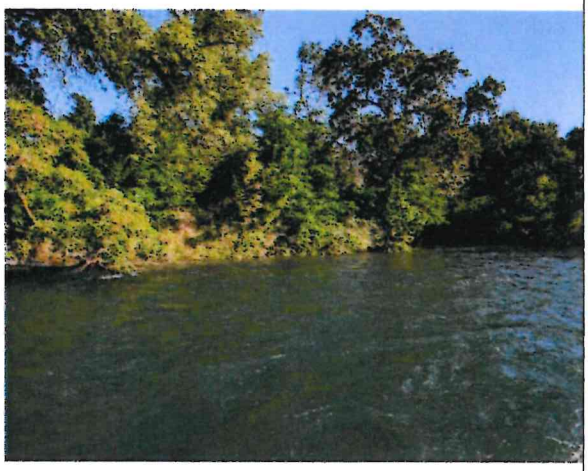


Figure 2-3. Photograph of River Looking Upstream



Figure 2-4. Photograph of Parkview Riverfront Park



Figure 2-5. Photograph of Existing Canal Spill Looking Upstream

2.3 Pump Station and Fish Screen Intake

2.3.1 Fish Screen

The proposed fish screen would be an on-bank concrete structure constructed along the edge of the river channel, placed near the outside of a moderate river bend to facilitate sweeping of fish, debris, and sediment past the structure. The proposed structure would employ vertical flat-plate screens that slide into place from the top of the structure using guide slots. The flat-plate screens would be constructed from stainless-steel wedge-wire with a 1.75-millimeter gap between wires. Sufficient screen area would be located below the minimum normal water surface, allowing full diversion and pumping capacity at flows equal to or greater than the minimum Sacramento River flow. Water would flow through the fish screen into a forebay that transitions flow toward the pump station located at the southern end of the forebay. The final design phase would need to complete computational fluid dynamics (CFD) modeling of the proposed fish screen and pump station arrangement, and physical modeling for the pump inlet conditions. Future design phases must complete hydraulic modeling for the river with the fish screen structure to ensure minimal impacts to water surface elevations.

2.3.2 Mechanical Equipment

A fish screen cleaning system would be required to maintain the riverside surfaces of the fish screens in a clean condition, sufficient to pass the design flows through the fish screens without violating fish screen criteria or allowing inordinately high-pressure drops across the screens. The fish screen cleaning system would remove algae, sediment, and other debris from the surfaces of the screens. The fish screen cleaning system would consist of a cleaning arm assembly that traverses a length of screen in a back-and-forth cycle traveling on a monorail and pulled by a stainless-steel cable. The cleaning arm would be suspended from the monorail and have nylon bristle brushes in the elevations occupied by the fish screens. A cantilevered weight would maintain the required contact pressure to effect screen cleaning. An adjustable-speed drive would modulate the assembly and gear drive to allow varying speeds to meet the varying seasonal and daily debris loads. The cleaning system would be operator-controlled or automatically controlled by timer or level differential across the fish screens. Because the fish screen structure would be quite long, multiple fish screen cleaning systems would be employed.

A sediment jetting system would be required to reduce sediment buildup in the bays of the fish screen structure, especially during flood flows. Sediment that is deposited in the bays would be pushed into the forebay by the sediment jetting system.

The pump station would include up to five installed pumps, as follows:

- Three large-capacity pumps with constant-speed drives (three duty, no standby)
- One low-capacity pump with adjustable-frequency drive (AFD) (one duty, no standby)
- Sediment jetting pump (one duty, no standby)

The pumps would be vertical mixed-flow or axial-flow type.

Rated condition for high-capacity pumps (each) would be 125 cfs at anticipated 45 feet total head. The motor size of the high-capacity pumps is anticipated to be 900 horsepower (HP).

Rated condition for the low-capacity pump would be 75 cfs at anticipated 45 feet total head. The motor size of the low-capacity pump is anticipated to be 500 HP.

Pump selection and rated conditions would be selected such that the pumps operate within their preferred operating region as defined by Hydraulic Institute (HI) standards.

The pumps would be provided with axial or tilted disc type check valves. Individual butterfly valves would isolate each pump discharge pipe and check valve for maintenance purposes. Individual flow meters would be provided for each pump to monitor the pump station flow.

The wet well would be a rectangular intake designed in accordance with American National Standards Institute/Hydraulic Institute (ANSI/HI)-9.8, Rotodynamic Pumps for Pump Intake Design. Future design phases must consider wet well isolation to accommodate maintenance activities. A typical approach for wet well isolation would be to use bulkheads to temporarily isolate individual wet well bays.

To mitigate sediment buildup within the wet well, a sediment jetting system would be provided. The sediment jetting system would jet the wet well floor with high-pressure water to resuspend sediment. Once resuspended, the solids would be conveyed out of the wet well by the pumps.

The motor size of the sediment jetting pump is anticipated to be 200 HP.

An evaluation of the anticipated hydraulic transient response to an uncontrolled pump shutdown would be performed to determine whether surge mitigation would be required and to inform which method of surge mitigation would likely be most practical and effective. Preliminary findings indicate that surge mitigation would be required and could be effectively provided by use of an air-over-water hydropneumatic surge tank(s) and pressure-relief valve installed on the pumped flow bypass line.

2.3.3 Electrical Equipment

The assumed load for this facility is approximately 3.8 megavolt-amperes (MVA). For the purposes of this study, Jacobs considered that a single utility service provides an acceptable level of source reliability. Many different electrical configurations are possible, and local conditions must be considered during subsequent design efforts. REU service would need to be provided to the site. REU would provide the primary switch and meter devices. Additional upgrades to REU's distribution system could be required to adequately serve the pump station.

All electrical equipment is expected to be grouped together and is identified on the site plan as "Electrical Yard". The utility meter section and transformer would be designed and installed according to REU standards. A block or concrete building, or prefabricated e-house is proposed as the structure to house all the electrical switchgear, motor control equipment, and any needed programmable logic controller (PLC)/control devices. Area lighting should be considered in final design for all facilities and gate entrance.

As indicated in Section 5, this site is too small to accommodate a solar PV array to generate the required electricity for this pump station. If a solar field is installed at another location, this site will require approval from REU for consumption meter aggregation.

2.3.4 Civil Features

The pump station site is in FEMA-designated Special Flood Hazard Area Zone AE. The base flood elevation for the site is 471 as stated in Section 1.6. *California Code of Regulations* (CCR), Title 23, Waters, Division 1 Central Valley Flood Protection Board (CVFPB) provides regulations promulgated by CVFPB to define criteria for structures constructed within floodways. The pump station would be designed to comply with CCR, Title 23, Division 1, Section 113, which requires structures within a floodplain to be securely anchored and floodproofed to at least 2 feet above the design flood elevation.

The site topography slopes down to the water edge, which would require retaining walls for construction of the pump station and forebay. Earthwork would consist primarily of excavation of the forebay, and pump station wet well foundation, with fill behind the retaining walls to level the site finished grade. Re-grading would be required to transition from Parkview Avenue.

Access to the site would be provided from Parkview Avenue. A new driveway would need to be constructed to accommodate vehicle access. A security gate would be required at the driveway entrance to prevent unauthorized vehicles from entering the site. Security fencing and cameras would be required around the facilities.

The site contains an existing drainage named Linden Ditch. This ditch receives stormwater from the west of the site and conveys the stormwater into the Sacramento River. The location of the ditch conflicts with the proposed fish screen and forebay. The conceptual layout shows the ditch being relocated north of the proposed facilities. The existing site includes a pedestrian bridge over the ditch to accommodate trail use. To maintain access over the ditch and accommodate maintenance vehicle traffic, a buried box culvert is shown at the discharge to the river.

The pump station discharge piping would be a buried 102-inch-diameter welded steel pipe approximately 1,050 feet long. The piping would cross Parkview Avenue, which would require multiple existing utility crossings including water, sewer, and high-pressure gas. After crossing Parkview Avenue, the piping could continue as a buried pipeline or transition to an open canal. The conceptual layout shows the pipeline continuing all the way to the Main Canal. There are existing 72-inch-diameter and 48-inch-diameter stormwater pipes that discharge into the Linden Ditch adjacent to Parkview Avenue. These existing pipes would need to be coordinated with the proposed pipeline or open canal and likely would require an extension to pass under the proposed conveyance.

The proposed conveyance discharge into the existing ACID canal would become the new start of the canal system. Fill would be added to the canal north of the discharge to delineate the new start of the canal system.

2.3.5 City Zoning

This site is zoned Open Space – Specific Plan Overlay (OS-SP). Open Space districts are intended to include areas that enhance the community character, maintain the scenic beauty, and increase recreational opportunities by preserving open space. Specific Plan Overlay areas require that all development be consistent with the goals, policies, guidelines, and standards of the specific plan adopted by the City of Redding. The proposed facilities would likely not align with land use regulations of the Open Space – Specific Plan Overlay zoning. Thus, a change in zoning would be required to accommodate the facilities.

3. Alternative 2 – Breslauer Way Site

3.1 Overview

This site was selected as an alternative for consideration because of its proximity to the existing Main Canal, favorable river conditions, and available open space. Figure 3-1 show the facility layout site plan. The site is located on a parcel owned by Shasta County. The proposed ACID facilities were located to avoid impacts to the existing Shasta County facilities and infrastructure. Existing utilities at this site are minimal and limited to an existing sewer pipe and overhead electrical. The final design phase must confirm all existing utilities are accounted for and accurately located.

This site is south of the northernmost ACID customer by approximately 1 mile along the length of the Main Canal. Options will need to be explored to maintain existing water deliveries upstream of potential discharge into the Main Canal. The canal is basically level in elevation between the proposed discharge and customers at the northern end of the District. Thus, it is assumed that water could be moved to the north without significant improvements. Installing a check structure in the Main Canal downstream would help control water elevation within the canal to maintain water deliveries. Field surveys and an analysis of canal hydraulics are required during future design phases to confirm this assumption.



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ANDERSON-COTTONWOOD IRRIGATION DISTRICT
ANDERSON, CALIFORNIA

FEASIBILITY REPORT
ALTERNATIVE 2
BRESLAUER WAY
LOCATION PLAN

FIGURE 3-1

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3.2 Site Photographs

Figure 3-2 is a photograph of the river looking north toward the potential fish screen site. Figure 3-3 is a photograph of the site looking north toward the potential location of the pump station facilities. Figure 3-4 is a photograph of the Main Canal where the pump station would discharge. Figure 3-5 is a photograph of the south end of the existing solar array and open space where the pump station discharge piping would be routed. Photographs of the site were taken on November 19, 2024.



Figure 3-2. Photograph of River Looking Upstream



Figure 3-3. Photograph of Site Looking North



Figure 3-4. Photograph of Main Canal Looking Downstream



Figure 3-5. Photograph of Existing Solar Array Looking to the East

3.3 Pump Station and Fish Screen Intake

3.3.1 Fish Screen

The proposed fish screen would be an on-bank concrete structure constructed along the edge of the river channel, placed near the outside of a moderate river bend to facilitate sweeping of fish, debris, and sediment past the structure. The proposed structure would employ vertical flat-plate screens that slide into place from the top of the structure using guide slots. The flat-plate screens would be constructed from stainless-steel wedge-wire with a 1.75-millimeter gap between wires. Sufficient screen area would be located below the minimum normal water surface, allowing full diversion and pumping capacity at flows equal to or greater than the minimum Sacramento River flow. Water would flow through the fish screen into a forebay that transitions flow toward the pump station. The pump station would be located at the center of the forebay to facilitate better site access, preserve open space used by Shasta County, and reduce the conveyance pipeline length. The fish screen would include porosity panels behind the fish screen panels used to tune water flow through the fish screens to maintain fish passage criteria, likely accommodating the placement of the pump station with respect to the fish screen. The final design phase would need to complete CFD modeling of the proposed fish screen and pump station arrangement, and physical modeling for the pump inlet conditions. Future design phases must complete hydraulic modeling for the river with the fish screen structure to ensure minimal impacts to water surface elevations.

3.3.2 Mechanical Equipment

A fish screen cleaning system would be required to maintain the riverside surfaces of the fish screens in a clean condition, sufficient to pass the design flows through the fish screens without violating fish screen criteria or allowing inordinately high-pressure drops across the screens. The fish screen cleaning system would remove algae, sediment, and other debris from the surfaces of the screens. The fish screen cleaning system would consist of a cleaning arm assembly that traverses a length of screen in a back-and-forth cycle traveling on a monorail and pulled by a stainless-steel cable. The cleaning arm would be suspended from the monorail and have nylon bristle brushes in the elevations occupied by the fish screens. A cantilevered weight would maintain the required contact pressure to effect screen cleaning. An adjustable-speed drive would modulate the assembly and gear drive to allow varying speeds to meet the varying seasonal and daily debris loads. The cleaning system would be operator-controlled or automatically controlled by timer or level differential across the fish screens. Because the fish screen structure would be quite long, multiple fish screen cleaning systems would be employed.

A sediment jetting system would be required to reduce sediment buildup in the bays of the fish screen structure, especially during flood flows. Sediment that is deposited in the bays would be pushed into the forebay by the sediment jetting system.

The pump station would include up to five installed pumps, as follows:

- Three large-capacity pumps with constant-speed drives (three duty, no standby)
- One low-capacity pump with AFD (one duty, no standby)
- Sediment jetting pump (one duty, no standby)

The pumps would be vertical mixed-flow or axial-flow type.

Rated condition for high-capacity pumps (each) would be 125 cfs at anticipated 52 feet total head. The motor size of the high-capacity pumps is anticipated to be 1,100 HP.

Rated condition for the low-capacity pump would be 75 cfs at anticipated 51 feet total head. The motor size of the low-capacity pump is anticipated to be 650 HP.

Pump selection and rated conditions would be selected such that the pumps operate within their preferred operating region as defined by HI standards.

The pumps would be provided with axial or tilted disc type check valves. Individual butterfly valves would isolate each pump discharge pipe and check valve for maintenance purposes. Individual flowmeters would be provided for each pump to monitor the pump station flow.

The wet well would be a rectangular intake designed in accordance with American National Standards Institute/Hydraulic Institute (ANSI/HI)-9.8, Rotodynamic Pumps for Pump Intake Design. Future design phases must consider wet well isolation to accommodate maintenance activities. A typical approach for wet well isolation would be to use bulkheads to temporarily isolate individual wet well bays.

To mitigate sediment buildup within the wet well, a sediment jetting system would be provided. The sediment jetting system would jet the wet well floor with high-pressure water to resuspend sediment. Once resuspended, the solids would be conveyed out of the wet well by the pumps.

The motor size of the sediment jetting pump is anticipated to be 200 HP

An evaluation of the anticipated hydraulic transient response to an uncontrolled pump shutdown would be performed to determine whether surge mitigation would be required and to inform which method of surge mitigation would likely be most practical and effective. Preliminary findings indicate that surge mitigation would be required and could be effectively provided by use of an air-over-water hydropneumatic surge tank(s) and pressure-relief valve installed on the pumped flow bypass line.

3.3.3 Electrical Equipment

The assumed load for this facility is approximately 4.2 MVA. For the purposes of this study, Jacobs considered that a single utility service provides an acceptable level of source reliability. Many different electrical configurations are possible, and local conditions must be considered during subsequent design efforts. REU service would need to be provided to the site. REU would provide the primary switch and meter devices. Additional upgrades to REU's distribution system could be required to adequately serve the pump station.

All electrical equipment is expected to be grouped together and is identified on the site plan as "Electrical Yard". The utility meter section and transformer would be designed and installed according to REU standards. A block or concrete building, or prefabricated e-house is proposed as the structure to house all the electrical switchgear, motor control equipment, and any needed PLC/control devices. Area lighting should be considered in final design for all facilities and gate entrance.

Section 5 documents solar offset overview for each site. The site has an existing solar PV array approximately 1 acre in area. While there is the potential ability to add additional panels, as indicated in Section 5, the site is too small to fit a solar PV array to generate the required electricity. If a solar field is installed at another location, this site will require approval from REU for consumption meter aggregation. Civil Features

The pump station site is in FEMA-designated Special Flood Hazard Area Zone AE. The base flood elevation for the site is 464 as stated in Section 1.6. CCR, Title 23, Waters, Division 1 Central Valley Flood Protection Board provides regulations promulgated by CVFPB to define criteria for structures constructed within floodways. The pump station would be designed to comply with CCR, Title 23, Division 1, Section 113, which requires structures within a floodplain to be securely anchored and floodproofed to at least 2 feet above the design flood elevation.

The site topography slopes down to the water edge, which would require retaining walls for construction of the pump station and forebay. Earthwork would consist primarily of excavation of the forebay, and pump station wet well foundation, with fill behind the retaining walls to level the site finished grade.

Access to the site is proposed through a proposed driveway entrance at the end of Breslauer Way. Gravel surfacing would be used to provide access from the end of the paved road to the pump station and fish screen. A security gate would be required at the driveway entrance to prevent unauthorized vehicles from entering the site. Security fencing should be considered around the facilities.

The pump station discharge piping would be a buried 102-inch-diameter welded steel pipe approximately 1,480 feet long. The piping would be routed past the existing solar array and down the northern edge of the existing Shasta County facility parking lot. This portion of the parking lot would not be accessible during construction. However, the parking lot would be returned to its original condition.

3.3.4 City Zoning

This site is zoned Public Facilities (PF). Public Facilities districts are intended to include areas for utility and public service needs. This site is within the ACID district, and the proposed use is in line with the current zoning.

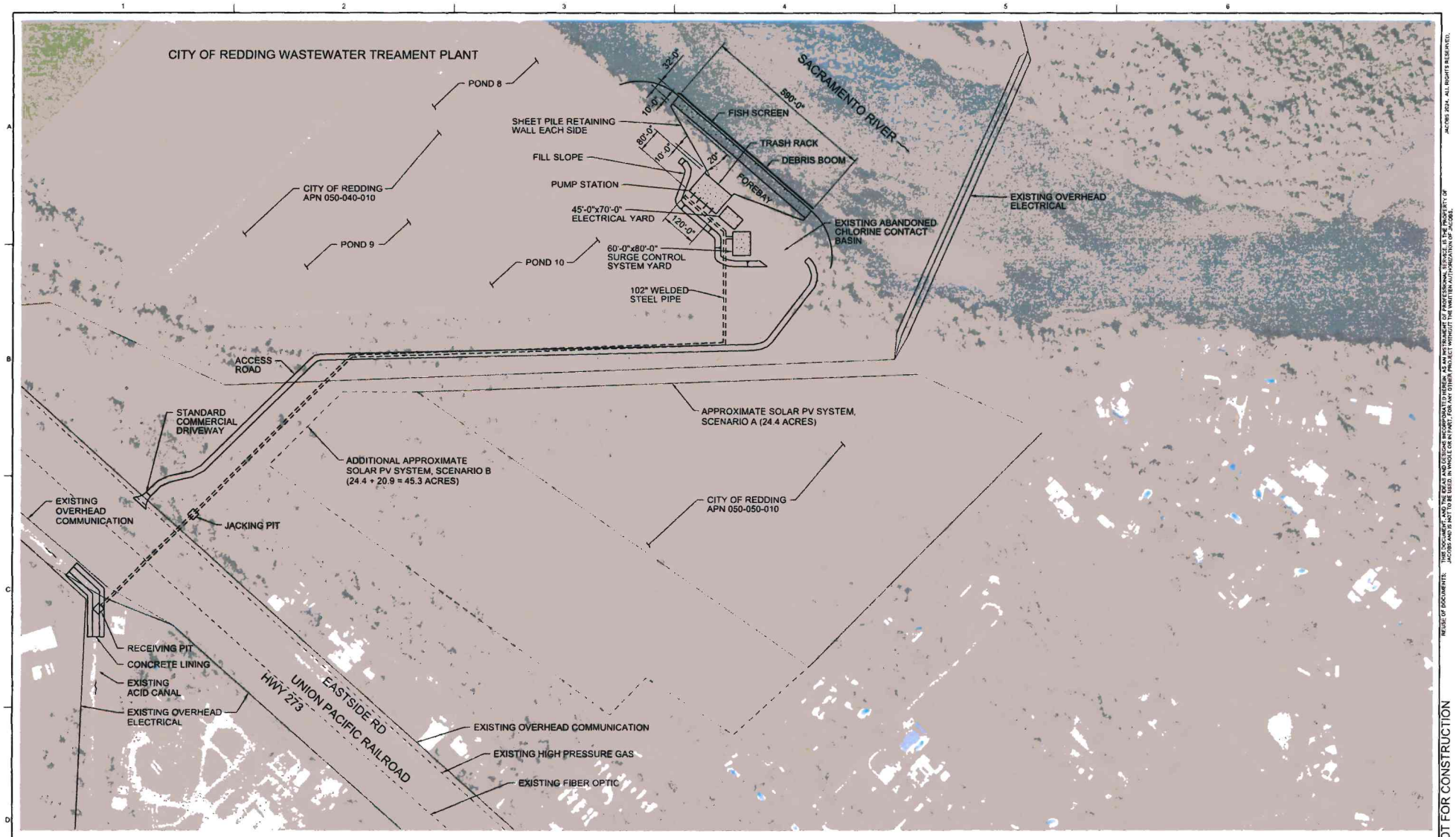
4. Alternative 3 – Clear Creek Wastewater Treatment Plant Site

4.1 Overview

This site was selected as an alternative for consideration because of its proximity to the existing Main Canal and matching public utility operations land use. The City of Redding owns and operates the CCWWTP. Figure 4-1 shows the facility layout site plan. The site is shown in a portion of Pond 10, the southernmost point of the treatment plant, adjacent to the existing abandoned chlorine contact basin (CCB). Coordination with treatment plant staff would be necessary to ensure the reduced volume of Pond 10 would not impact treatment plant operations. The proposed ACID facilities are shown to avoid the abandoned CCB. Coordination with the City of Redding would be required to determine if the abandoned CCB should be demolished with the project. Demolishing the CCB would provide additional flexibility for the facility layout and could limit the impact of fill within Pond 10. Record drawings indicate that CCWWTP has small diameter buried piping around Pond 10. Existing piping would need to be confirmed during final design and relocated to avoid conflicts with the proposed facilities. Additional known existing utilities include overhead electrical and communication lines and buried high-pressure gas and fiber optic lines at the road crossings.

Of the three site alternatives, this site is the farthest south. The site is approximately 6.7 miles south along the Main Canal of the northernmost ACID customers. Options would need to be explored during final design to ensure water deliveries are maintained at existing upstream customers. Preliminary options for maintaining water deliveries include installing a check structure to help control water elevation within the Main Canal (move water north) and installing groundwater wells. Future design phases would need to analyze the ability to move water north. It is unlikely that all existing customers at the northern end of the District could be served from this site given the elevation differences and capacity of the Main Canal. Thus, groundwater wells, or other means of providing water, would be required to maintain service to all customers.

The Main Canal crosses Clear Creek with a buried siphon near Redding Rancheria. This existing crossing has documented fish passage concerns in Clear Creek because of an elevation jump at sheet piles installed within and across the creek. The sheet piles were installed many years ago to protect the belowgrade siphon pipe from erosion at the creek bed. ACID is working on restoration options for this crossing that would improve fish passage at the crossing. One of the preliminary design options for the improvement project was to move ACID's diversion south of the crossing and decommission the siphon. That option could work with the CCWWTP site if the existing customers to the north were maintained with groundwater wells. However, groundwater wells induce challenges with water delivery. The Main Canal is largest at the northern end of the District. If the Main Canal system were used to maintain deliveries, the canal would likely need to operate full. Filling the Main Canal system to maintain deliveries to a limited number of customers is likely not justified given the quantity of water required to fill the canal system versus the quantity of water delivered to the customers. If groundwater wells were used, they would likely need to be strategically located adjacent to the existing customers and discharge into new piping or modified canals specifically sized for the well capacity and water deliveries. The cost to design and construct groundwater wells is not considered in this report. These costs must be accounted for in future planning phases if groundwater wells are selected.



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PLAN
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DATE	FEBRUARY 2025
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REDDING, CA 96001
(530) 243-5831

ACID WATER SUPPLY & FISHERIES RESILIENCY PROJECT
ANDERSON-COTTONWOOD IRRIGATION DISTRICT
ANDERSON, CALIFORNIA

FEASIBILITY REPORT
ALTERNATIVE 3
CCWWTP SITE
LOCATION PLAN

FIGURE 4-1

FILENAME: Figure4-1.dgn PLOT DATE: 20250212\1 PLOT TIME: 4:20:25 PM

PRELIMINARY - NOT FOR CONSTRUCTION

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4.2 Site Photographs

Figure 4-2 is a photograph of the river looking south and right bank in the vicinity of the potential fish screen facility. Figure 4-3 is a photograph of the riverbank looking in the vicinity of the proposed fish screen facility. Photographs of the river were taken on July 12, 2024. Figure 4-4 is a photograph of the Main Canal where the pump station would discharge. Figure 4-5 is a photograph of the parcel along Eastside Road where the pipeline would be installed.



Figure 4-2. Photograph of River Looking Downstream

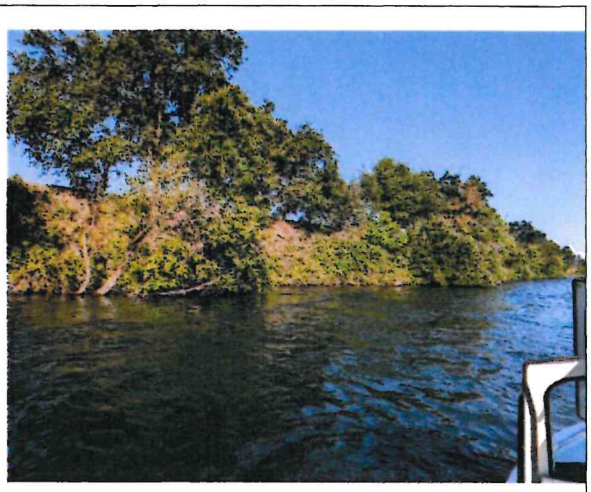


Figure 4-3. Photograph of River Looking Upstream



Figure 4-4. Photograph of Main Canal Looking Downstream



Figure 4-5. Photograph of Eastside Road Looking East

4.3 Pump Station and Fish Screen Intake

4.3.1 Fish Screen

The proposed fish screen is an on-bank concrete structure constructed along the edge of the river channel, placed near the outside of a moderate river bend to facilitate sweeping of fish, debris, and sediment past the structure. The fish screen would be installed approximately 1,000 feet downstream of CCWWTP wastewater outfall. The proposed structure would employ vertical flat-plate screens that slide into place from the top of the structure using guide slots. The flat-plate screens would be constructed from stainless-steel wedge-wire with a 1.75-millimeter gap between wires. Sufficient screen area would be located below the minimum normal water surface, allowing full diversion and pumping capacity at flows equal to or greater than the minimum Sacramento River flow. Water would flow through the fish screen into a forebay that transitions flow toward the pump station located at the center of the forebay. Special attention to river bathymetry would be required during final design to ensure the fish screen is in an optimal location. The pump station would be located at the center of the forebay to reduce the facility footprint within Pond 10 and avoid the existing abandoned CCB. The pump station could slide to the southern end of the forebay if required for hydraulic performance. The final design phase would need to complete CFD modeling of the proposed fish screen and pump station arrangement, and physical modeling for the pump inlet conditions. Future design phases must complete hydraulic modeling for the river with the fish screen structure to ensure minimal impacts to water surface elevations.

4.3.2 Mechanical Equipment

A fish screen cleaning system would be required to maintain the riverside surfaces of the fish screens in a clean condition, sufficient to pass the design flows through the fish screens without violating fish screen criteria or allowing inordinately high-pressure drops across the screens. The fish screen cleaning system would remove algae, sediment, and other debris from the surfaces of the screens. The fish screen cleaning system would consist of a cleaning arm assembly that traverses a length of screen in a back-and-forth cycle traveling on a monorail and pulled by a stainless-steel cable. The cleaning arm would be suspended from the monorail and have nylon bristle brushes in the elevations occupied by the fish screens. A cantilevered weight would maintain the required contact pressure to effect screen cleaning. An adjustable-speed drive would modulate the assembly and gear drive to allow varying speeds to meet the varying seasonal and daily debris loads. The cleaning system would be operator-controlled or automatically controlled by timer or level differential across the fish screens. Because the fish screen structure would be quite long, multiple fish screen cleaning systems would be employed.

A sediment jetting system would be required to reduce sediment buildup in the bays of the fish screen structure, especially during flood flows. Sediment that is deposited in the bays would be pushed into the forebay by the sediment jetting system.

The pump station would include up to five installed pumps, as follows:

- Three large-capacity pumps with constant-speed drives (three duty, no standby)
- One low-capacity pump with AFD (one duty, no standby)
- Sediment jetting pump (one duty, no standby)

The pumps would be vertical mixed-flow or turbine type.

Rated condition for high-capacity pumps (each) would 125 cfs at anticipated 91 feet total head. The motor size of the high-capacity pumps is anticipated to be 1,800 HP.

Rated condition for the low-capacity pump would be 75 cfs at anticipated 90 feet total head. The motor size of the low-capacity pump is anticipated to be 1,100 HP.

Pump selection and rated conditions would be selected such that the pumps operate within their preferred operating region as defined by HI standards.

The pumps would be provided with axial or tilted disc type check valves. Individual butterfly valves would isolate each pump discharge pipe and check valve for maintenance purposes. Individual flowmeters would be provided for each pump to monitor the pump station flow.

The wet well would be a rectangular intake designed in accordance with American National Standards Institute/Hydraulic Institute (ANSI/HI)-9.8, Rotodynamic Pumps for Pump Intake Design. Future design phases must consider wet well isolation to accommodate maintenance activities. A typical approach for wet well isolation would be to use bulkheads to temporarily isolate individual wet well bays.

To mitigate sediment buildup within the wet well, a sediment jetting system would be provided. The sediment jetting system would jet the wet well floor with high-pressure water to resuspend sediment. Once resuspended, the solids would be conveyed out of the wet well by the pumps.

The motor size of the sediment jetting pump is anticipated to be 200 HP.

An evaluation of the anticipated hydraulic transient response to an uncontrolled pump shutdown would be performed to determine whether surge mitigation would be required and to inform which method of surge mitigation would likely be most practical and effective. Preliminary findings indicate that surge mitigation would be required and could be effectively provided by use of an air-over-water hydropneumatic surge tank(s) and pressure-relief valve installed on the pumped flow bypass line.

4.3.3 Electrical Equipment

The assumed load for this facility is approximately 6.6 MVA. For the purposes of this study, Jacobs considered that a single utility service provides an acceptable level of source reliability. Many different electrical configurations are possible, and local conditions must be considered during subsequent design efforts. REU service would need to be provided to the site. REU would provide the primary switch and meter devices. Additional upgrades to REU's distribution system could be required to adequately serve the pump station.

All electrical equipment is expected to be grouped together and is identified on the site plan as "Electrical Yard". The utility meter section and transformer would be designed and installed according to REU standards. A block or concrete building, or prefabricated e-house is proposed as the structure to house all the electrical switchgear, motor control equipment, and any needed PLC/control devices. Area lighting should be considered in final design for all facilities and gate entrance.

4.3.4 Solar Array

This site is the only site of the three alternatives with sufficient open space to accommodate a solar array to offset pump station power consumption. Reference Section 5 for additional discussion on solar design.

4.3.5 Civil Features

The pump station site is in FEMA-designated Special Flood Hazard Area Zone AE. The base flood elevation for the site is 430 as stated in Section 1.6. CCR, Title 23, Waters, Division 1 Central Valley Flood Protection Board provides regulations promulgated by CVFPB to define criteria for structures constructed within floodways. The pump station would be designed to comply with CCR, Title 23, Division 1, Section 113,

which requires structures within a floodplain to be securely anchored and floodproofed to at least 2 feet above the design flood elevation.

The pump station site is located within Pond 10. Earthwork would consist of excavation of the forebay, and pump station wet well foundation and fill around the pump station facilities to provide maintenance access. Re-grading would be required at the northern and southern ends of the site to maintain vehicle access and transition to the existing gravel roads.

Access to the site would be provided from Eastside Road. A new driveway and gravel access would need to be constructed to accommodate vehicle access. A security gate would be required at the driveway entrance to prevent unauthorized vehicles from entering the site. Additional security gates should be considered at the intersections of the proposed facility access road and CCWWTP access roads.

The pump station discharge piping would be a buried 102-inch-diameter welded steel pipe approximately 2,990 feet long. The piping would traverse across an open field headed west toward Eastside Road. The pipeline would need to cross under Eastside Road, UPRR, and SR 273 to get to the Main Canal. It is assumed that these crossings would be made by pipe jacking or microtunneling rather than opencut to maintain vehicle and rail traffic and avoid conflicts with existing utilities. The crossing would be considered a siphon operating as a gravity pipe. Gravity pipe crossings under the highway and railroad do not require a casing pipe, which is required for pressure-pipe crossings.

The capacity of the Main Canal must be verified at the start of the next design phase. The Main Canal at the potential CCWWTP pump station discharge was observed to be smaller than the Main Canal adjacent to the potential sites at Breslauer Way and Cypress Avenue and could limit the capacity of the pump station discharge.

4.3.6 Potential Water Supplement from Clear Creek Wastewater Treatment Plant

This site alternative is near the existing treated effluent outfall for the CCWWTP, which discharges treated effluent directly into the river upstream of the fish screen. There is a potential for CCWWTP to discharge treated effluent directly into the pump station forebay, provided recycled water quality requirements are met for irrigation water usage. In California, CCR, Title 22, § 60304 defines water quality regulations for use of recycled water for irrigation. Wastewater treatment plants can produce four different types of recycled water based on the treatment processes used to produce the recycled water. Depending on the treatment processes and the level of treatment, Title 22 defines how recycled water can be used for irrigation water. Table 4-1 summarizes recycled, non-potable, water uses for irrigation based on the treatment level. The existing CCWWTP treatment system includes chlorination and tertiary treatment to meet disinfected secondary 23 limits. The existing system potentially could meet disinfected secondary 2.2 with operational adjustments. Upgrades to the treatment system could also be incorporated to achieve disinfected tertiary.

A supplement of water from CCWWTP would provide the following benefits:

- Recycled water is drought-proof and could supplement water allocation reductions during Shasta critical water years.
- Supplemental recycled water received from CCWWTP would reduce the river diversion, allowing the reduced diversion quantity to be sold and transferred similar to ACID's existing groundwater well transfers for an additional revenue source to ACID.

If this site is selected as the preferred alternative, moving forward, this type of water supplement option would require the following next steps:

- Reach out to the City of Redding regarding potential for CCWWTP to update their treatment system and National Pollutant Discharge Elimination System discharge permit to include non-potable reuse to and in partnership with ACID. A Title 22 Engineering Report for the CCWWTP recycled water treatment facilities and distribution pipe to the ACID forebay application point would be required to initiate permitting.
- Reach out to the City of Redding to see if the option is economically viable for operations and maintenance.
- Confirm that all ACID customers meet the agricultural application type for disinfected secondary 2.2. If any customers grow food crops where the recycled water would come into contact with the edible portion of the crop, then disinfected tertiary would be needed, requiring upgrades to meet more stringent turbidity and total coliform limits.
- A new, dedicated pipeline would be needed from CCWWTP to the ACID forebay.
- The cost of this option is not included in this report. If this option was selected, additional analysis would be required to determine the design, permitting, construction, and O&M costs.

Table 4-1. Title 22 Allowable Use of Recycled Water for Irrigation

Type of Recycled Water Use for Agricultural Irrigation	Title 22 Treatment Level			
	Disinfected Tertiary	Disinfected Secondary 2.2	Disinfected Secondary 23	Undisinfected Secondary
Food crops, including all edible root crops, where the recycled water comes into contact with the edible portion of the crop	✓			
Food crops where the edible portion is produced above ground and not contacted by the recycled water	✓	✓		
Ornamental nursery stock and sod farms where access by the general public is not restricted	✓	✓	✓	
Pasture for animals producing milk for human consumption	✓	✓	✓	
Orchards where the recycled water does not come into contact with the edible portion of the crop	✓	✓	✓	✓
Vineyards where the recycled water does not come into contact with the edible portion of the crop	✓	✓	✓	✓
Non-food-bearing trees	✓	✓	✓	✓

Type of Recycled Water Use for Agricultural Irrigation	Title 22 Treatment Level			
	Disinfected Tertiary	Disinfected Secondary 2.2	Disinfected Secondary 23	Undisinfected Secondary
Fodder and fiber crops and pasture for animals not producing milk for human consumption	✓	✓	✓	✓
Seed crops not eaten by humans	✓	✓	✓	✓
Food crops that must undergo commercial pathogen-destroying processing before being consumed by humans	✓	✓	✓	✓
Ornamental nursery stock and sod farms provided no irrigation with recycled water occurs for a period of 14 days prior to harvesting, retail sale, or allowing access by the general public	✓	✓	✓	✓

4.3.7 City Zoning

The riverbank of this site is zoned Open Space (OS). The existing abandoned CCB is within the Open Space area. Open Space districts are intended to include areas that enhance the community character, maintain the scenic beauty, and increase recreational opportunities by preserving open space. Investigation of Open Space designation at this site would be required in the final design phase. The Open Space zoning extends north along the riverbank of Pond 10 to the northern end of Pond 8. Public access is not allowed in this area. The remainder of Pond 10 is zoned Public Facilities (PF), which is consistent with the land use of the treatment plant. The open field west of Pond 10 where the solar array could be installed, and where the pipeline would be routed is zoned Heavy Industry (HI). Heavy Industry areas accommodate the broadest range of industrial uses, including those that are characterized by significant outdoor processing or storage. The solar array would likely meet the use of Heavy Industry zoning.

5. Solar Offset Overview

Each site alternative is within the REU service area. The proposed pump station would consume a significant amount of electricity. To offset electricity consumption costs, ACID would like to install a solar PV array to generate electricity.

This section summarizes Jacobs' evaluation of the technical and financial feasibility of installing a solar array for each of the candidate pump station sites. The following items are addressed herein:

1. **Utility Programs:** Utility renewable energy programs are screened for benefits and drawbacks.
2. **Sizing and Footprint:** Array capacities and footprints are estimated.
3. **Class V Cost Estimate:** Capital and O&M costs are estimated for array options.
4. **Financial Return Estimate:** Simple payback is estimated for array options.
5. **Next Steps:** Tasks for advancing the implementation of a solar array are listed.

Following are conclusions from the solar PV screening for a proposed pump station for ACID:

1. Each of the available REU renewable energy programs has significant roadblocks and drawbacks for creating a financially advantageous arrangement for ACID. It is recommended that meetings with REU be held to determine if an arrangement can be agreed upon that would involve (1) monthly or annual net-metering, (2) higher capacity limit, and (3) generation and consumption meter aggregation.

2. Depending on the pump station site that is selected and what arrangement can be agreed upon with REU, 5 to 19 megawatts direct current (MW-DC) solar array would be necessary to offset the selected pump station's energy costs. The solar array would have a footprint of 21 to 71 acres. Federal incentives can lower the capital cost of a solar array to $8 million (M) to $26 M. It is recommended that additional grants and incentives be researched to improve the project finances.

3. If REU offers no flexibility in its renewable energy programs, it is recommended that the feasibility of batteries be examined to assist the solar array in providing a more consistent supply of electricity that can offset a greater portion of REU supply.

5.1 Utility Programs

REU renewable energy programs were screened for benefits, roadblocks, and drawbacks for implementing a solar PV array at any of the candidate pump station sites. California Public Utilities Commission (CPUC) renewable energy programs were screened as well. Although REU is a municipal utility that is not subject to CPUC regulations, CPUC programs could serve as an example to reference when negotiating with REU.

5.1.1 REU: Renewable Resource Net-Metering Service (E*NET)

REU offers the Renewable Resource Net-Metering Service (E*NET). Following are key aspects of E*NET:

1. As of January 1, 2020, E*NET is not accepting new generators.

2. Generator must be solar, wind, or other eligible generator.

3. E*NET has a maximum generator capacity limit of 1 MW.

4. Generator must be owned and operated by the customer.

5. Generator must be connected in parallel with the customer's loads that are serviced by REU and located on the customer's premises.

6. Generation must be intended to offset part or all the customer's electrical consumption.

7. All three candidate pump station sites would be serviced as Large Commercial customers by REU. Subsequently, under E*NET, each site would be slotted for monthly net-metering where generation and consumption are netted monthly to offset monthly energy costs. In the case where monthly consumption exceeds generation, the customer is responsible for paying REU for the difference in energy. In the case where monthly generation exceeds consumption, REU would pay the customer the difference in energy at REU's avoided cost for energy.

8. As of January 1, 2020, REU's avoided energy cost is set at $0.0608/kilowatt-hour (kWh).

E*NET is a type of service for renewables that is commonly referred to as monthly net-metering. Monthly net-metering is typically a financially advantageous business model for customers looking to install solar PV. Offsetting utility energy costs often leads to savings great enough to pay back solar investment costs within 10 to 15 years.

Although the E*NET service is an interesting option for ACID that could provide long-term value, there are three clear roadblocks for implementation: (1) the program is currently not accepting new generators, (2) the solar array capacity needed to offset any of the three candidate site's annual consumption would exceed the 1-megawatt (MW) generator capacity limit, and (3) two of the three candidate sites have limited space for a solar array, which raises issues with interconnecting the loads and generator with REU in parallel within the same premises.

5.1.2 REU: Zero Net Energy Service (E*ZNE)

REU Schedule of Rates offers the Zero Net Energy Service (E*ZNE). Following are key aspects of E*ZNE:

1. E*ZNE is currently accepting new generators.

2. Generator must be solar, wind, or other eligible generator.

3. E*ZNE has a maximum generator capacity limit of 1 MW.

4. Generator must be owned and operated by the customer.

5. Generator must be connected in parallel with the customer's loads that are serviced by REU and located on the customer's premises.

6. Generation must be intended to offset part or all the customer's electrical consumption.

7. Under E*ZNE, when a customer's generation meets consumption, the utility energy rate is avoided by the customer. When a customer's generation exceeds consumption, REU would pay the customer the difference in energy at the avoided cost for energy. In the case where consumption exceeds generation, the customer is responsible for paying REU for the difference in energy.

8. As of January 1, 2020, REU's avoided energy cost is set at $0.0608/kWh.

E*ZNE is a type of service for renewables that is commonly referred to as instantaneous net-billing. Rather than crediting generation toward the utility energy rate for an entire month in monthly net-metering arrangements, generation is only credited at the utility energy rate when generation aligns with consumption at a given time. This leads to less generation being credited at the higher utility energy rate and more generation being credited at the lower avoided cost rate. This typically leads to less of the customer's loads being accounted as being met with renewables and leads to a lower financial return than monthly net-metering arrangements.

Similar to E*NET, the generator capacity 1-MW limit and parallel interconnection requirements would be roadblocks for implementing the E*ZNE at any of the candidate sites.

5.1.3 CPUC: Renewable Energy Self-Generation Bill Credit Transfer (RES-BCT)

Although REU is a municipal utility that is not subject to CPUC regulations, CPUC programs could serve as an example to reference when negotiating with REU. CPUC offers the Renewable Energy Self-Generation Bill Credit Transfer (RES-BCT) program under Public Utilities Code 2830. Following are key aspects of RES-BCT:

1. Benefiting customer accounts must be a local government, campus, or tribe.
2. Generator must be an eligible renewable energy resource. Solar PV qualifies as an eligible renewable energy resource.
3. RES-BCT has a maximum generator capacity of 5 MW.
4. Generator must be owned, operated, or on property owned by the local government, campus, or tribe.
5. Separate generation and consumption accounts owned by the customer can be bundled together.
6. Generation must be intended to offset part or all the customer's electrical consumption.
7. Under RES-BCT, generation and consumption are netted monthly. When monthly consumption exceeds generation, the customer is responsible for paying the electric utility the difference. When monthly generation exceeds consumption, the difference is rolled over to the next month. After a 12-month period, any remaining excess is reset to 0.
8. Excess generation is not compensated by the electric utility.

RES-BCT is a type of service for renewables that is typically referred to as annual net-metering. Similar to monthly net-metering, annual net-metering is a financially advantageous business model as generation offsets utility energy costs. The program is also considered "virtual" annual net-metering because the program allows for separate meters to be aggregated together on a customer's bill.

RES-BCT offers two key advantages in comparison to the services offered by REU: (1) the program increases the maximum generator capacity to 5 MW, which is closer to the solar capacity needed to offset a significant portion of any of the three site's consumption; and (2) the program allows generation and consumption to be interconnected with the electric utility at different points.

5.1.4 Utility Programs Summary

Table 5-1 summarizes the benefits, roadblocks, and drawbacks for each renewable energy utility program screened in Section 5.1.1 through 5.1.3. Each of the REU programs has significant roadblocks and drawbacks. It is recommended that meetings with REU be held to determine if an arrangement can be agreed upon that would involve (1) monthly or annual net-metering, (2) higher capacity limit, and (3) generation and consumption meter aggregation.

Table 5-1. Solar PV Utility Programs Summary

Solar PV Program	Benefits	Roadblocks and Drawbacks
REU: E*NET	Framework for monthly net-metering. Avoided energy cost of $0.0608/kWh is relatively good for excess generation in comparison to other utilities.	Currently not accepting new generators. Maximum capacity limit of 1 MW. Parallel interconnection of loads and generation with utility.
REU: E*ZNE	Currently accepting new generators.	Instantaneous net-billing is less financially beneficial than monthly or annual net-metering. Maximum capacity limit of 1 MW. Parallel interconnection of loads and generation with utility.
CPUC: RES-BCT	Framework for annual net-metering. Increased capacity limit of 5 MW. Generation and consumption meter aggregation.	Program not available to REU customers. Excess generation is not compensated.

5.2 Sizing and Footprint

Considering the utility programs for solar PV that could potentially be negotiated with REU, the following two scenarios are developed for sizing a solar array for each candidate site:

1. **Scenario A:** The solar PV array is sized to generate the annual consumption of a given candidate site. This scenario models an annual net-metering program.
2. **Scenario B:** The solar PV array is sized to generate the peak month of consumption of a given candidate site. This scenario models a monthly net-metering program.

Annual consumption for each candidate site is estimated based on pump sizes and flow ratings provided by the Jacobs design team. Annual consumption is then scaled with monthly peaking factors developed from the ACID contracted total flow to estimate monthly consumption for each candidate site. Figure 5-1 shows the monthly peaking factors used across each candidate site. Because ACID's contract runs only from April through October, there is a high concentration of energy consumption in the summer months. Table 5-2 lists the annual and peak month energy consumption for each candidate site.

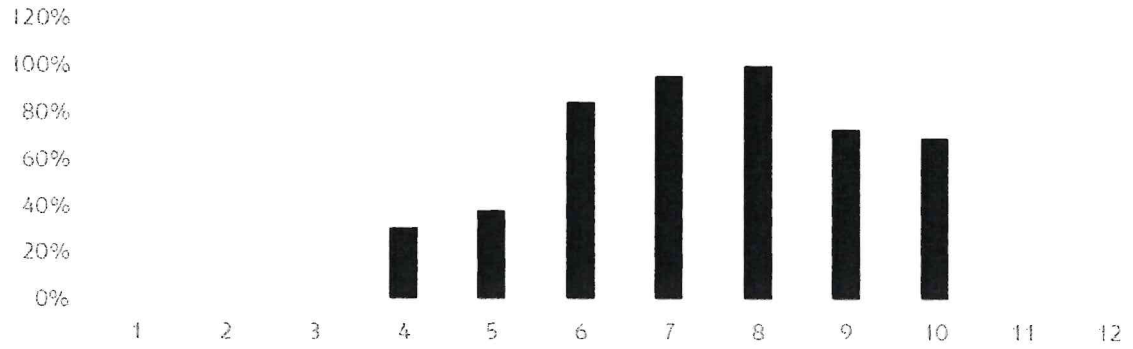


Figure 5-1. ACID Contracted Flow Peaking Factors

Table 5-2. Annual and Peak Month Energy Consumption

Sizing Scenario	Cypress Avenue (kWh)	Breslauer Way (kWh)	CCWWTP (kWh)
Scenario A – Annual	6,995,000	7,737,000	12,930,000
Scenario B – Peak Month	1,421,000	1,572,000	2,626,000

The solar PV yield for Redding, California, is modeled using National Renewable Energy Laboratory's System Advisory Model. Standard array characteristics are used to model generation from a ground-mount fixed-axis array. Solar array capacities are upsized by 15% to account for 0.5% annual capacity degradation over a 30-year lifetime.

Table 5-3 lists solar PV capacities for each candidate site and sizing scenario. Table 5-3 shows that sizing an array based on the peak consumption month results in an array capacity nearly double the size of an array sized based on the annual consumption.

Table 5-3. Solar PV Capacity

Sizing Scenario	Cypress Avenue (kW-DC)	Breslauer Way (kW-DC)	CCWWTP (kW-DC)
Scenario A – Annual	5,350	5,920	9,890
Scenario B – Peak Month	9,960	11,020	18,410

kW-DC =– kilowatts direct current

Solar array footprints are estimated based on a standard rectangular layout for a ground-mount fixed-axis array. Table 5-4 lists solar PV footprints for each candidate site and sizing scenario.

Table 5-4. Solar PV Footprint

Sizing Scenario	Cypress Avenue (acres)	Breslauer Way (acres)	CCWWTP (acres)
Scenario A – Annual	13.2	14.6	24.4
Scenario B – Peak Month	24.5	27.1	45.3

5.3 Solar Cost Considerations

A Class V cost estimate was completed based on the assumptions listed in Section 5.2. Class V Association for the Advancement of Cost Engineering (AACE) cost estimates are prepared with parametric capital expenditure (CAPEX) and operational expenditure (OPEX) values that are based on industry cost reports and Jacobs' project experience. Parametric CAPEX is set to $2,000/kW-DC, and parametric OPEX is set to $20/kW-DC/year to align with typical costs for ground-mount fixed-axis solar PV arrays.

The Biden administration implemented the Inflation Reduction Act, which included provisions to increase the Investment Tax Credit (ITC) incentives for solar PV to 30% of CAPEX and to be available to non-taxpaying entities as a direct payment from the federal government. Currently, the 30% incentive can increase to 40% if the array satisfies American materials and manufacturing requirements. Further investigation is necessary to determine if the added 10% incentive would pay off potential cost increases for limiting equipment to American materials and manufacturers.

As of early January 2025, it is unknown how the new Trump administration will view the incentives for solar PV available through the ITC. It is worth noting that before the Inflation Reduction Act, the ITC was available only as a tax credit and was limited to 26% of CAPEX. As of December 2024, it is unclear how the tariffs proposed by the incoming Trump administration will affect prices for solar equipment for both American and foreign products. Considering these uncertainties, the ITC incentive is limited to 30% of CAPEX for this analysis.

Table 5-5 lists CAPEX estimates with the 30% ITC included for each candidate site and sizing scenario. CAPEX metrics are all-in costs that represent the cost of designing, purchasing, and installing the equipment with all necessary balance of system.

Table 5-5. Solar PV CAPEX and 30% ITC Estimates

Sizing Scenario	Cypress Avenue	Breslauer Way	CCWWTP
Scenario A – Annual	$10.70 M – $3.21 M = $7.49 M	$11.83 M – $3.50 M = $8.27 M	$19.77 M – $5.93 M = $13.84 M
Scenario B – Peak Month	$19.92 M – $5.98 M = $13.86 M	$22.04 M – $6.61 M = $15.43 M	$36.83 M – $11.05 M = $25.78 M

Table 5-6 lists OPEX estimates for each candidate site and sizing scenario. Annual OPEX metrics include costs for cleaning, inspection, monitoring, and component replacement.

Table 5-6. Solar PV OPEX Estimates

Sizing Scenario	Cypress Avenue	Breslauer Way	CCWWTP
Scenario A – Annual	$107,000/year	$118,300/year	$197,800/year
Scenario B – Peak Month	$199,200/year	$220,400/year	$368,300/year

5.4 Next Steps

Next steps for advancing the implementation of a solar array at a proposed pump station site is listed as follows:

1. Select a pump station site to provide more certainty around solar PV sizing.
2. Hold meetings with REU to determine if an arrangement can be agreed upon that would involve (1) monthly or annual net-metering, (2) higher capacity limit, and (3) generation and consumption meter aggregation.
    a. If REU offers no flexibility in its renewable energy programs, it is recommended that the feasibility of batteries be examined to assist the solar array in providing a more consistent supply of electricity that can offset a greater portion of REU supply.
3. Research additional incentives and grants that a solar array may potentially be eligible to receive.
4. Assess emissions reductions and public benefit associated with renewable energy generation from a solar array.
5. Identify required environmental permits for installing a solar array.
6. Identify potential utility interconnection points.
7. Prepare design documents for the solar array and potentially coupled battery.

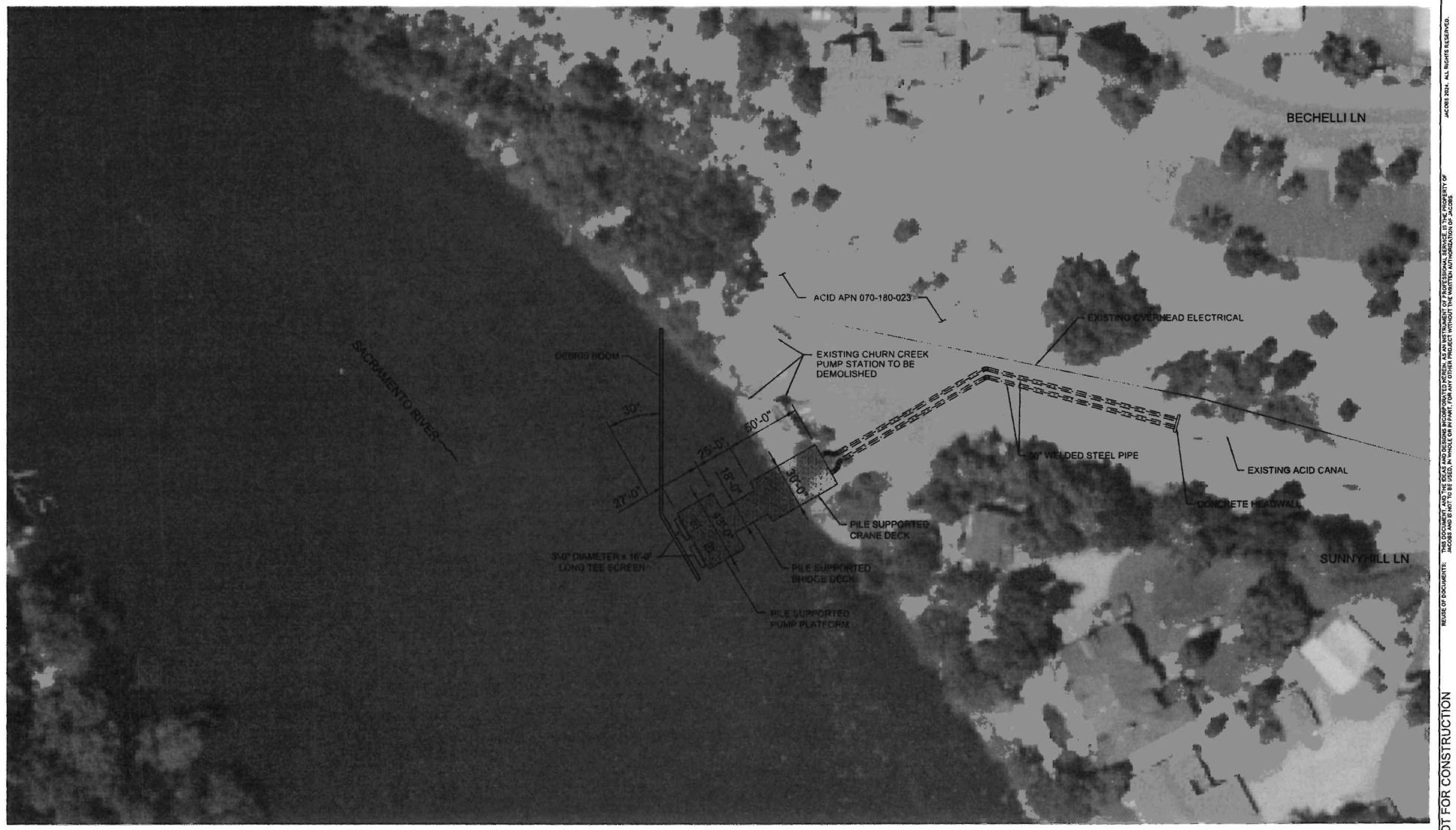
6. Churn Creek Pump Station Replacement

6.1 Overview

ACID operates the existing Churn Creek Pump Station on the left bank of the Sacramento River near River Mile 292. The existing pump station delivers 60 cfs irrigation water to Churn Creek Bottom. Historically, water deliveries to Churn Creek Bottom were maintained with a flume across the Sacramento River near the location of the existing pump station. A flood event prior to the construction of Shasta Dam washed away the historic flume. The existing pump station was constructed as a replacement to the historic flume.

Figure 6-1 shows the facility layout site plan. The proposed pump station is shown downstream of the existing pump station. This layout would allow the existing pump station to remain online during construction of the proposed pump station to maintain water deliveries during construction. Once the proposed pump station is online, the existing pump station facilities would be demolished. The proposed pump station was schematically located based on publicly available bathymetry and topography data. The final design phase must collect accurate data to precisely locate the proposed pump station. A 36-inch-diameter cylindrical tee screen was selected for the conceptual analysis in this report. Accurate bathymetry data and design low water surface elevation must be defined to locate the fish screen with 18 inches minimum clearance to the riverbed and 18 inches minimum submergence (one screen radius) at the design low water surface elevation. Future design phases must confirm the design low water surface elevation with consideration of future river operations.

The Churn Creek Pump Station replacement preliminary layout consists of two vertical mixed-flow irrigation pumps with a total diversion capacity of 60 cfs that would discharge into the existing ACID Churn Creek Canal. Pump intake fish screening is achieved with cylindrical tee screens designed and fabricated to meet state and federal fish passage criteria. The pumps are supported on a cast-in-place concrete elevated concrete deck supported by steel piles. The concrete deck is sized to support a maintenance crane that would be used to install and remove all mechanical equipment. The concrete deck is also sized for vehicles out to the pump deck. The portion of the pump station within the water would be protected from floating debris by a debris boom. The leading edge of the debris boom is angled at 30 degrees, maximum, from the river flow to ensure debris is shed down river.



N

PLAN
1"=60'

0 60 120 180
1"=60'

DATE	FEBRUARY 2025
PROJ	W8Y33000

JACOBS 2525 AIRPARK DR. REDDING, CA 96001 (530) 243-5831

ACID WATER SUPPLY & FISHERIES RESILIENCY PROJECT
ANDERSON-COTTONWOOD IRRIGATION DISTRICT
ANDERSON, CALIFORNIA

FEASIBILITY REPORT
CHURN CREEK
PUMP STATION
LOCATION PLAN

FIGURE 6-1

FILENAME: Figure6-1.dgn PLOT DATE: 2025\01\29 PLOT TIME: 4:51:29 PM

PRELIMINARY - NOT FOR CONSTRUCTION

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6.2 Pump Station and Fish Screen Intake

6.2.1 Fish Screen

Two electrically operated fish screen units would be installed on the intake structure to prevent fish from entering the pump suction cans and being pulled into the pump. Each screen would consist of two rotating drum wedge-wire screens mounted to a common suction manifold. The approximate size of each screen is 36 inches diameter by 16 feet long. Submersible electric motors would periodically rotate each drum screen against fixed nylon brushes to clean interior and exterior surfaces of the stainless-steel wedge-wire screens. An electric hoist would be installed at the top of the fixed-track assembly mounted on the structure to retract the screen and manifold assembly for inspection and maintenance.

The fish screen design criteria and guidelines issued by CDFW and NOAA –NMFS for salmonids include guidance from NOAA Fisheries West Coast Region Guidance to Improve the Resilience of Fish Passage Facilities to Climate Change (June 2022). These guidelines are generally supported by the U.S. Fish and Wildlife Service and include the following:

- Approach velocity (water velocity perpendicular to the screen) – less than or equal to 0.40 fps where exposure time is limited to less than 60 seconds, or 0.33 fps where exposure time is greater than 60 seconds.
- Minimum sweeping velocity (water velocity parallel to the screen) – two times the approach velocity; between 0.8 and 3.0 fps is optimal.
- Screen slot opening size – 1.75 millimeters (0.069 inch).
- Screen porosity – 27% minimum open area.

6.2.2 Irrigation Pumps

Two 30-cfs pumps would provide the required 60-cfs flow rate at anticipated 35 feet total differential head. The pumps would be a vertical mixed-flow or an axial-flow type with shaft-enclosing tube and grease lubrication. Grease fittings would be provided at the pump motor stand for occasional manual lubrication of the shaft packing and bearings. The motor size of the pumps is anticipated to be approximately 200 HP. The pump motor would be driven by an AFD and designed to operate over a wide range of river elevations. The final design phase must confirm all pump design criteria and sizing. The pump intake must be designed in accordance with American National Standards Institute/Hydraulic Institute (ANSI/HI)-9.8, Rotodynamic Pumps for Pump Intake Design.

In addition to the irrigation pumps, it is anticipated that a sediment jetting and washdown pump would be provided. The sediment jetting/washdown pump would be used to charge a pipe with utility hose connections and pump suction can sediment jetting lines.

A flow meter would be required to record and monitor flow discharge from each pump. An electromagnetic flow meter specifically designed for the piping configuration upstream and downstream of the meter should be considered during the final design phase.

6.2.3 Electrical Equipment

REU provides service to the existing site. Final design must verify the adequacy of the existing service and requirements for upgrades to the utility transformer and meter. The utility main disconnect would feed a motor control center that would be located on the pump station concrete deck. All electrical equipment would be outdoor-rated and located above the design flood elevation in accordance with CVFPB regulations. Area lighting should be considered on the pump platform and gate entrance.

6.2.4 Civil Features

The pump station site is in FEMA-designated Special Flood Hazard Area Zone AE. The base flood elevation for the site is 453.5 as stated in Section 1.6. CCR, Title 23, Waters, Division 1 Central Valley Flood Protection Board provides regulations promulgated by CVFPB to define criteria for structures constructed within floodways. The pump station would be designed to comply with CCR, Title 23, Division 1, Section 113, which requires structures within a floodplain to be securely anchored and floodproofed to at least 2 feet above the design flood elevation.

Access to the site would be maintained via Sunnyhill Lane. Grading would be required to conform the existing driveway to the deck of the proposed pump station. The existing security gate should be updated to provide enhanced site security and meet current best practices for site security.

The irrigation pumps would discharge to a 30-inch-diameter welded steel pipe. The piping would transition from exposed below the pump station deck to buried piping to the Churn Creek Canal. Piping would discharge into the Churn Creek Canal at the same location as the existing pump station discharge piping.

6.2.5 City Zoning

ACID's parcel is split between Rural Lands (RL-2) and Open Space (OS). Rural Lands districts are intended to include areas constrained by relatively extreme topography or outlying rural areas. The proposed pump station is a replacement of the existing pump station and consistent with the purpose for which the area was originally dedicated for public use and should be allowed within the current zoning.

7. Environmental Compliance

7.1 California Environmental Quality Act

The California Environmental Quality Act (CEQA) was enacted in 1970 with the primary purpose of informing local and state government decision makers and the public about the potential significant environmental effects of proposed activities and identifying the ways that environmental damage can be avoided or minimized to prevent significant, avoidable damage to the environment. CEQA compliance would be required for the ACID Water Supply & Fisheries Resiliency Project for all three alternatives evaluated. It is anticipated that project impacts from noise and to biological resources would be potentially significant and necessitate the development of an Environmental Impact Report. Because some of the project features would be well-defined during project planning, but others, specifically the decommissioning of the existing Diversion Dam (discussed further in Section 8) would be dependent on agency input and availability of funding and would take longer to define, it is anticipated that a Programmatic Environmental Impact Report would be developed, with some impacts analyzed at the project-level and some impacts assessed programmatically. It is assumed that ACID would serve as the CEQA lead agency.

7.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) was signed into law on January 1, 1970, to establish a national environmental policy with the goals of protecting, maintaining, and enhancing the environment. NEPA provides federal agencies with a process for implementing these goals. NEPA compliance is required by all federal agencies undertaking a proposed action or project, as well as actions and projects undertaken by nonfederal agencies that are federally funded. The project has three potential NEPA triggers which apply to all three alternatives.

First, NEPA compliance would be required if funding from federal sources is obtained. Based on preliminary funding discussions, this is expected. Secondly, an update to the location of the diversion point on a figure in the ACID's water rights Settlement Contract with Reclamation would be required, which is an "action" by a federal agency. However, this action is considered administrative and assumed to be Categorically Excluded. Finally, if the project does not qualify for a Nationwide Permit in compliance with Section 404 of the Clean Water Act, then the issuance of an Individual Permit would require NEPA compliance, which would need to be performed by the U.S. Environmental Protection Agency. If NEPA compliance is determined to be required, it is assumed that Reclamation would serve as the NEPA lead agency.

7.3 Permits and Approvals

Several permits and approvals from federal, state, regional, and local agencies for construction and operation were considered potentially applicable to this project. These permits and approvals, the agencies responsible for their oversight, a determination of their applicability to the project, and the responsible party, when applicable, are presented in Table 7-1.

Table 7-1. Potentially Applicable Federal, State, Regional, and Local Permits and Approvals

Agency	Permit/Approval	Applicability	Alternative 1 – Cypress Avenue	Alternative 2 – Breslauer Way	Alternative 3 – Clear Creek WWTP	Churn Creek Pump Station Replacement
Federal Agency Permits and Approvals						
U.S. Army Corps of Engineers	Clean Water Act Section 404/Rivers and Harbors Act Section 10 Pre-Construction Notification	Required for work performed below the OHWM of jurisdictional Waters of the U.S.	Would be required for work performed below the OHWM of the Sacramento River.			
U.S. Army Corps of Engineers	Section 408	Required for modifications, alterations, or occupation of public works projects owned by USACE.	This section of the Sacramento River does not fall within USACE jurisdiction; therefore, Section 408 permission would not be required.	This section of the Sacramento River falls within USACE jurisdiction; therefore, Section 408 permission would be required.	This section of the Sacramento River does not fall within USACE jurisdiction; therefore, Section 408 permission would not be required.	
U.S. Fish and Wildlife Service	ESA Section 7 Consultation	Analysis of potential impacts to terrestrial special-status species protected under the ESA required as part of the Section 404 permitting process.	Would be required as part of the Section 404 permitting process.			
National Marine Fisheries Service	ESA Section 7 Consultation	Analysis of potential impacts to terrestrial special-status species protected under the ESA required as part of the Section 404 permitting process.	Would be required as part of the Section 404 permitting process.			

Agency	Permit/Approval	Applicability	Alternative 1 – Cypress Avenue	Alternative 2 – Breslauer Way	Alternative 3 – Clear Creek WWTP	Churn Creek Pump Station Replacement
Bureau of Reclamation	Settlement Contract amendment	Required to amend the location of ACID's diversion.	Updated figure and description of location would be required.			Updated figure may be required.
U.S. Coast Guard	Private Aids to Navigation	Private Aids to Navigation approval is required for new lights and potential marine obstructions and hazards on navigable waterways.	Would be required.			
State Agency Permits and Approvals						
California Department of Fish and Wildlife	Lake or Streambed Alteration Agreement	Required for any alteration of the bed, bank, or channel of any river, stream, or lake.	Would be required for impacts to the Sacramento River.			
California Department of Fish and Wildlife	California Fish and Game Code Section 2081 Incidental Take Permit	Required for impacts to special-status species protected under CESA.	Assumed to be required, though all special-status species anticipated in this vicinity are expected to be protected under both ESA and CESA; therefore, CDFW may consider issuing a Consistency Determination.			
State Historic Preservation Officer	National Historic Preservation Act Section 106 Consultation	Analysis of potential impacts to cultural and tribal cultural resources required as part of the Section 404 permitting process.	Would be required as part of the Section 404 permitting process.			
State Water Resources Control Board	Change of Point of Diversion	Required to relocate the ACID's existing diversion.	It is assumed the project would qualify for a Minor Change Request as defined under California Water Code Section 1700.4.			Updated figure may be required.
Regional Agency Permits and Approvals						
Central Valley Flood Protection Board	Encroachment Permit	Required for construction within the Designated Floodway.	Would be located within the floodway; therefore, permit would be required.			

Agency	Permit/Approval	Applicability	Alternative 1 – Cypress Avenue	Alternative 2 – Breslauer Way	Alternative 3 – Clear Creek WWTP	Churn Creek Pump Station Replacement
Central Valley Regional Water Quality Control Board	Clean Water Act Section 401 Water Quality Certification	Required for work performed below the OHWM of jurisdictional Waters of the U.S.	Would be required for work performed below the OHWM of the Sacramento River.			
Central Valley Regional Water Quality Control Board	National Pollutant Discharge Elimination System Construction General Permit	Preparation of Notice of Intent/Stormwater Pollution Prevention Plan required when the construction disturbance area is greater than 1 acre.	Would be required.			
Local Agency Permits and Approvals						
Shasta County Department of Public Works	Encroachment Permit	Required for construction in County-owned rights-of-way.	Would not be required.	Would be required.	Would not be required.	Would not be required.
City of Redding Department of Public Works	Grading Permit	Required when the construction disturbance area is within the City limits and greater than 1 acre.	Would be required.			
City of Redding Department of Public Works	Clearing Permit	Required for brushing or clearing a parcel within the City limits and greater than 1 acre.	Would be required.			
City of Redding Department of Public Works	Encroachment Permit	Required for construction in City-owned rights-of-way.	Would be required.	Would be required.	Would be required.	Would not be required.
City of Redding Department of Public Works	Transportation Permit	Required to transport oversized materials and equipment to project site on City-owned roadways.	Would be required.			

Agency	Permit/Approval	Applicability	Alternative 1 – Cypress Avenue	Alternative 2 – Breslauer Way	Alternative 3 – Clear Creek WWTP	Churn Creek Pump Station Replacement
City of Redding Planning Division	Building Permit	Required for new commercial solar arrays.	Would be required if solar array is sited within City limits.		Would be required for new solar array.	Would not be required.
City of Redding Planning Division	Use Permit	Required for a substantial improvement project within a floodplain.	Would be required.			
City of Redding Planning Division	Rezoning	Required when proposed land use conflicts with existing zoning.	Would be required.	Would not be required.	Expected to be required for the portion of the site zoned Open Space.	Would not be required.
City of Redding	RMC18.40.100	Limits construction noise hours based on time of year and day of week. Limits operational noise as measured at the nearest adjacent property.	Because the project proponent does not meet the exemption requirements under RMC 18.40.100.H.5, adherence to established noise standards during construction would be required. Operational noise would be exempt according to RMC 18.40.100.H.6.			
Redding Electric Utility (REU)	Interconnection Agreement	Required to connect solar array to existing electrical grid.	Would be required if solar array is sited within City limits.		Would be required.	Would not be required.
Other Entities						
Union Pacific Railroad	Encroachment Permit	Required for construction in UPRR-owned rights-of-way.	Would not be required.		Would be required.	Would not be required.

Notes:

CESA = California Endangered Species Act
ESA = federal Endangered Species Act
OHWM = ordinary high water mark
RMC = Redding Municipal Code
USACE = U.S. Army Corps of Engineers

7.4 Other Environmental Considerations

Although the following resources may not directly affect required environmental compliance and approvals, potential impacts to them should also be taken into consideration because they present the greatest potential for public opposition to the project.

7.4.1 Vegetation

Vegetation management and removal is known to be a necessity for most infrastructure projects. However, the extent of vegetation removal required has the potential to affect public perception of proposed projects in addition to being a potential impact that must be identified in CEQA and/or NEPA disclosure documents as well as some permit applications. For this reason, a qualitative desktop review of the existing vegetation at the location of each alternative was conducted. This review yielded the following conclusions, which would need to be verified in the field but should be considered in the overall evaluation of the alternatives.

7.4.1.1 Alternative 1 – Cypress Avenue

Of the three alternatives, this location has the densest existing vegetation and would require the most robust vegetation removal effort. Satellite imagery indicates that several dozen mature trees and shrubs, in addition to grasses, would need to be removed to allow for project construction. Because these trees and shrubs are largely located within the riparian corridor, the potential for higher mitigation requirements for removal exists, and their removal could result in potentially significant impacts to special-status species as well as aesthetics.

7.4.1.2 Alternative 2 – Breslauer Way

This location is in an area with less dense vegetation than Alternative 1 but would be expected to still require the removal of approximately at least a dozen mature trees plus numerous shrubs, both within the riparian corridor at the pump station site as well as within the predominantly grassy area where the solar array would be sited.

7.4.1.3 Alternative 3 – Clear Creek Wastewater Treatment Plant

This location would require the least vegetation removal. Based on satellite imagery, it is believed that only shrubs and no mature trees would need to be removed. Therefore, this would be expected to have the lowest environmental impact of the three alternatives considered.

7.4.2 Sensitive Receptors

Sensitive receptors include hospitals, residences, libraries, schools, daycare facilities, elderly housing, and convalescent facilities. These are places where the occupants may be relatively more susceptible to construction- and operation-related noise as well as localized changes in air quality. The presence and extent of nearby sensitive receptors can affect the overall public perception of a project. Generally, as it relates to noise specifically and excluding other resources, projects located in more rural areas tend to receive less public opposition because fewer people are directly affected by these impacts. The presence of sensitive receptors near the project alternatives was evaluated at the desktop level, and the review indicates the following.

7.4.2.1 Alternative 1 – Cypress Avenue

This project alternative is in the most densely populated area of the alternatives considered herein. Although it does not meet the criteria of a sensitive receptor, there is a business located less than 100 feet from the expected construction footprint, and there may be as many as 100 residences located within 0.25 mile from the project site, in addition to numerous other businesses as well as City Hall. Hence, it is anticipated that this alternative would require the most extensive noise minimization and mitigation strategies, which may result in increased costs. It is also worth noting that there may be an increased risk of noise complaints because, as noted in Table 7-1, the project would be required to comply with the City's noise ordinance.

7.4.2.2 Alternative 2 – Breslauer Way

Alternative 2 would be in an area that does not have sensitive receptors immediately to the north or east, but there is a housing development approximately 0.1 mile south of the site; and several dozen homes would fall within the 0.25-mile buffer. Although some existing vegetation, including mature trees, would provide a noise break between the site and the nearest residences, it would be anticipated that noise-related effects to these sensitive receptors would need to be addressed during the planning process.

7.4.2.3 Alternative 3 – Clear Creek Wastewater Treatment Plant

This project site is in a relatively rural area, with the nearest sensitive receptors being approximately four residences within 0.25 mile of the project site. Construction-related noise would be an adverse effect to these residences, although the extent of sensitive receptors is the lowest of the three alternatives considered.

7.4.3 Access

Access to each alternative location was reviewed.

7.4.3.1 Alternative 1 – Cypress Avenue

The Cypress Avenue site would be accessed from Park Marina Drive via Cypress Avenue. Although Cypress Avenue does provide direct access to nearby Interstate 5, it is also a busy arterial within the City limits that could present traffic challenges during peak construction periods when many vehicles would be expected to enter the site daily. Additionally, vehicles would be required to access the site via a left turn from an unprotected center lane, which could present further logistical challenges and would increase risk of accident and incident during construction. Also, there are no existing access roads on the site where the proposed pump station would be located, so additional vegetation removal would be required to construct the proposed access road.

7.4.3.2 Alternative 2 – Breslauer Way

As the name of this alternative suggests, access to the Alternative 2 site would be from Breslauer Way. To access Breslauer Way, it is anticipated that construction traffic would be enter from Market Street/SR 273, and vehicles coming from outside the City limits would access this route from Interstate 5 via South Bonnyview Road or Cypress Avenue. Vehicles accessing Breslauer Way from the south would have a sharp right turn from SR 273, which could be difficult for large trucks. Vehicles accessing the site from the north would have a protected turn lane on SR 273. At the eastern end of Breslauer Way before entering the potential project site, the street is narrow; and traffic management would be required. An existing gate and dirt road provide access to the site itself, so limited additional vegetation removal would be required for site access.

7.4.3.3 Alternative 3 – Clear Creek Wastewater Treatment Plant

This alternative would require the construction of an approximate 0.5-mile new access road that would connect to Eastside Road. Construction of this access road would require removal of some shrubs and other vegetation. Because of the presence of a UPRR track between Eastside Road and SR 273, construction traffic would need to access the site from SR 273 at Whitehouse Drive. There are turn lanes for traffic from both directions at this intersection, but there are no traffic signals.

8. Diversion Dam Decommissioning

After the proposed intake and pump station have been commissioned, the existing Diversion Dam would be decommissioned. At the time of this analysis, three options have been identified. A description of each of these options is included in Sections 8.1 through 8.3. The extent of both anticipated adverse effects during construction and post-construction benefits varies by option. The option ultimately selected will be dependent on input from several regulatory agencies and available funding.

8.1 Abandonment

This option would entail abandoning the Diversion Dam and adjacent fishways in-place. The flashboards and steel support frames would be removed, as they are seasonally under existing conditions; but all other permanent cast-in-place concrete features associated with this facility would remain. This option would result in no additional disturbance beyond that needed for the new, downstream diversion, and it provides the most stability to the riverbed by limiting scour and aggrade. However, it would also continue to limit fish passage based on river flow and impede access for both motorized and nonmotorized water vessels.

8.2 Partial Demolition

This option would remove a portion of the structure but leave some facilities in-place. Although the extent of removal could vary, it is anticipated that, if this option is implemented, the cast-in-place concrete piers would be removed to foundation level; but the at grade and below grade concrete foundation would remain. This would result in some additional disturbance and impacts, but it may also improve fish passage and recreational river access while maintaining below grade stability.

8.3 Full Demolition

This option would entail removing all facilities and equipment associated with the existing Diversion Dam and restoring the Sacramento River riverbed and bank. This option would result in the greatest disturbance and potential for impacts to biological resources during demolition, but it would also remove all impediments to fish passage and recreational access once demolished. The riverbed could be restored to its original condition and access to upstream spawning habit would be dramatically improved. However, this option would also erode some stability of the riverbed and enable aggrade and scour.

8.4 Permits and Approvals

As with the analysis conducted for the project alternatives, potentially applicable permits for the decommissioning of the Diversion Dam were considered for these three options. These are presented in Table 8-1.

Table 8-1. Potentially Applicable Permits for Decommissioning the Diversion Dam

Agency	Permit/Approval	Applicability	Option 1 – Abandonment	Option 2 – Partial Demolition	Option 3 – Full Demolition
Federal Agency Permits and Approvals					
U.S. Army Corps of Engineers	Clean Water Act Section 404/Rivers and Harbors Act Section 10 Pre-Construction Notification	Required for work performed below OHWM of jurisdictional Waters of the U.S.	Would not be required.	Would be required for work performed below the OHWM of the Sacramento River.	
U.S. Army Corps of Engineers	Section 408	Required for modifications, alterations, or occupation of public works projects owned by USACE.	This section of the Sacramento River does not fall within USACE jurisdiction; therefore, Section 408 permission would not be required.		
U.S. Fish and Wildlife Service	ESA Section 7 Consultation	Analysis of potential impacts to terrestrial special-status species protected under the ESA required as part of the Section 404 permitting process.	Would not be required.	Would be required as part of the Section 404 permitting process.	
National Marine Fisheries Service	ESA Section 7 Consultation	Analysis of potential impacts to terrestrial special-status species protected under the ESA required as part of the Section 404 permitting process.	Would not be required.	Would be required as part of the Section 404 permitting process.	

Agency	Permit/Approval	Applicability	Option 1 – Abandonment	Option 2 – Partial Demolition	Option 3 – Full Demolition
U.S. Coast Guard	Private Aids to Navigation	Private Aids to Navigation approval is required for new lights and potential marine obstructions and hazards on navigable waterways.	Would not be required.	Would be required.	
State Agency Permits and Approvals					
California Department of Fish and Wildlife	Lake or Streambed Alteration Agreement	Required for any alteration of the bed, bank, or channel of any river, stream, or lake.	Would not be required.	Would be required for impacts to the Sacramento River.	
California Department of Fish and Wildlife	California Fish and Game Code Section 2081 Incidental Take Permit	Required for impacts to special-status species protected under the CESA.	Assumed to be required, though all special-status species anticipated in this vicinity are expected to be protected under both ESA and CESA; therefore, CDFW may consider issuing a Consistency Determination.		
State Historic Preservation Officer	National Historic Preservation Act Section 106 Consultation	Analysis of potential impacts to cultural and tribal cultural resources required as part of the Section 404 permitting process.	Would not be required.	Would be required as part of the Section 404 permitting process.	
Regional Agency Permits and Approvals					
Central Valley Flood Protection Board	Encroachment Permit	Required for construction within the Designated Floodway.	Would not be required.	Would be required.	

Agency	Permit/Approval	Applicability	Option 1 – Abandonment	Option 2 – Partial Demolition	Option 3 – Full Demolition
Central Valley Regional Water Quality Control Board	Clean Water Act Section 401 Water Quality Certification	Required for work performed below the OHWM of jurisdictional Waters of the U.S.	Would not be required.	Would be required for work performed below the OHWM of the Sacramento River.	
Central Valley Regional Water Quality Control Board	National Pollutant Discharge Elimination System Construction General Permit	Preparation of Notice of Intent/Stormwater Pollution Prevention Plan required when the construction disturbance area is greater than 1 acre.	Would not be required.	May be required if disturbance and staging areas exceed 1 acre.	
City of Redding Department of Public Works	Grading Permit	Required when the construction disturbance area is within the City limits and greater than 1 acre.	Would not be required.	May be required if disturbance and staging areas exceed 1 acre.	
City of Redding Department of Public Works	Clearing Permit	Required for brushing or clearing a parcel within the City limits and greater than 1 acre.	Would not be required.	Not required unless disturbance and staging areas exceeds 1 acre.	
City of Redding Department of Public Works	Encroachment Permit	Required for construction in City-owned rights-of-way.	Would not be required.	Would be required for impacts to City-owned lands north and south of the Sacramento River.	
City of Redding Department of Public Works	Transportation Permit	Required to transport oversized materials and equipment to project site on City-owned roadways.	Would not be required.	Would be required.	

Agency	Permit/Approval	Applicability	Option 1 – Abandonment	Option 2 – Partial Demolition	Option 3 – Full Demolition
City of Redding Planning Division	Use Permit	Required for a substantial improvement project within a floodplain.	Would not be required.	Would be required.	
City of Redding	RMC 18.40.100	Limits construction noise hours based on time of year and day of week. Limits operational noise as measured at the nearest adjacent property.	Adherence would not be required.	Because the project proponent does not meet the exemption requirements under RMC 18.40.100.H.5, adherence to established noise standards during construction would be required.	

9. Capital and Operations and Maintenance Cost Estimates

For each project alternative, a conceptual-level cost was estimated for both capital costs and O&M costs. Capital and O&M costs are estimated to assist in differentiating the project alternatives based on cost, together with other major evaluation criteria, and to provide approximate planning information for project funding and financing discussions. The information presented here is based on the concept-level drawings in this report and the assumed future operating conditions developed from the design and performance criteria for the alternatives. The cost data presented are not suitable for specific project financing and cost budgeting purposes. Several major steps are required to refine whichever project alternative is ultimately selected, including refinement of that alternative's primary features and operating conditions, right-of-way acquisition, preliminary and final design, environmental studies, submittal of detailed bids by qualified contractors, and other steps that will provide final costs for the project.

9.1 Capital Cost Estimates

Planning-level cost opinions were prepared for each project alternative. These are classified as a Class 5 estimate as defined by the Association for the Advancement of Cost Engineering International (AACEI). The typical end usage purpose of Class 5 estimates is to screen concepts, determination of feasibility, concept evaluation, and preliminary budget considerations. Class 5 estimates are used when the level of project definition and preliminary engineering is between 0% to 2% complete. The accuracy range for a Class 5 estimate is +100% to -50%. The costs estimates presented here are based on the conceptual site plan figures in this report. Estimating databases for the construction industry have been used, as well as bid tabs for recent similar-sized projects.

The estimated construction cost includes the following contractors' costs: directly related costs, allowances for contractor mobilization, material sales tax, bonds, permits, insurance, subcontractor markup, overhead, and profit. A 25% contingency was used for the alternatives that is then added to the estimated construction cost to account for the uncertainty in the final project scope. As the design progresses, the contingency factor will decrease.

Non-contract costs must be considered in addition to the construction costs to consider project financial or economic feasibility or funding requirements. Add-on percentages are assumed for the following non-contract costs:

- Engineering and design: 15% of construction cost.
- Construction services and management: 15% of construction cost.
- Legal and administrative: 6% of construction cost.
- Property acquisition: 10% of construction cost.
- Permits and environmental documentation: 10% of construction cost.
- Compensatory mitigation: Based on a 1:1 mitigation ratio for comparison purposes only. The estimated cost of compensatory mitigation for USACE In-Lieu Fee program could be imposed at a 2:1, or possibly a 3:1, ratio, which would double or triple the mitigation cost, respectively. The current cost for Aquatic Resource Credits is approximately $200,000 per acre of impact.

Costs presented are expressed in current January 2025 dollars. Project timing has not been determined; therefore, costs presented do not have an escalation factor included. Normally, an escalation factor is included to express costs to the midpoint of construction to account for increased costs of labor and materials for the life of the project. When a specific project schedule is determined, an escalation factor should be applied to determine projected project costs.

The cost estimates shown, and any resulting conclusions on project financial or economic feasibility or funding requirements, have been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate. The final costs of the project and resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors. Therefore, the final project costs will vary from each of the estimates presented here. Because of project feasibility and benefit cost ratio factor, risks and funding needs must be reviewed in greater detail prior to making specific financial decisions or establishing project budgets for implementation.

9.2 Total Capital Cost

Table 9-1 summarizes the total capital costs for the project alternatives. Project feasibility and funding should consider the accuracy range for a Class 5 estimate, +100% to -50%, prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

Table 9-1. Capital Cost Estimate Summary

Description	Alternative 1 – Cypress Avenue	Alternative 2 – Breslauer Way	Alternative 3 – CCWWTP	Churn Creek Pump Station
Fish Screen and Pump Station	$100.4 M	$80.4 M	$93.3 M	$12.0 M
Site Improvements	$15.5 M	$10.2 M	$10.5 M	$1.2 M
Pipeline	$8.5 M	$11.6 M	$28.0 M	$0.8 M
PV System (Scenario B)	$13.9 M	$15.4 M	$25.8 M	Not applicable
Subtotal	$138.3 M	$117.7 M	$157.7 M	$14.0 M
Contingency (25%)	$34.6 M	$29.4 M	$39.4 M	$3.5 M
Construction Cost	$172.9 M	$147.1 M	$197.1 M	$17.5 M
Engineering and Design (15%)	$26.0 M	$22.1 M	$29.6 M	$2.6 M
Construction Management (15%)	$26.0 M	$22.1 M	$29.6 M	$2.6 M
Legal and Administrative (6%)	$10.4 M	$8.9 M	$11.9 M	$1.1 M
Property Acquisition (10%)	$17.3 M	$14.7 M	$19.7 M	Not applicable
Permitting/Environmental (10%)	$17.3 M	$14.7 M	$19.7 M	$1.7 M
Compensatory Mitigation	$5.0 M	$4.0 M	$3.0 M	$0.2 M
Total Non-Contract Cost	$102.0 M	$86.5 M	$113.5 M	$8.2 M
Total Capital Cost	$274.9 M	$233.6 M	$310.6 M	$25.7 M

The following observations are noted regarding the estimated capital costs of the alternatives:

- The cost for Alternative 2 is the lowest of the alternatives. This is primarily driven by the site being a more favorable construction site.
- The cost for the PV system for each alternative used scenario B. If scenario A were approved by REU, the cost for the PV system would be lower at each site.
- Alternative 3 does not include any cost data to maintain water service for customers at the northern end of the District. It is assumed that the Alternative 3 pump station cannot fully serve all existing

customers. If this site is selected, additional cost must be added to construct new facilities to maintain existing service. Additionally, potential costs associated with receiving treated effluent from the CCWWTP have not been included in the cost data.

- The costs for all alternatives do not include the cost of a Main Canal check structure. It is recommended that downstream water control be investigated in future design phases. Water delivery efficiency would likely be improved with a check structure installed in the Main Canal.

9.3 Operations and Maintenance Costs

O&M costs for each facility were developed to include approximate costs for electrical power, labor time, maintenance, repairs, and other miscellaneous recurring costs required to keep a facility operating and in a state of good reliability. The cost of electrical power could vary substantially based on how a PV system is incorporated into the project. The following are the key factors used in the O&M cost analysis:

- A 30-year project life analysis period should be assumed for project total life-cycle costs. Most project facilities and major components have useful lives equal to or longer than 30 years, so replacement costs are not included.
- The PV system was sized based on water deliveries documented over the last 16 years as defined in Section 1.8. An average diversion of 250 cfs over the entire irrigation season was used in preliminary sizing. Diverting a greater quantity of water would increase pumping demand and associated electrical costs. Additionally, if full power offset cannot be achieved, additional power cost must be included.
- Power costs in 2025 are $0.1086/kWh for large commercial service. However, it is assumed that the PV system will sufficiently offset power costs. If project constraints limit the size of the PV system, additional electrical costs must be considered for operations.
- O&M costs for pump station and fish screens maintenance are 0.25% of construction costs and increase with inflation.
- O&M costs for pipelines are 0.25% of construction costs and increase with inflation.
- O&M costs for PV are defined in Section 5.3 and increase with inflation.

Table 9-2 summarizes annual O&M costs for each alternative based on construction costs.

Table 9-2. Estimated Annual Operation and Maintenance Costs

O&M Item	Alternative 1 – Cypress Avenue	Alternative 2 – Breslauer Way	Alternative 3 – CCWWTP
Fish Screen and Pump Station O&M	$251,000	$201,000	$233,000
Pipeline O&M	$21,000	$29,000	$70,000
PV System Scenario B O&M	$200,000	$220,000	$370,000
Annual O&M Total	$472,000	$450,000	$673,000

10. Right-of-Way and Easements

ACID would need to acquire both temporary construction and permanent easements for construction of the Main Pump Station facilities. Alternatives 1 and 3 would require coordination with the City of Redding. Alternative 2 would require coordination with Shasta County. For work in the Sacramento River, ACID might be required to obtain a land use lease or receive an easement exemption from the California State Lands Commission for the diversion of water for irrigation use. Alternative 3 would result in work within the Caltrans right-of-way and UPRR right-of-way. Both Caltrans and UPRR would require an encroachment permit.

Easement requirements were estimated for each facility using geographic information system mapping from the City of Redding. For proposed pipelines, the easement width is assumed to be 30 feet for permanent easement and 80 feet for temporary construction easements. These widths are approximate and intended for use in providing a rough estimate of easement requirements only. No field surveying of property lines or existing easement boundaries was completed under this study. Actual easement widths would vary depending on factors such as restrictive conditions or very open conditions in undeveloped areas, as well as the final facility layout and pipeline routing.

Table 10-1 shows approximate easements required for each site.

Table 10-1. Approximate Easement Requirements

O&M Item	Alternative 1 – Cypress Avenue	Alternative 2 – Breslauer Way	Alternative 3 – CCWWTP
Permanent Easements	6.0 acres	5.1 acres	7.3 acres
Temporary Construction Easements	3.5 acres	1.9 acres	4.8 acres

Table 10-1 does not include property or easement needs for a solar PV system. As noted in Section 5, coordination with REU is required to determine the feasibility of a solar PV system. Table 5-4 lists probable footprint sizes for each site alternative and net-metering scenario.

11. Summary Evaluation of Project Alternatives

The information presented in the preceding sections of this report provide the basis for a summary evaluation of the three site alternatives. The purpose of the summary evaluation is to objectively rank each alternative. To objectively rank alternatives considered, a set of criteria was established. Each alternative is evaluated based on operability, adjacent solar PV availability, capital cost, permitting/environmental, and constructability/risk considerations. The objective of this process is to determine which alternative should be considered for final design. A comparative scale from 1 to 5 is used for each criterion, with the lowest number being the best alternative. Table 11-1 presents the results of the evaluation for each element.

Table 11-1. Site Alternative Decision Matrix

Site Alternative	Operability	Adjacent Solar PV	Capital Cost	Permitting/ Environmental	Constructability/ Risk	Total Score
Alternative 1 – Cypress Avenue	1	3	2	3	3	12
Alternative 2 – Breslauer Way	1	3	1	2	1	8
Alternative 3 – CCWWTP	5	1	3	1	4	14

11.1 Operability

Operability considerations include the ability for the facilities to meet existing operational goals and water deliveries. Site Alternative 1 is located upstream of the District boundary and would maintain service to all customers. Site Alternative 2 is located just downstream of the northernmost customer. A score of 1 was given to Site Alternative 2 because it is likely that customer service would not be impacted. This must be confirmed during future design phases. Site Alternative 3 received a high score because it is not clear how the existing customer base north of the site would be served.

11.2 Adjacent Solar Photovoltaic Availability

Site Alternative 3 is the only site with sufficient open real estate to fit the required solar array adjacent to the proposed pump station. Site Alternatives 1 and 2 would require coordination and approval from REU to allow offsite generation and consumption meter aggregation. It should be noted that coordination and approval from REU would also be required at Site Alternative 3 for net-metering and higher array capacity.

11.3 Capital Cost

The alternatives were ranked based on the construction cost information provided in Section 9. Capital costs are similar for all facilities except for the pipeline and PV system. Site Alternative 1 would have the shortest pipeline, but it would cross a roadway and have significant existing utility coordination requirements and site improvements. Site Alternative 3 would have a significant road crossing that would require encroachment permits from multiple agencies. Site Alternative 3 would have additional cost considerations to maintain water deliveries at the northern end of the District. Additional considerations to maintain water deliveries are beyond the scope of this study. However, they must be considered if the District is to maintain service at the northern end of the District.

11.4 Permitting/Environmental

In-water work for all sites would be approximately equal. Site Alternative 1 would have the greatest disturbance viewable by the public. Much of the existing vegetation and trees within the Parkview Riverfront Park would be removed. Site Alternative 3 received a slightly lower score than Site Alternative 2 because the CCWWTP site zoning aligns with the intended use for public facilities.

11.5 Constructability/Risk

Site Alternative 2 received the lowest score because of its simplified conveyance alignment and limited visibility to the public. The Site Alternative 1 conveyance alignment must cross Parkview Avenue, which would require coordination with numerous existing buried and overhead utilities. The existing utility crossing are challenging with a large-diameter conveyance pipeline. Maintenance of traffic must also be considered to accommodate traffic during the construction of the Parkview Avenue crossing. Road and utility crossings would induce risks during construction. Site Alternative 1 is highly visible to the public. This will induce risk for project permitting and risk for vandalism.

Site Alternative 3 must cross Eastside Road, UPRR, and SR 273. The crossings would be feasible by tunneling. However, tunneling below the crossings would present risks during permitting and construction not anticipated with the other alternatives. Additionally, the available space at the tunneling receiving shaft is limited and could present layout challenges during design and construction. Discussions with the City of Redding are required to determine the impacts to the treatment plant from a reduction in volume in Pond 10. This risk must be mitigated prior to the design phase if Site Alternative 3 is selected.

12. Recommendations and Next Steps

12.1 Recommendations

Jacobs recommends ACID proceed with plans to implement Site Alternative 2 – Breslauer Way because of the following considerations:

- The alternative would maintain operations and water deliveries to customers.
- The alternative would have the simplest pipeline conveyance route, which would limit construction risk.
- The site is located within Redding but away from the eye of the public.
- The alternative is the least expensive to build.

12.2 Next Steps

The following next steps are recommended:

- Obtain recommendation from ACID of a preferred project alternative.
- Secure funding for design and permitting.
- Initiate discussions with Shasta County on property and easement acquisitions.
- Initiate discussions with City of Redding on stormwater coordination in abandoned portion of the Main Canal.
- Initiate discussions with REU on solar PV options and electrical service for the Main Pump Station. Additional considerations and discussions could be held for WAPA power supply.
- Finalize project design criteria, in particular design minimum river flow and pump station capacity.
- Complete a Sacramento River geomorphology study of the preferred site.
- Obtain detailed surveying, mapping, river bathymetry, geotechnical investigations, and existing utility information for the project site.
- Analyze detailed river flow two-dimensional modeling, surge analyses, and corrosion analyses.
- Develop permit applications.
- Consult with NMFS, CDFW, and USFWS.
- Develop final design drawings sufficient for permit acquisition and construction.
- Prepare detailed construction schedule and cost estimate and conduct a more detailed constructability evaluation.
- Secure funding for property acquisition, construction support, and construction.

13. References

Redding Electric Utility (REU). 2024. Schedule of Rates. Rate Book January 2024 – Draft Clean

National Marine Fisheries Service (NMFS). 2022. NOAA Fisheries West Coast Region Anadromous Salmonid Passage Design Manual, NMFS, WCR, Portland, Oregon.