Attachment 2 – Project Justification

Introduction

The Upper Kings Basin IRWM Authority (Authority) has developed a priority list of projects as described in Attachment 1. The project proponent is Consolidated Irrigation District (CID). Because of the limited amount of funding available, this grant application proposal includes one project from the Upper Kings IRWM region that will provide several benefits including improving the water supply reliability of a Disadvantaged Community. CID's Adams and Academy Basin project will increase water supply and reliability by providing needed groundwater recharge, develop a dry year supply, improve water quality, and capture floodwater lost to the region. In addition to the benefits provided to both CID and Parlier, water pumped from the recovery wells will allow surface water to be made available to other stakeholders in the region.

Project Summary Table

Table 2-1 identifies the IRWM Project Element that is applicable to the project.

Table 2-1: DWR Table 4 – Project Summary Table

IRWM Project Element		CID
IR.1	Water supply reliability, water conservation, and water use efficiency	X
IR.2	Stormwater capture, storage, clean-up, treatment, and management	X
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands	
IR.4	Non-point source pollution reduction, management, and monitoring	
IR.5	Groundwater recharge and management projects	X
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users	
IR.7	Water banking, exchange, reclamation, and improvement of water quality	X
IR.8	Planning and implementation of multipurpose flood management programs	X
IR.9	Watershed protection and management	
IR.10	Drinking water treatment and distribution	
IR.11	Ecosystem and fisheries restoration and protection	X

IR.1 - Water supply reliability, water conservation, and water use efficiency

The project will provide groundwater recharge that will help sustain the local aquifer around the project, and the recovery well will provide additional sup-ply available to the District.

IR.2 - Stormwater capture, storage, clean-up, treatment, and management

See the Additional Benefit Section in this Attachment describing the Surface Storage and Flood Diversion.

IR.5 - Groundwater recharge and management projects

The project will recharge 2,268AF/yr.

IR.7 - Water banking, exchange, reclamation, and improvement of water quality

The project includes a recovery well and will provide 1,320AF/yr of water recovery capacity for possible exchange. See description of the Secondary Project benefit in this Attachment.

IR.8 - Planning and implementation of multipurpose flood management programs

See the Additional Benefit Section in this Attachment describing the Flood Diversion Benefit.

IR.11 - Ecosystem and fisheries restoration and protection

See the Additional Benefit Section in this Attachment under the Habitat Creation Benefit.

Brief Project Description

The project, implemented by CID, is a 50-acre groundwater banking and recharge facility that will yield 1,320 acre-feet/year and recharge the aquifer.

Expanded Project Description

The 50-acre project will expand the available water supply to the region by developing a conjunctive use project that captures flood water lost to the region in wet years, recharging that water, and later pumping out the banked water supply during dry or drought years. The project includes a turnout to divert water from the canal adjacent to the basin site, a sedimentation channel, two recharge basins including diversion piping and flow measurement devices, and a recovery well and delivery piping to take water back to the canal, and other associated appurtenances. Available surface water such as Kings River flood water will be diverted from the Kings River through CID's existing canals and delivered to the basin site for recharge. A portion of the recharged water will be left in the aquifer. The recharged water will later be pumped out using a new recovery well connected to the existing CID canal for delivery to meet existing demands downstream of the basin site during the irrigation season. This new supply delivered to meet grower demands downstream will allow the District to extend deliveries within the District or make surface water still held in storage at Pine Flat Reservoir available for exchange.

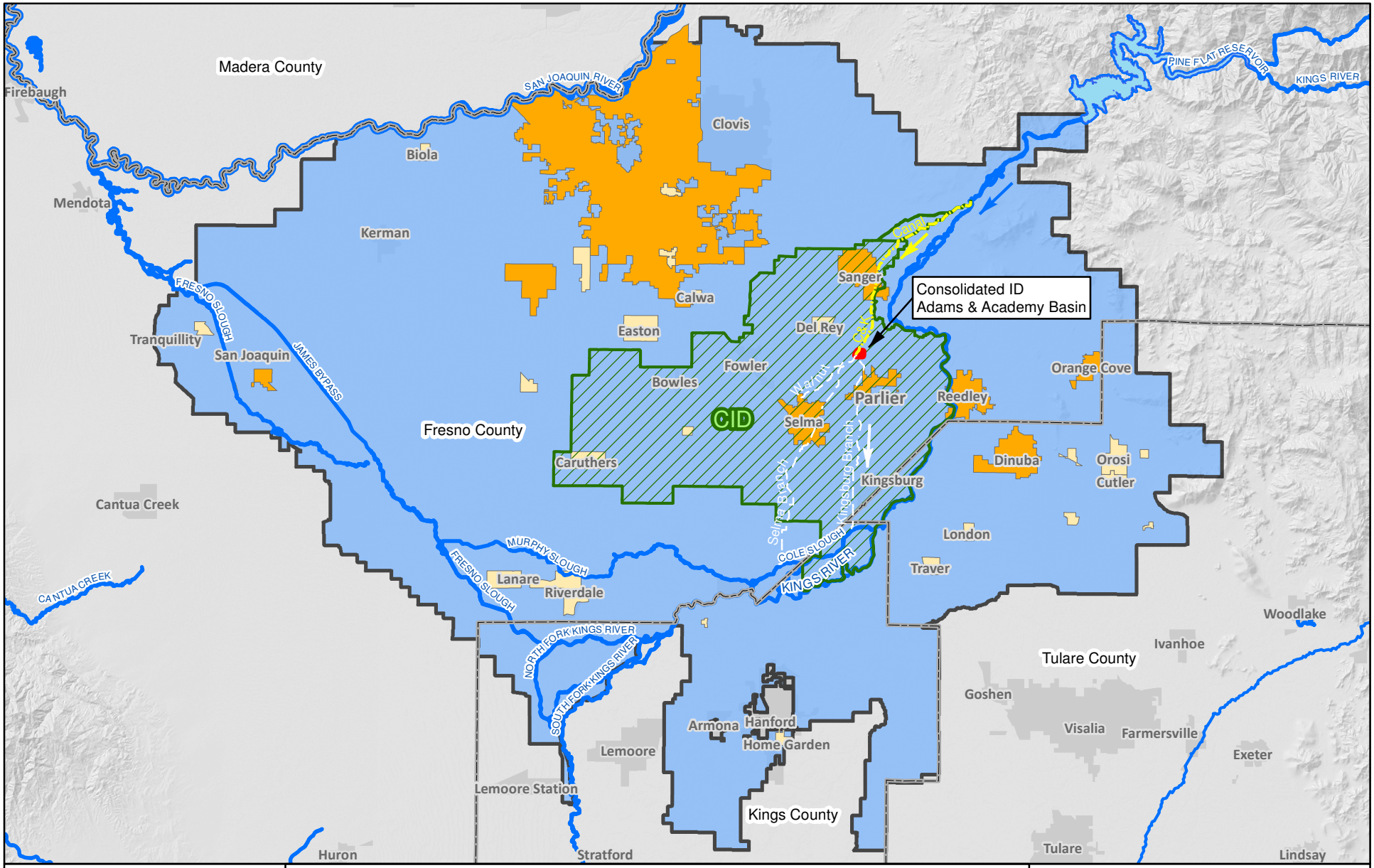
CID's project will address several current needs facing the region, including groundwater overdraft, limited dry year supply, and the capture of floodwater. The project will address the following concerns:

- Increased Dry Year (Drought) Supply: 2015 is the third consecutive year that CID has not had enough surface water entitlement to deliver any water for irrigation to growers. Growers in CID have relied solely on groundwater during the drought. CID is a conjunctive use District, so that even in average hydrologic years, surface water supplies are not adequate to meet most crop demands so growers are required to pump groundwater to meet demands. During extended dry periods, increased pumping causes declining groundwater levels. The project will yield 1,320AF/yr of dry year supply. The project provides a long-term water supply source during drought periods.
- Groundwater Overdraft Reduction and Efficient Groundwater Basin Management: Groundwater recharged/banked by the Project will help mitigate basin overdraft and increase groundwater levels in the immediate and surrounding areas. Groundwater levels in the project vicinity, including the City of Parlier have dropped 15 feet in the last 6 years as shown in **Figures 2-5 through 2-7** below. The project will provide 2,268 AF/yr of groundwater recharge, which directly improves the condition of overdraft. The project will also make 1,320 AF/yr available to market for delivery within Kings Service area, even in drought years, helping to reduce the groundwater pumping. This will provide a reliable long term dry year solution. Groundwater recharge and banking is a critical component for CID and the region to attain sustainability as required under the Sustainable Groundwater Management Act.
- Addressing the Critical Water Supply needs of a Disadvantaged Community. The City of Parlier is a Disadvantaged Community that relies solely on groundwater for its supply. The project will recharge 2,268 AF/yr to replenish the aquifer that the City of Parlier relies on. The unincorporated area around the basin is also a DAC (**see Figure 2-2 and Attachment 7**).
- Increased Operational Flexibility: Increasing the amount of recharge basins within the District provides improved operational flexibility for deliveries and the capture of flood water. The basin is located at a critical diversion point of two canals that serve the Selma and Kingsburg areas, and will allow for flow fluctuations to be captured during deliveries. In addition, the banked groundwater can be pumped into the existing canals as an alternative supply, allowing surface water typically delivered to those canals to be delivered to other locations within the District or exchanged.
- Improved Water Quality: Kings River water is high quality and the recharge of high quality surface water in the aquifer will reduce the concentration of contaminants such as nitrates in the aquifer.
- Delay of Potential Rate Increases. The marketing of water from the project will generate revenue for the District, helping to delay potential future rate increases.
- Floodwater Capture. During wet years, the region loses water supply as high flows occur during limited demand periods when the water cannot be beneficially used. The project will allow flood water to be captured, recharged, and stored in the aquifer for use during wet years.

Regional and Project Map

The regional map (see **Figure 2-1**) included identifies the IRWM boundary and includes a marker identifying the CID project contained in the Proposal. Also shown on **Figure 2-1** are the water supply route from Pine Flat Dam to the proposed recharge basin and the existing conveyance canals from the basin to potential users downstream of the basin.

Also included is an individual project map (see **Figure 2-2**) of the CID project that shows the project's geographical location and the surrounding work boundaries, facilities of the project, groundwater contours, District conveyance canals, the DACs within the project area, and the proposed monitoring locations.



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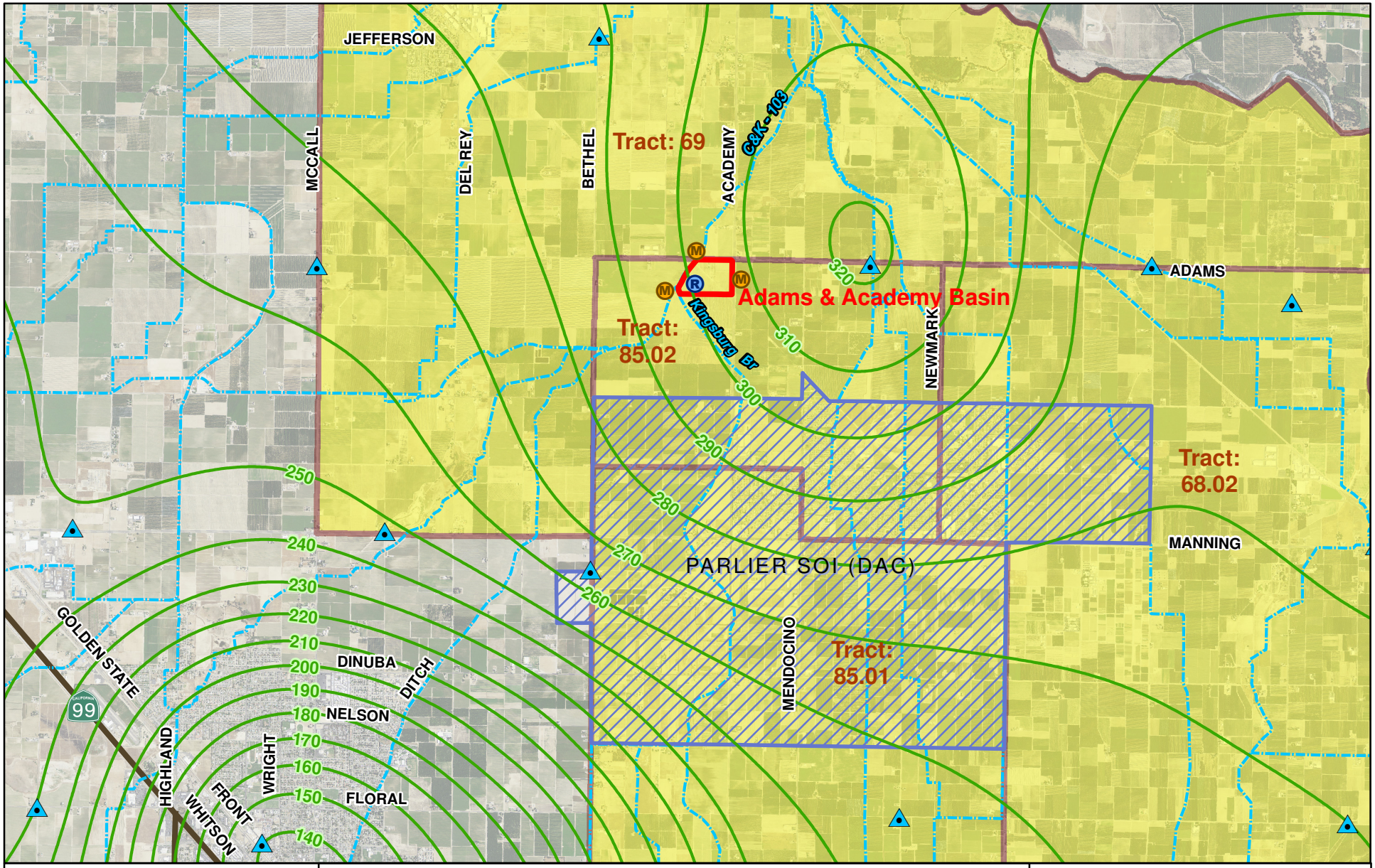

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Kings Basin Water Authority
CID: Adams & Academy Basin
Figure 2-2: Project Map
2015 IRWM
Implementation Solicitation

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Project Physical Benefits

Table 2-2: DWR Table 5 – Annual Project Physical Benefits - Primary

Project Name: CID Adams and Academy Basin
Type of Benefit Claimed: Groundwater Recharge (Primary)
Units of the Benefit Claimed : Acre-Feet
Anticipated Useful Life of Project (years) 50 years (although basin life is expected to be 100+)

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2017	0	0	0
2018	0	3,525	3,525
2019	0	0	0
2020	0	5,813	5,813
2021	0	0	0
2022	0	2,944	2,944
2023	0	0	0
2024	0	2,944	2,944
2025	0	0	0
2026	0	2,944	2,944
2027	0	0	0
2028	0	2,475	2,475
2029	0	3,094	3,094
2030	0	2,944	2,944
2031	0	4,669	4,669
2032	0	3,525	3,525
2033	0	0	0
2034	0	2,944	2,944
2035	0	139	139
2036	0	4,763	4,763
2037	0	0	0
2038	0	2,944	2,944
2039	0	0	0
2040	0	5,407	5,407
2041	0	2,658	2,658
2042	0	5,813	5,813
2043	0	0	0
2044	0	4,321	4,321
2045	0	6,375	6,375
2046	0	3,613	3,613
2047	0	0	0
2048	0	5,231	5,231
2049	0	0	0
2050	0	2,944	2,944
2051	0	0	0
2052	0	2,944	2,944
2053	0	0	0
2054	0	2,944	2,944
2055	0	0	0
2056	0	2,944	2,944
2057	0	3,563	3,563
2058	0	4,683	4,683
2059	0	2,381	2,381
2060	0	4,781	4,781
2061	0	1,256	1,256
2062	0	2,944	2,944
2063	0	0	0
2064	0	2,944	2,944
2065	0	0	0
2066	0	0	0
Average	**0**	**2,268**	**2,268**
Average (when water delivered)	**0**	**3,544**	**3,544**
Total	**0**	**113,408**	**113,408**

Comments: Total Supply available to the project and recharge amounts shown in **Figure 2-3**. Recharge amounts are based on monthly supply available, basin size and infiltration rates. **Figure 2-4** provides annual recharge, and extraction operational amounts. Extraction amounts based on well capacity and duration of pumping as shown in **Figure 2-4**. More detailed water supply and operational information is included in the Feasibility Study included as **Attachment 3b**.

Table 2-3: DWR Table 5 – Annual Project Physical Benefits - Secondary			
Project Name: __CID Adams and Academy Basin_____			
Type of Benefit Claimed: __Dry Year Supply (Groundwater Pumped from Storage - Secondary)			
Units of the Benefit Claimed : __Acre-Feet_____			
Anticipated Useful Life of Project (years)__50 years (although basin life is expected to be 100+)			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (c) – (b)**
2017	0	0	0
2018-2066	0	1,320	1,320
Average	**0**	**1,294**	**1,294**
Average (when water delivered)	**0**	**1,320**	**1,320**
Total	**0**	**64,680**	**64,680**
Comments: Total Supply available to the project and recharge amounts shown in **Figure 2-3**. Recharge amounts are based on monthly supply available, basin size and infiltration rates. **Figure 2-4** provides annual recharge, and extraction operational amounts. Extraction amounts based on well capacity and duration of pumping as shown in **Figure 2-4**. More detailed water supply and operational information is included in the Feasibility Study included as **Attachment 3b**.			

Technical Analysis of Physical Benefits Claimed

A project feasibility study was completed in May 2014 for the project and is included as **Attachment 3b.** The feasibility study evaluated two basin sites, and the project site proposed in this site was recommended for development because of an expected higher infiltration rate at the location. The feasibility study provides the primary technical justification for the physical benefits claimed. The feasibility includes:

- Site specific soil borings at the project site conducted in 2014
- Review of site specific soil borings conducted in 2008
- Surface soil and sub-surface geologic evaluation including preparation of cross-sections
- Estimation of anticipated long-term infiltration rate (0.5ft/day)
- Groundwater quality testing performed on water samples collected from a nearby well
- Groundwater mounding evaluation
- Estimate of Recovery Well capacity (2,500gpm or 11AF/day)
- Conceptual basin layout, facilities and construction cost estimate
- A 50-year hydrologic evaluation of surface water supply availability including dry/drought years. The project will utilize Kings River Flood water and Kings River Fisheries Management Program water (often referred to as Kings River Fish Water). Kings River Flood water was estimated based on historic flow measurements of flood water lost to the region. CID has diversion capacity available to divert additional flood water, but needs additional basin capacity such as this project to utilize flood water that occurs in wet years when there is no demand. The project also will utilize Kings River Fish Water. As part of the Kings River Fisheries Management Program agreement, CID is obligated to divert a portion of its surface water supply to maintain the Fishery Program along the river during dry years in order to maintain minimum flows suitable for fish downstream of Pine Flat Dam to the headgates of CID's canal from the river. This project will allow the District to divert water for this program, but not lose the water supply as CID can divert to the proposed basin for recharge and later recovery from the projects proposed well.
- A calculation of the recharge potential of the basin based on the available surface supply, basin volume, diversion capacity (40cfs) and infiltration rate. Recharge potential estimated to be 2,268AF/yr. A copy of this table is included as **Figure 2-3** in this application.
- Based on the recharge potential calculated in **Figure 2-3** and projected recovery well capacity, an operational analysis of the proposed basin was prepared. The table shows the potential recharge volumes and recovery capacity on a year by year basis. A copy of this table is included in the application as **Figure 2-4**.

In addition to the Feasibility Study, additional efforts to prepare the project include:

- Securing an option to purchase the property and paying for schedule extensions (see **Attachment 3a)**
- Preparation of preliminary Plans and Specifications have been prepared (see **Attachments 3e** and **3f**)
- Revisions to the Construction Cost Estimate based on CID's recently completed similar project

The workplan includes a Project Performance Monitoring Plan, included as the project's Groundwater Monitoring Plan and Annual Report, to ensure the project benefits are obtained. As part of the groundwater banking operations the annual report will be prepared including groundwater level and water quality data from a monitoring network surrounding the basin and a report of the measured flows into the basin, extracted from recovery wells and the resulting recharge and storage volumes.

Consolidated Irrigation District
Max Potential Yield - Adams and Academy Site
(Includes Kings River Floodwater and Fish Flows)

Figure 2-3

MAXIMUM PROJECT DIVERSION =	**40**	CFS
TOTAL DIVERSION =	40	CFS
BASIN CAPACITY =	113	AF
BASIN INFILTRATION RATE =	**0.5**	FT/DAY
BASIN ACREAGE =	**37.5**	ACRES
BASIN WATER DEPTH =	**3.0**	FT
DAILY RECHARGE VOLUME =	18.75	AF/DAY
EXTRACTION CAPACITY =	**11**	AF/DAY

	MONTHLY MAXIMUM DIVERSIONS IN ACRE-FEET (BASED ON FLOWRATE ABOVE)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**TOTAL**
Days	31	30	31	31	28	31	30	31	30	31	31	30	365
Project Diversion Vol.	2460	2381	2460	2460	2222	2460	2381	2460	2381	2460	2460	2381	28,966
Infiltration	581	563	581	581	525	581	563	581	563	581	581	563	6,844
Storage + Infiltration	694	675	694	694	638	694	675	694	675	694	694	675	8,194

Year	**% KR Water Year**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Totals**
1955	66%	0	0	0	0	0	0	0	0	0	0	0	0	0
1956	153%	694	563	581	581	525	581	0	0	0	0	0	0	3,525
1957	74%	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	149%	694	563	581	581	525	581	563	581	563	581	0	0	5,813
1959	48%	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	42%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1961	34%	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	110%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1963	112%	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	52%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1965	117%	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	72%	694	563	0	694	525	0	0	0	0	0	0	0	2,475
1967	196%	0	0	694	0	0	0	675	581	563	581	0	0	3,094
1968	50%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1969	258%	0	0	0	694	525	581	563	581	563	581	581	0	4,669
1970	78%	694	563	581	581	525	581	0	0	0	0	0	0	3,525
1971	69%	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	50%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1973	125%	0	0	0	0	0	0	0	0	139	0	0	0	139
1974	123%	694	563	581	581	525	0	675	581	563	0	0	0	4,763
1975	93%	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	32%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1977	23%	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	203%	694	563	581	581	525	581	563	581	563	176	0	0	5,407
1979	102%	0	0	0	0	397	218	563	581	563	337	0	0	2,658
1980	179%	694	563	581	581	525	581	563	581	563	581	0	0	5,813
1981	61%	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	183%	694	0	0	694	525	0	675	581	563	581	8	0	4,321
1983	263%	0	675	581	581	525	581	563	581	563	581	581	563	6,375
1984	116%	581	563	581	581	525	581	200	0	0	0	0	0	3,613
1985	74%	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	192%	694	563	581	581	525	581	563	581	563	0	0	0	5,231
1987	46%	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	49%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1989	53%	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	40%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1991	63%	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	41%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1993	150%	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	51%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
1995	203%	0	0	0	0	0	694	563	581	563	581	581	0	3,563
1996	123%	694	563	581	581	525	581	0	694	464	0	0	0	4,683
1997	156%	0	0	694	581	525	581	0	0	0	0	0	0	2,381
1998	182%	694	0	0	694	525	581	563	581	563	581	0	0	4,781
1999	74%	0	675	581	0	0	0	0	0	0	0	0	0	1,256
2000	90%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
2001	59%	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	67%	694	563	581	581	525	0	0	0	0	0	0	0	2,944
2003	84%	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	62%	0	0	0	0	0	0	0	0	0	0	0	0	0

Total	16,538	13,725	14,756	16,144	14,572	7,887	7,288	7,669	7,353	5,163	1,752	563	113,408
Min	0	0	0	0	0	0	0	0	0	0	0	0	0
Max	694	675	694	694	525	694	675	694	563	581	581	563	6,375
Avg	331	275	295	323	291	158	146	153	147	103	35	11	2,268
***Avg**	345	272	295	310	282	140	128	136	130	83	12	0	2,076

*** Excludes 1969, 1983, 1998**

Losses	10%
Estimated Yield	2041
Estimated Yield*	1869

Consolidated Irrigation District

Estimation of Basin Site Yield - Adams and Academy Site

Figure 2-4

Extraction Capacity =	11.0	AF/DAY
Days of Groundwater Extraction =	120	DAYS
Maximum Available in Storage, assumed to be 90% of maximum annual diversion capacity =	7,374	AF

	Same As	CVP % Water Year	Supply Available (1)	Delivery to Basin (2)	Direct Recharge (3)	Available for Extraction (4)	Storage at Start of Year (5)	Project Extraction (6)	Storage at End of Year (7)
1	55	66%	0	0	0	0	0	0	0
2	56	153%	139,502	3,525	353	3,173	3,173	0	3,173
3	57	74%	0	0	0	0	3,173	1,320	1,853
4	58	149%	206,415	5,813	581	5,231	7,084	1,320	5,764
5	59	48%	0	0	0	0	5,764	1,320	4,444
6	60	42%	0	2,944	294	2,649	7,093	1,320	5,773
7	61	34%	0	0	0	0	5,773	1,320	4,453
8	62	110%	0	2,944	294	2,649	7,103	1,320	5,783
9	63	112%	0	0	0	0	5,783	1,320	4,463
10	64	52%	0	2,944	294	2,649	7,112	1,320	5,792
11	65	117%	0	0	0	0	5,792	1,320	4,472
12	66	72%	0	2,475	248	2,228	6,699	1,320	5,379
13	67	196%	312,903	3,094	309	2,784	7,374	1,320	6,054
14	68	50%	0	2,944	294	2,649	7,374	1,320	6,054
15	69	258%	723,180	4,669	467	4,202	7,374	1,320	6,054
16	70	78%	95,091	3,525	353	3,173	7,374	1,320	6,054
17	71	69%	0	0	0	0	6,054	1,320	4,734
18	72	50%	0	2,944	294	2,649	7,374	1,320	6,054
19	73	125%	213	139	14	125	6,179	1,320	4,859
20	74	123%	124,621	4,763	476	4,286	7,374	1,320	6,054
21	75	93%	0	0	0	0	6,054	1,320	4,734
22	76	32%	0	2,944	294	2,649	7,374	1,320	6,054
23	77	23%	0	0	0	0	6,054	1,320	4,734
24	78	203%	435,352	5,407	541	4,867	7,374	1,320	6,054
25	79	102%	17,975	2,658	266	2,392	7,374	1,320	6,054
26	80	179%	626,812	5,813	581	5,231	7,374	1,320	6,054
27	81	61%	0	0	0	0	6,054	1,320	4,734
28	82	183%	316,636	4,321	432	3,888	7,374	1,320	6,054
29	83	263%	1,296,577	6,375	638	5,738	7,374	1,320	6,054
30	84	116%	559,373	3,613	361	3,251	7,374	1,320	6,054
31	85	74%	0	0	0	0	6,054	1,320	4,734
32	86	192%	497,057	5,231	523	4,708	7,374	1,320	6,054
33	87	46%	0	0	0	0	6,054	1,320	4,734
34	88	49%	0	2,944	294	2,649	7,374	1,320	6,054
35	89	53%	0	0	0	0	6,054	1,320	4,734
36	90	40%	0	2,944	294	2,649	7,374	1,320	6,054
37	91	63%	0	0	0	0	6,054	1,320	4,734
38	92	41%	0	2,944	294	2,649	7,374	1,320	6,054
39	93	150%	0	0	0	0	6,054	1,320	4,734
40	94	51%	0	2,944	294	2,649	7,374	1,320	6,054
41	95	203%	427,245	3,563	356	3,206	7,374	1,320	6,054
42	96	123%	103,527	4,683	468	4,214	7,374	1,320	6,054
43	97	156%	326,636	2,381	238	2,143	7,374	1,320	6,054
44	98	182%	593,379	4,781	478	4,303	7,374	1,320	6,054
45	99	74%	30,657	1,256	126	1,131	7,185	1,320	5,865
46	00	90%	0	2,944	294	2,649	7,374	1,320	6,054
47	01	59%	0	0	0	0	6,054	1,320	4,734
48	02	67%	0	2,944	294	2,649	7,374	1,320	6,054
49	03	84%	0	0	0	0	6,054	1,320	4,734
50	04	62%	0	0	0	0	4,734	1,320	3,414
Avg			136,663	2,268	227	2,041	6,525	1,267	5,257
Avg (8)				3,544	354	3,190	6,658	1,320	5,365
Total				113,408	11,341	102,067		63,360	

Notes:
1) Supply Available is the water supply for the project from MaxPotDiv1000Base-10PCT (10% of available flows).
2) Delivery to Basin is the amount of water diverted to the basin. Amount is limited by the available supply and is set not to exceed the Maximum Available in Storage minus the Storage at Year End.
3) Direct Recharge is the total annual amount of water that will be recharged in the project that will be left behind and not extracted. 10% of delivered.
4) Available for Extraction is the amount of water delivered to the basin minus the amount left behind for recharge.
5) Storage at Start of Year is the sum of the Storage at the End of the previous year and the Available for Extraction for the current year.
6) Project Extraction is the amount of water extracted based on the extraction capacity multiplied by the number of days considered for extraction.
7) Storage at Start of Year is the Available for Extraction at the start of the year minus the Project Extraction for that
8) Average of years when water is actually delivered to or extracted from basin.

Total "Project Extraction" for the 50-year period may be less than the total "Available for Extraction" if the sum of the annual "Storage at End of Year" and "Available for Extraction" exceeds the assumed "Maximum Available in

Figure 2-5

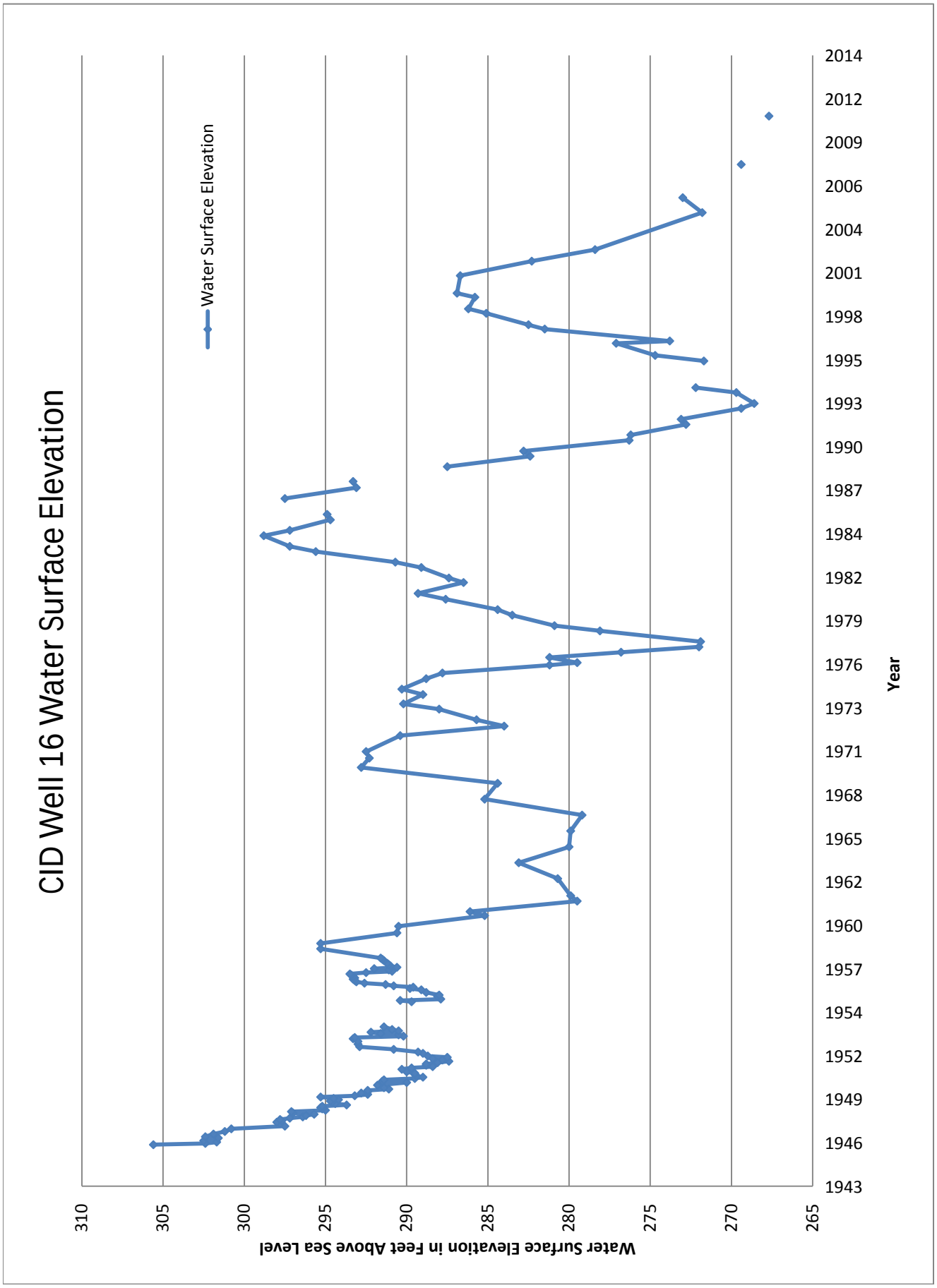

CID Well 16 Water Surface Elevation
Water Surface Elevation
Water Surface Elevation in Feet Above Sea Level
310
305
300
295
290
285
280
275
270
265
Year
2014
2012
2009
2006
2004
2001
1998
1995
1993
1990
1987
1984
1982
1979
1976
1973
1971
1968
1965
1962
1960
1957
1954
1952
1949
1946
1943

Figure 2-6

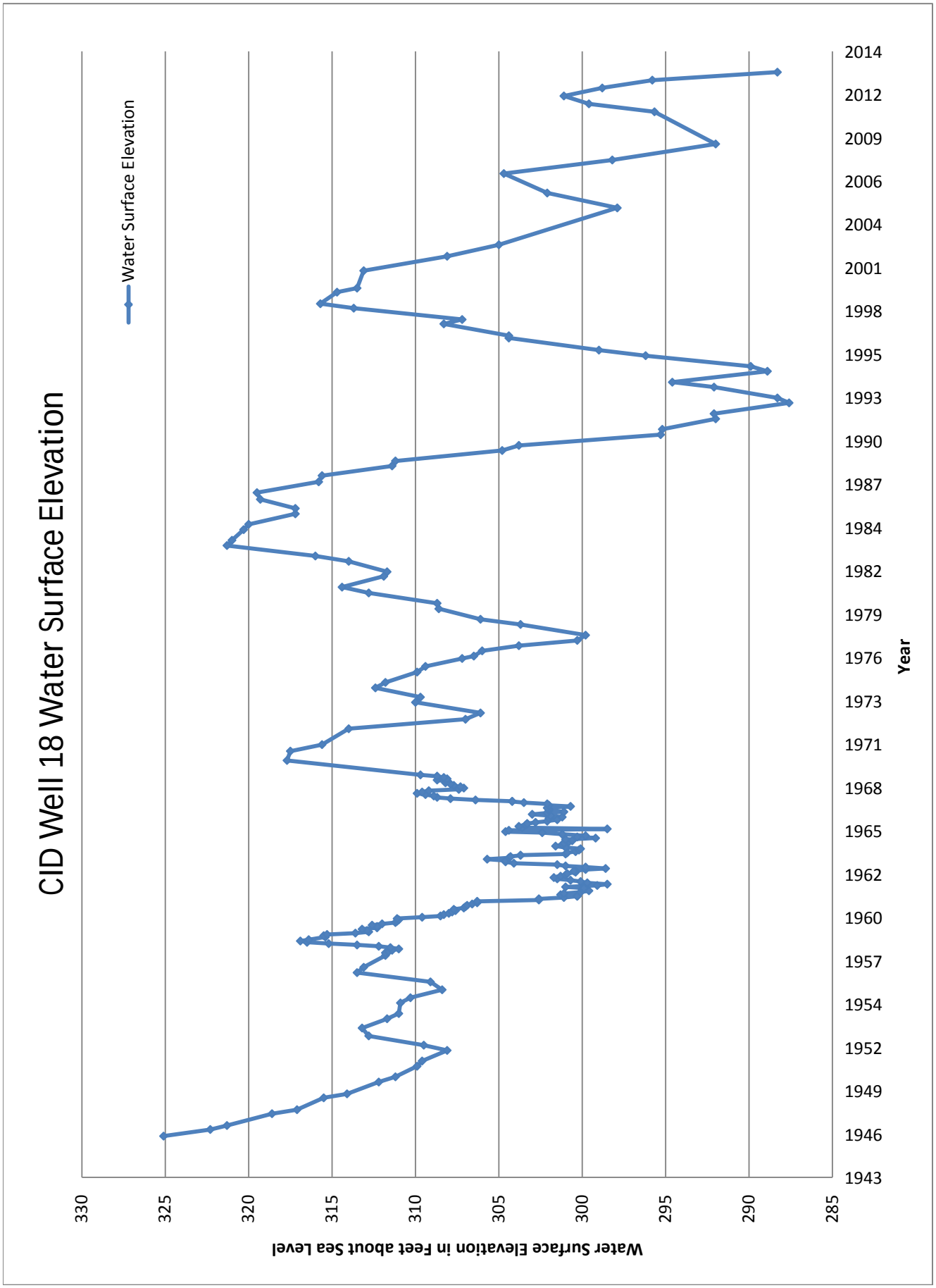
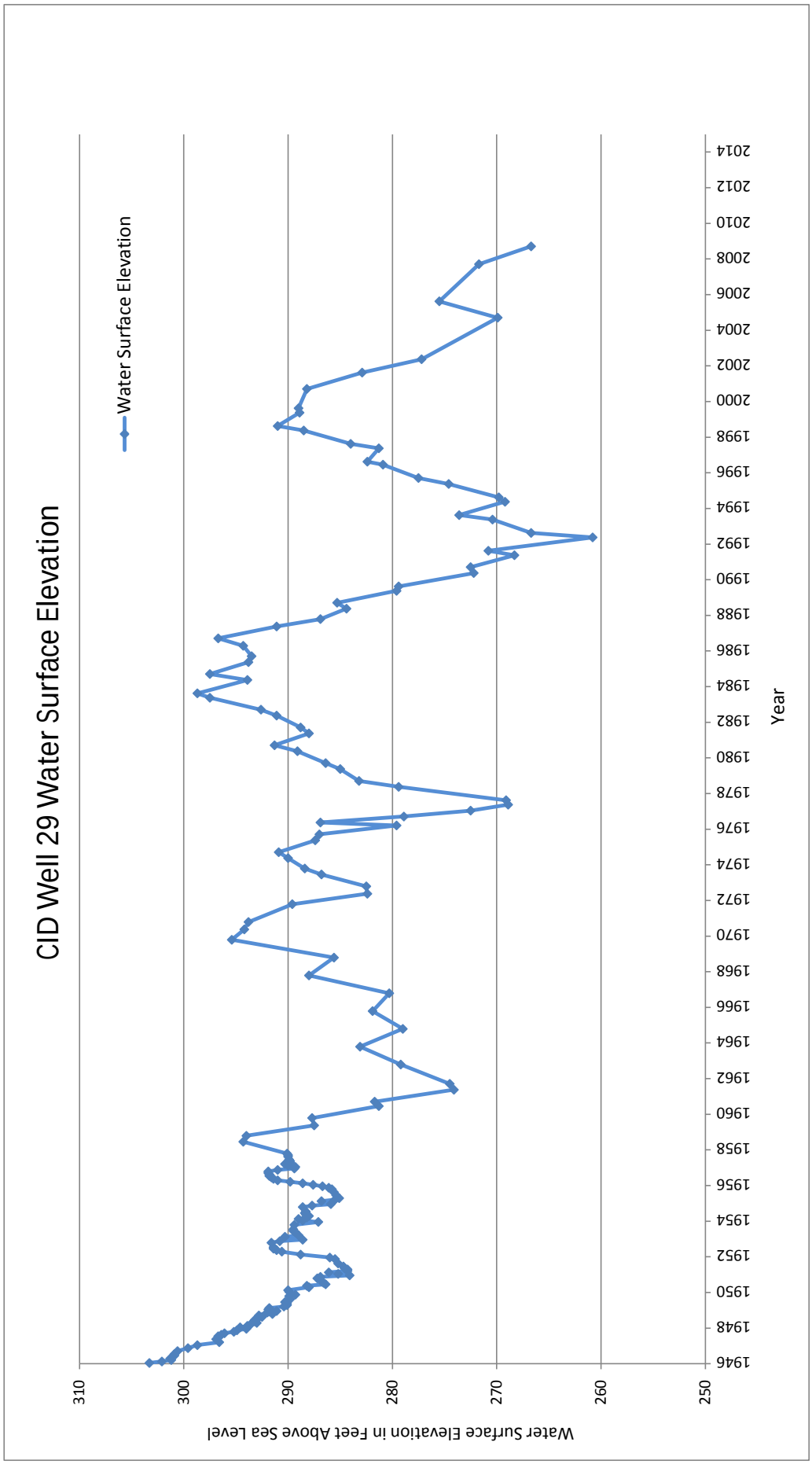

CID Well 18 Water Surface Elevation
Water Surface Elevation
Water Surface Elevation in Feet about Sea Level
330
325
320
315
310
305
300
295
290
285
Year
2014
2012
2009
2006
2004
2001
1998
1995
1993
1990
1987
1984
1982
1979
1976
1973
1971
1968
1965
1962
1960
1957
1954
1952
1949
1946
1943

Figure 2-7


CID Well 29 Water Surface Elevation
Water Surface Elevation
Water Surface Elevation in Feet Above Sea Level
310
300
290
280
270
260
250
Year
1946
1948
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

1. Need for Project

Groundwater levels in Consolidated Irrigation District are declining, including within the Disadvantaged Community of Parlier which is near the project and relies solely on groundwater for its water supply. Nearby wells as part of the District's monitoring network are shown in **Figure 2-2**, and hydrographs are included as **Figure 2-7**. The hydrographs show the groundwater levels in the project vicinity have been declining for many years, and have dropped more than 15 feet since 2009. This condition has been exacerbated by the drought as agricultural users in the area are required to rely more heavily on groundwater. CID and Parlier have entered into an agreement to replenish the groundwater aquifer (**Attachment 6b**), utilizing projects such as this. The project will also help CID and the region meet Sustainable Groundwater Management Act requirements. The banking component of the project will provide a dry year supply to CID to make available to its growers or for exchange. 2015 is the third consecutive year that CID has not delivered surface water because of drought conditions.

2. Without Project Conditions

Without the project, none of the benefits would be realized. The flood water supply for the project occurs during times of little demand and the supply flows out of the Kings Basin and is lost to local water users and the region. The Kings Fish water diverted out of storage by CID would also not be able to be utilized at the basin.

3. Methods to Estimate Physical Benefits

Primary Project Physical Benefit – Groundwater Recharge

A description and monthly simulation of the available surface water supplies that can be used for groundwater recharge/banking at the project shows that an average of 2,268 AF/year could be recharged by the project. The simulation is provided as **Figure 2-3**. The simulation is based on an assumed recharge rate of 0.5 feet/day, which is consistent with observed rates at other nearby District ponds. According to the Project Feasibility Study, this rate, or an even higher rate, could be maintained at the basin with proper maintenance. Over the 50-year life of the basin recharge would be over 113,000 AF. In very wet years, with long periods of floodwater, recharge could be as high as 6,375 AF in one year. The recharged water will help to raise groundwater levels, lower groundwater pumping costs, and provide a more reliable dry-year water supply. The project analysis includes a recharge leave behind of 10% or approximately 230 AF/yr (the Feasibility Study is included in **Attachment 3b**) as a net benefit to the aquifer.

Secondary Project Physical Benefit – Banked Water/Dry Year Supply

The project includes one recovery well that will provide up to 1,320AF/yr of banked groundwater recovery capacity that can be delivered to growers downstream, thereby freeing up surface water in storage upstream to be made available to District growers or available for exchange to other stakeholders. Additional yield could be achieved by extended pumping or constructing additional extraction wells at a later date. The estimation of the groundwater pumping and operations is presented in the Feasibility Study; see **Tables 2-1** and **2-2** above (the Feasibility Study is included in **Attachment 3b**).

Additional Benefits

Although the PSP asks for a primary and secondary benefit to be identified, it is important to acknowledge that the project has several other project benefits described below.

Additional Project Physical Benefit – Flood Diversion

The project will have the capacity to divert up to 40 cfs of floodwater (see **Figure 2-4**). Average annual floodwater diversions to the project site are estimated to be approximately 2,268 AF. In very wet years, such as 1968-1969, 1979-1980 and 1982-1983, flood water was available for over 180 days each year. With six months of floodwater, diversions could be as high as 6,375 AF/year. This will reduce water levels and peak flows on the Kings River during flood periods, and thereby potentially reduce flood damage.

Additional Project Physical Benefit – Average Water in Bank

As discussed above, the project will recharge up to 2,268 AF/yr and extract 1,320 AF/yr, depending on the water and weather conditions in the year. This practice will allow some amount of water to remain in the aquifer each

year, which will also vary. **Figure 2-4** shows the anticipated quantity of water to remain in the groundwater bank for future use; the average amount in the bank is approximately 5,365 AF of supply that could be available for extraction.

Additional Project Physical Benefit – Surface Storage Capacity/Regulation Reservoir

The project will have the capacity to divert floodwater, creating additional options for the routing of Kings River flood water and local stormwater that is routed into CID's system. Floodwater diversions will reduce water levels and peak flows on the Kings River during flood periods, and thereby potentially reduce flood damage. The water will be diverted on the east end of the San Joaquin Valley, and the flood reduction benefits will be realized along a significant reach of the Kings River. These flood flows ultimately reach the San Joaquin River and Delta, so some flood damage reduction will also be seen in those areas. The basin will provide additional 113 AF of surface storage. By providing additional floodwater routing capacity, the project has potential to help reduce flood-related damage to sensitive habitat in the Kings River and local streams.

Additional Project Physical Benefit – Fisheries Management and Habitat Creation

The project site will be converted from agricultural land to a 50-acre recharge basin that is periodically flooded. The project will also facilitate the furtherance of the Kings River Fisheries Management Program. The program requires water rights holders to divert water supply from Pine Flat Dam to down the river during periods of limited demand (typically October through February) to maintain the flows for the fishery. The fisheries program requires diversion of flows to CID's headgates. The development of this basin project will allow the water diverted to be routed to the basin and recharged, and later pumped out for delivery using the recovery wells. This project will also provide the following benefits to local wildlife:

- Water supply for terrestrial wildlife
- Creation of waterfowl, upland, wetland and aquatic habitat
- Resting, roosting, nesting, drinking, and foraging habitat for waterfowl, shorebirds, resident and migratory birds and a variety of other wildlife
- Waterfowl habitat for bird species on the Pacific flyway
- Reduction in fugitive dust and pesticide applications from changing the land use from agriculture to recharge basins

The project will also include the following features that will improve wildlife habitat:

- Flat Levee Slopes. Interior levee slopes will be 5H:1V, which will promote the growth of native wetland and upland vegetation to provide wildlife habitat.
- Varying Water Depths. Water depths in the basin will frequently vary, providing a variety of habitat environments for different species, including foraging areas for waterfowl, shorebirds, and other wildlife.
- Interior Levees. The interior levee for the settling channel will provide semi-isolated habitat and safer conditions from predation.

These features will significantly improve habitat for local wildlife, which has been highly disturbed for many years due to agricultural activity.

Additional Project Physical Benefit – Energy Conservation & Greenhouse Gas Reduction

Energy will be saved by raising groundwater levels and reducing pumping lifts. If it is assumed that the recharged water spreads out over six square miles then water levels will rise several feet each year. It is assumed that this water is available on average for two years before it is pumped out and used. Using these criteria energy savings will be about 20,700 KWH/year which has a value of about $3,000. This also equates to a reduction in greenhouse gasses of 14.6 metric tons/year of carbon dioxide.

Additional Project Physical Benefit – Water Quality Improvement

While not easily quantifiable, the project will have a positive impact on local groundwater quality by mixing high quality surface water with lower quality groundwater. This will also aid with slowing movement of any groundwater contamination plumes in the area.

4. Facilities, Policies, and Actions Required

The project would require a turnout structure to divert water from the Centerville Kingsburg Canal, into a sedimentation channel that will settle out fines that could potentially plug the basin floors, into a distribution structure that would distribute water from the settlement channel and into the basins. Flow measurement devices will be installed to measure flow into the basins. Monitoring wells will be constructed to gage impacts from the project and determine if changes need to be made during operations of the project. A recovery well will be constructed to pump stored groundwater and deliver to the canal which for delivery to downstream users. The recovery well will be equipped with a flowmeter to measure water pumped from storage. See **Figure 2-8** for a schematic of the proposed improvements. The pumped groundwater will allow the District to extend surface water deliveries, or consider an exchange of surface water kept in storage. No new policies are required to implement this project.

5. Potential Adverse Physical Effects

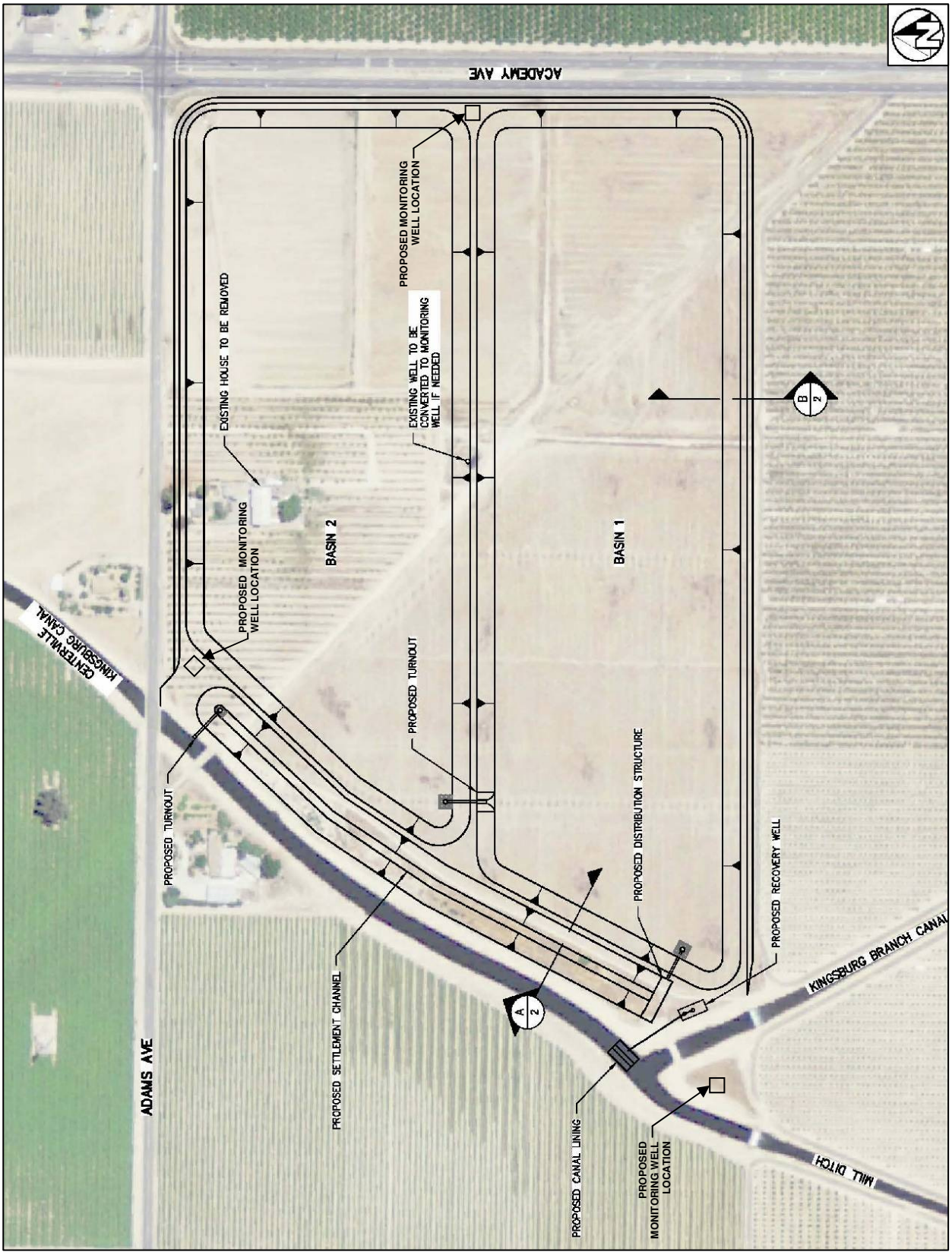
No potential adverse effects are anticipated from the project. Recharge basins sometimes cause groundwater mounding and high groundwater levels on adjacent lands. This is a low concern for this project since the basin is depressed and below the surrounding ground surface and the sandy soils should quickly absorb water delivered to the site. The facility will also include a monitoring network using existing wells around the basin to track monitor water level and provide information to reduce or stop recharge if water levels are raised too high. The proposed recovery well will also not cause any adverse effects. The recovery well will not pump out more water than has been recharged. The well is located at an area to have minimal impact on neighboring wells. A drawdown test will be performed during well development to consider impacts to neighboring wells and operational limitations will be recommended to minimize impacts to other wells. The Groundwater Monitoring Network established under Task 5 will include gathering of baseline data prior to recharge and recovery well operations. The District will gather frequent (often daily using data loggers) groundwater levels from the monitoring network to review and evaluate recharge and pumping operations compared to the baseline conditions. The District will review basin operations with stakeholders and the neighboring landowner committee and modify operations as required.

6. Long-Term Drought Preparedness

The project will help the District provide long-term drought preparedness and contributes to sustaining water supply and reliability during water shortages by increasing recharge by capturing flood water lost to the region during wet years that can later be pumped out during drought periods. Recharged water will help sustain the aquifer. In additional, the recovery well included in the project will provide an every year (including dry years) supply. This project:

- Promotes conjunctive use by providing flood water capture and storage and includes capability to pump stored groundwater in later years.
- Provides efficient groundwater basin management by capturing water lost to the region, recharging it, and making it available for later recovery and beneficial use,
- Yields a new water supply to the region with the inclusion of the recovery well that will pumped stored water for delivery to growers downstream, either extending local deliveries or making other surface water supply available for exchange.

Figure 2-8: Adams and Academy Basin Proposed Improvements



Direct Water-Related Benefit to a DAC

This project was determined by DWR, during the 2014 Drought Solicitation, to meet the needs of a disadvantaged community (DAC). This project meets the critical water supply need to the DAC because it is necessary to assure continued reliability of the minimum quality and quantity of water available to the City of Parlier and the surrounding area. The project will provide recharge to Parlier as well as the area surrounding the basin which is also a DAC as shown in Figure 2-2. As described in the Need for Project section above, groundwater levels in Parlier and the surrounding area are declining, and Parlier relies solely on groundwater for its supply. Groundwater flow in the area of the proposed basin is in the direction of Parlier and its sphere, so the recharged water will benefit Parlier and the nearby area. Declining groundwater levels also cause migration of contaminants in the aquifer, such as higher nitrate levels. Recharging the aquifer will help minimize groundwater migration toward the Parlier, and the recharge of high quality Kings River surface water will also benefit groundwater quality in the area. Parlier has been involved in project discussions and is a supporter of the project (**see Attachment 6a**).

The project is also the first related to an agreement between the Parlier and CID (**Attachment 6b**) to provide recharge near Parlier in order to sustain the aquifer that the Parlier relies upon. The agreement and the implementation of this project represent an important cooperative effort between the two agencies. Without the agreement, Parlier would be forced to develop other alternatives to provide a sustainable groundwater supply. Other alternatives for a City such as Parlier that does not have a surface water supply would be more costly, and will require significant rate increases to DAC constituents.

The project will also bank water each year for use by the community in proximity to the project during drought years. During drought years, the banked water supply can be extracted without a net loss to the aquifer, allowing the users to continue their operations without additional groundwater pumping. While the benefit to these community members is not identified as a critical water supply need, without the safeguarded supply provided by the banking portion of the project, the farmers would not be able to sustain their cropland during drought years.

DAC Benefit is also described earlier in Attachment 2, as well as in Attachments 6 and 7.

Attachment 7c clearly shows that more than 25% of the project service area will benefit a DAC as the area surrounding the project is a DAC.

Project Performance Monitoring Plan

The Project Performance Monitoring Plan is more particularly described under Task 5 of the Workplan. The Table of Contents for a similar groundwater recharge and banking project is included as **Attachment 3d**. The amount of water delivered to the basin and extracted to the basin will be measured with flow meters, recorded and an annual report prepared. In additional a detailed groundwater monitoring network will be established and water level and quality data will be collected and reported annually to determine any impacts to the project area.

Table 2-4: DWR Table 6 – Project Performance Monitoring Plan

Project Name: CID – Adams and Academy Basin

Proposed Physical Benefits	Targets	Measurement tools and methods
Groundwater Recharge	2,268AF/yr	Flow meters into the basin will record all deliveries to the basin, and the AF/yr will be reported in the annual report. An average for the years of operation will be calculated and shown in the annual report.
Dry Year Water Supply	1,320AF/yr	A flow meter from the recovery well to the canal will measure the volume of banked groundwater that is pumped and delivered that would not have otherwise been available to the District. The total AF for each year and the average fore years of operation will be reported in the annual report.

Cost Effectiveness Analysis

<table>
<tr><th colspan="2">Table 2-5: DWR Table 7 – Cost Effective Analysis</th></tr>
<tr><td colspan="2">Project Name: CID – Adams and Academy Basin</td></tr>
<tr><td>Question 1</td><td>Types of benefits provided as shown in Table 5 (Annual Project Physical Benefits)
Provide groundwater recharge of approximately 2,268AF/yr, and annual yield of 1,320AF/yr.</td></tr>
<tr><td rowspan="3">Question 2</td><td>Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?
Yes; alternative methods to achieve the same benefits include constructing a recharge basin at an alternate site or purchasing additional surface water supplies as needed.</td></tr>
<tr><td>If no, why? N/A</td></tr>
<tr><td>If yes, list the methods (including the proposed project) and estimated costs.
<table>
<tr><th>Alternatives</th><th>Estimated Cost</th></tr>
<tr><td>Proposed Project</td><td>$4,149,299</td></tr>
<tr><td>Recharge Basin at Different Location</td><td>$5,000,000 or more and lower recharge benefit. The feasibility study (Attachment 3b) evaluated two basin sites, and the project site proposed in this site was recommended for development because of an estimated higher infiltration rate (0.5ft/day compared to 0.3ft/day at the alternative site). A lower infiltration rate will yield a lower recharge benefit. Land prices in the region also continue to escalate based on high commodity values for almonds and other crops. Finding another suitable property at this price per acre is not available at this time. Additional costs would also be needed, including purchase price negotiations, new costs for investigation, technical studies, and engineering work required to prepare). Another location would also not provide the operational flexibility that the proposed project provides at the diversion point of two major District canals.</td></tr>
<tr><td>Purchase 2,268AF Surface Water Supply</td><td>$22M (2,268AF/yr @$200/AF for 50 years; $200AF considered average price. Dry year prices this year selling for $800-$1500/AF)</td></tr>
</table></td></tr>
<tr><td>Question 3</td><td>If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.
The proposed project is the least cost alternative.</td></tr>
</table>