MADERA COUNTY

GROUNDWATER SUSTAINABILITY AGENCIES

County GSAs Rate Study

Final Report / May 6, 2022

RAFTELIS

May 6, 2022

Stephanie Anagnoson
Director of Water and Natural Resources
Madera County
200 West Fourth Street, Suite 3100
Madera, CA 93637

Subject: County GSAs Rate Study Report

Dear Stephanie,

Raftelis Financial Consultants, Inc. (Raftelis) is pleased to provide this rate study report for the Madera County Groundwater Sustainability Agencies (County GSAs). The rate study process involved the development of rates to fund project and programmatic costs of Groundwater Sustainability Plan (GSP) implementation for the Madera, Chowchilla, and Delta-Mendota subbasins within the County GSAs' jurisdiction. The proposed rates were developed in alignment with cost-of-service principles, as required by the Sustainable Groundwater Management Act (SGMA) statute and California's Proposition 218.

This report details the key assumptions, projects and programs information and cost estimates, analyses, policy decisions, and recommendations in the development of the rates. The key objectives of the study include the following:

- Consolidate and forecast cost estimates pertaining to the projects and programs as adopted in the County GSAs' GSPs, including groundwater recharge facilities, participation in the Sites Reservoir, domestic well mitigation, and agricultural lands repurposing
- Develop financial plans for the three subbasins that adequately fund operating, capital, and reserve requirements and provides adequate debt service coverage, where applicable
- Evaluate various rate structure options for consideration and selection by the County GSAs Board of Directors to determine the most appropriate rate structure to recover costs
- Calculate rates for a five-year adoption period
- Document the rate study in this report in alignment with Proposition 218 and to serve as the County GSAs administrative record

It has been a pleasure working with the County GSAs and the Board of Directors on this study. We thank you and your staff for the support and collaboration provided during this study.

Sincerely,

Kevin Kostiuk
Manager

Nancy Phan
Manager

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1. Executive Summary

Sustainable Groundwater Management Act

The Sustainable Groundwater Management Act (SGMA), comprised of Assembly Bill (AB) 1739, Senate Bill (SB) 168, and SB 1319, was enacted in September 2014 to provide a framework for managing groundwater in California State (State). As part of the legislation, the State developed a process to classify all California groundwater basins within the following priorities: high, medium, low, or very low priority. Critically overdrafted or high priority basins must become sustainable within 20 years from when each basin submits its Groundwater Sustainability Plan (GSP). High priority, critically overdrafted basins must reach sustainability by 2040, while high priority basins that are not critically overdrafted and medium priority basins have until 2042.

Madera County Groundwater Sustainability Agencies

The Madera County Groundwater Sustainability Agencies (County GSAs) were formed in January 2017 to manage areas known colloquially as "white areas" which lay within the boundaries of Madera County but are without representation from another Groundwater Sustainability Agency (GSA). The County GSAs includes lands in three different subbasins:

1. Madera Subbasin
2. Chowchilla Subbasin
3. Delta-Mendota Subbasin

The State Department of Water Resources (DWR) designates all three subbasins as high priority basins in a condition of critical overdraft. As a result, each of the three subbasins have submitted GSPs as of January 2020. GSPs demonstrate a plan to achieve sustainability by 2040 through a series of activities commonly known within SGMA as *projects and management actions*. These subbasins encompass multiple GSAs that cover portions of each subbasin. The parcels not within the boundaries of these other GSAs are the "white areas" under the County GSA's responsibility for groundwater management. For the remainder of this report, any reference to each of the three subbasins will refer specifically to the portions of these subbasins that are under the County GSA's jurisdiction, unless otherwise noted. For example, when referring to the Madera subbasin it is implied that we are discussing the projects, programs, costs, and other activities related specifically to the County GSAs management areas within the greater subbasin.

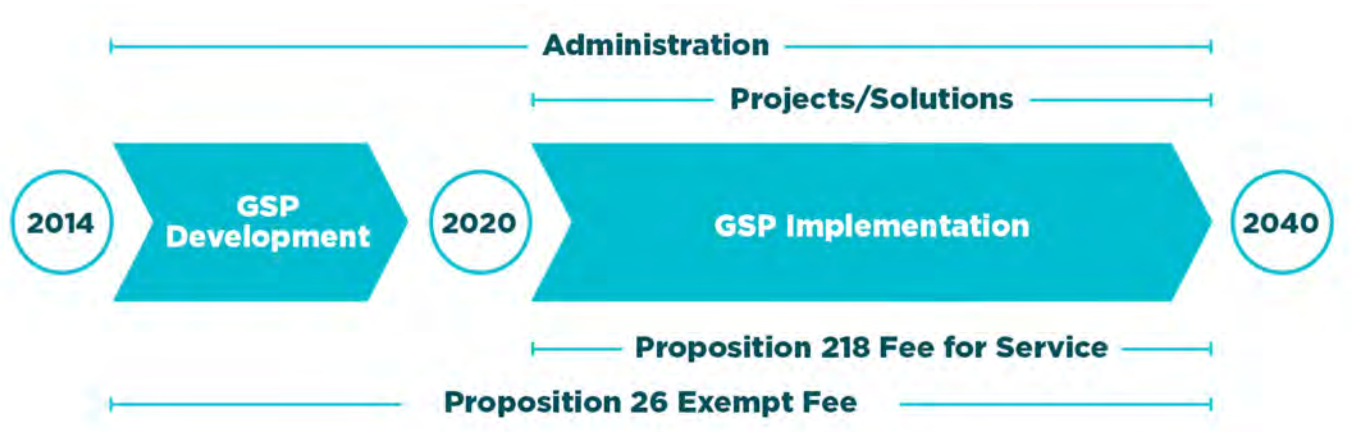
Study Background

The County GSAs engaged Raftelis in 2019 to develop GSA fees, which are designed to help the County GSAs recover the administrative costs associated with GSAs activities pre-GSP implementation. These costs include public outreach, grant administration, technical support services, legal and professional services, studies, reporting, and reserve funding. The fee, referred to in the community as the 'GSAs Admin Fee,' was adopted by the County GSA's Board of Directors (which are the same individuals as the County Board of Supervisors) in November 2019.

Subsequently, the County GSAs contracted with Raftelis in 2020 to develop GSP rates (post-GSP implementation), which are documented in this rate study report. The GSP rates developed in this study are designed to recover the costs incurred by the County GSAs to implement the GSPs' projects and programs that were included in the GSPs, adopted by the Board of Directors, and submitted to DWR.

Figure 1-1 shows the timeline for the County GSAs' SGMA-related activities. The Proposition 26 exempt fee refers to the GSAs Admin Fee adopted by the County GSAs in 2019. The Proposition 218 fee for service refers to the GSP rates developed in this rate study.

Figure 1-1: SGMA Timeline for County GSA



The costs of GSP implementation include: design, environmental permitting, construction, water rights acquisition, monitoring and future operating costs of groundwater recharge facilities; water supply augmentation via participation in the future Sites Project Authority (Sites) which includes participatory, construction, and future operating costs; programmatic costs for replacing domestic wells de-watered by chronic over-extraction by subbasin pumpers; and programmatic costs to incentivize land repurposing and retirement of irrigated (or recently irrigated) lands via direct payments.

The objective of this rate study is to fully fund the GSP items outlined above in order to achieve subbasin sustainability by 2040, and to do so in the least impactful manner to affected parcels.

Proposition 218 Requirements

Proposition 218 was enacted by voters in 1996 to ensure, in part, that fees and charges imposed for ongoing delivery of a service to a property (property-related fees and charges) are proportional to, and do not exceed, the cost of providing service. Based on the language of the SGMA statute[1], within the Water Code, where a GSA's financial authority is derived, the County GSAs' GSP rates are subject to the provisions of California Constitution Article XIII D, Section 6 subdivisions (a) and (b). This is commonly referred to as Proposition 218. Proposition 218 has both procedural and substantive requirements for adopting existing, new, or increased fees and charges. Procedural requirements include identifying parcels subject to the charge, calculating the amount to be imposed, providing written notice to all owners of record, and holding a public hearing no less than 45 days from the post-mark date of the notices. The substantive requirements of Proposition 218, which relates to fees and charges for GSP implementation, are as follows:

1. Revenues derived from the fee or charge shall not exceed the costs required to provide the property-related service.
2. Revenues derived by the fee or charge shall not be used for any purpose other than that for which the fee or charge was imposed.

[1] Part 2.74, Chapter 8, Section 10730.2 (c) of the Water Code added by Statute in 2014 reads: (a) Fees imposed pursuant to this section shall be adopted in accordance with subdivisions (a) and (b) of Section 6 of Article XIII D of the California Constitution.

3. The amount of the fee or charge imposed upon any parcel shall not exceed the proportional cost of service attributable to the parcel.
4. No fee or charge may be imposed for a service unless that service is actually used or immediately available to the owner of property.
5. A written notice of the proposed fee or charge shall be mailed to the record owner of each parcel not less than 45 days prior to a public hearing, when the agency considers all written protests against the charge.

Summary of Programs

Collectively, the subbasin GSPs (Madera, Chowchilla, and Delta-Mendota) identify four different activities that will altogether help the County GSAs reach sustainability by 2040 as required by SGMA. The County GSAs and Raftelis worked with several other consulting firms on this effort, with each firm responsible for providing the cost details of each of the four activities. KNN Public Finance (KNN) serves as the County GSAs' municipal advisor and worked directly with Raftelis to propose a financing plan where future borrowing will be required. The four programs include:

1. Groundwater Recharge Facilities (Recharge) led by Davids Engineering (DE)
2. Water Supplies from Sites led by the Sites Project Authority
3. Domestic Well Mitigation (Domestic Wells) led by Luhdorff & Scalmanini Consulting Engineers (LSCE)
4. Sustainable Agricultural Land Conservation (SALC) led by ERA Economics

The activities outlined in the GSP will help achieve sustainability through a combination of water supply augmentation (Recharge and Sites) and demand management (SALC and the County GSAs adopted water allocation schedules). The Recharge program will develop groundwater recharge facilities within the Madera and Chowchilla subbasins that aim to harness flood flows for the sole purpose of facilitating groundwater recharge in the respective subbasins. Sites participation will allow the County GSAs to purchase a water supply allocation from the yet-to-be constructed Sites Reservoir in the Sacramento Valley. Sites will capture and store flows from the Sacramento River and provide an additional source of new water to the Madera and Chowchilla subbasins. The Domestic Well mitigation program will provide funding to replace and re-drill wells that have been de-watered in the Madera and Chowchilla subbasins due to chronic lowering of groundwater elevations. The SALC program provides incentive payments for parcel owners to enroll acreage into the program, which reduces irrigated acreage and, in turn, groundwater extraction. Lands enrolled in the SALC program may be repurposed to other non-irrigated uses that provide multiple benefits to the County GSAs and communities in Madera County.

Figure 1-2, **Figure 1-3**, and **Figure 1-4** show the combined costs of the Recharge, Sites, Domestic Wells, and SALC programs for the Madera, Chowchilla, and Delta-Mendota subbasins, respectively.

Figure 1-2: Madera Subbasin Program Costs

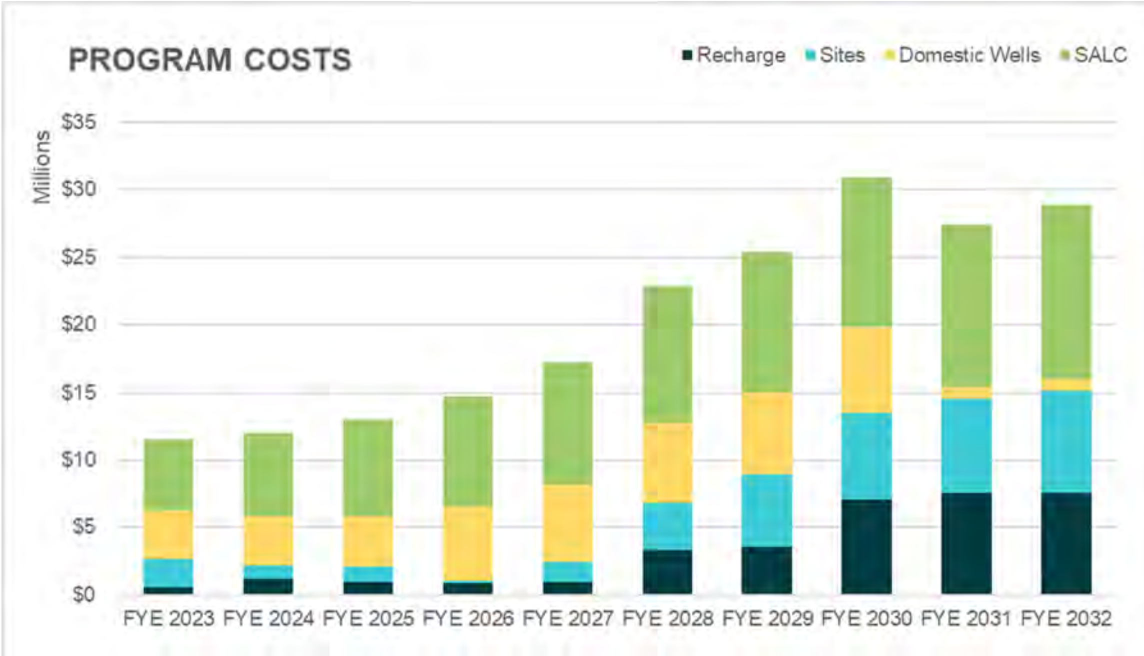


Figure 1-3: Chowchilla Subbasin Program Costs

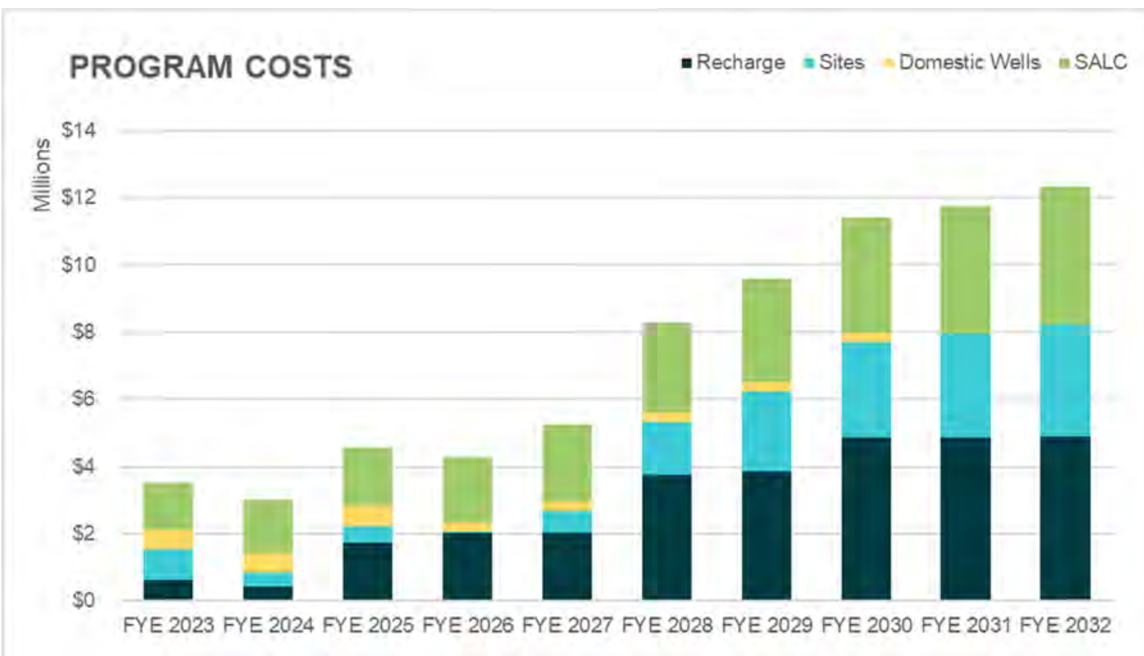


Figure 1-4: Delta-Mendota Subbasin Program Costs

Proposed Financial Plan

The rate study process involves developing a long-term financial plan for each of the three subbasins. The financial plans are designed to recover the estimated and projected costs of the programs outlined in the GSP, build up reserve funds over the study period (based on policy direction from the Board of Directors and industry norms), and ensure adequate debt capacity for future borrowing requirements. The County GSAs does not currently have adopted rates or reserve funds available for GSP implementation, and therefore this inaugural rate study will initiate new fees for adoption. Raftelis has recommended the following reserve policy for each of the three subbasins which will allow the County GSAs to meet its ongoing cash needs for operating and capital expenses, derive a revenue base for future debt service coverage, and mitigate the financial risks associated with emergency situations and uncertainty. Raftelis' recommendation is for a reserve policy that includes components for Operating, Capital, Debt Service, and Rate Stabilization Reserves, which is described in a later section of this report.

Table 1-1 shows the proposed revenue adjustments for each subbasin. As new entities, with cost centers that ramp up over time, and a starting revenue base of $0 (omitting one-time grant awards), the revenue generation of the County GSAs needs to expand each year. Since the County GSAs do not currently have an adopted GSP rate, the revenue needed in the first year of the study, Fiscal Year Ending (FYE) 2023, is equal to the total expenses for each subbasin, plus funding for reserves and design costs of upcoming recharge facilities. The additional revenues required in each year are referred to as revenue adjustments. The revenue adjustments in the table are then applied every subsequent year and assume adjustments occur on July 1 of the calendar year, which is the beginning of the County's Fiscal Year (FY). While the rate proposal is for a five-year period (the maximum allowable by Proposition 218), the table shows a ten-year horizon as rates for years one through five are partially informed by years six through ten.

Table 1-1: Proposed Revenue Adjustments by Subbasin

Line	A Revenue Adjustments	B Madera Subbasin	C Chowchilla Subbasin	D Delta-Mendota Subbasin
1	FYE 2023			
2	FYE 2024	$1,344,396	$136,076	$20,113
3	FYE 2025	$4,275,179	$413,670	$65,366
4	FYE 2026	$7,733,503	$702,369	$121,933
5	FYE 2027	$11,814,326	$1,002,615	$192,641
6	FYE 2028	$12,884,408	$1,783,255	$210,318
7	FYE 2029	$13,997,294	$2,641,959	$228,879
8	FYE 2030	$15,154,695	$3,586,534	$248,368
9	FYE 2031	$16,358,392	$4,625,566	$260,646
10	FYE 2032	$17,610,237	$5,768,502	$273,293

Figure 1-5 shows the proposed financial plan for the Madera subbasin. The dotted line represents proposed revenues resulting from the applied revenue adjustments (**Table 1-1**, Column B). The stacked bars represent operating costs (for the four programs as well as project management costs), anticipated debt service (for future recharge projects), rate-funded capital (for the Recharge, Sites participation, Domestic Wells, and SALC programs), and reserve funding.

Figure 1-6 shows the projected fund balances for the Madera subbasin. The turquoise bars represent the ending balance for all Madera subbasin reserves, and the grey line represents the recommended reserve targets. The ending balance in FYE 2028 exceeds the reserve target due to future bond proceeds being received in that year but spent on capital facilities in the subsequent year(s). Reserves are then maintained at or near target.

Figure 1-5: Madera Subbasin Proposed Financial Plan

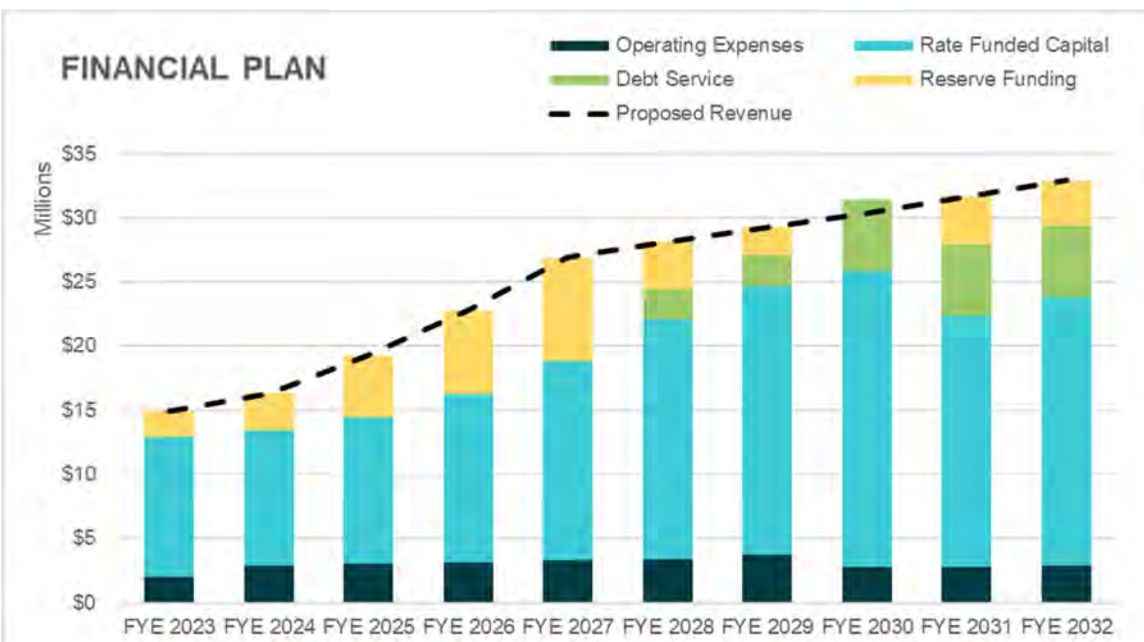


Figure 1-6: Madera Subbasin Projected Fund Balances

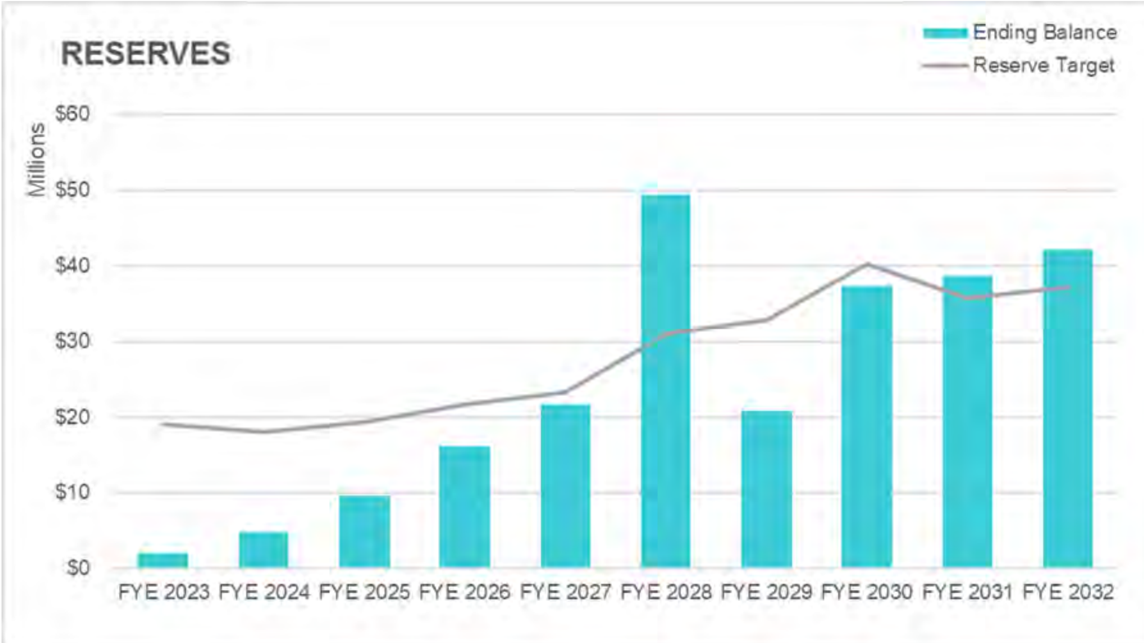


Figure 1-7 shows the proposed financial plan for the Chowchilla subbasin. The dotted line represents proposed revenues resulting from the applied revenue adjustments (**Table 1-1**, Column C). The stacked bars represent operating costs, anticipated debt service, rate-funded capital, and reserve funding.

Figure 1-8 shows the projected fund balances for the Chowchilla subbasin. The turquoise bars represent the ending balance for all Chowchilla subbasin reserves, and the grey line represents the recommended reserve targets. Same as the Madera subbasin financial plan, the Chowchilla subbasin ending balance in FYE 2028 exceeds the reserve target due to future bond proceeds being received in that year but spent on capital facilities in the subsequent year(s). Reserves are then maintained at or near target.

Figure 1-7: Chowchilla Subbasin Proposed Financial Plan

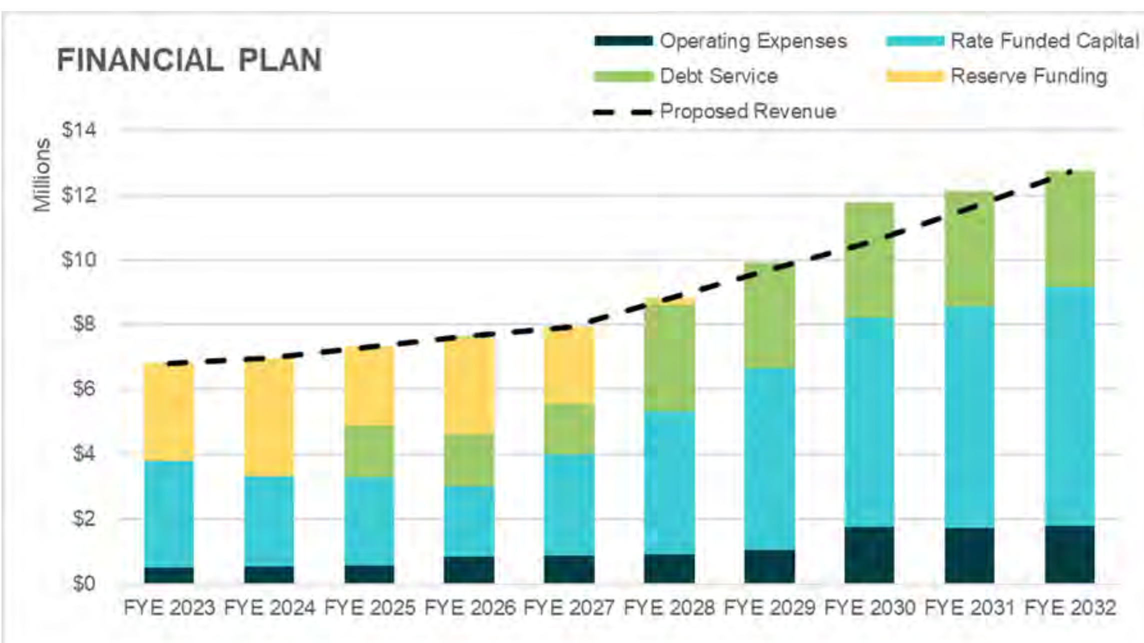


Figure 1-8: Chowchilla Subbasin Projected Fund Balances

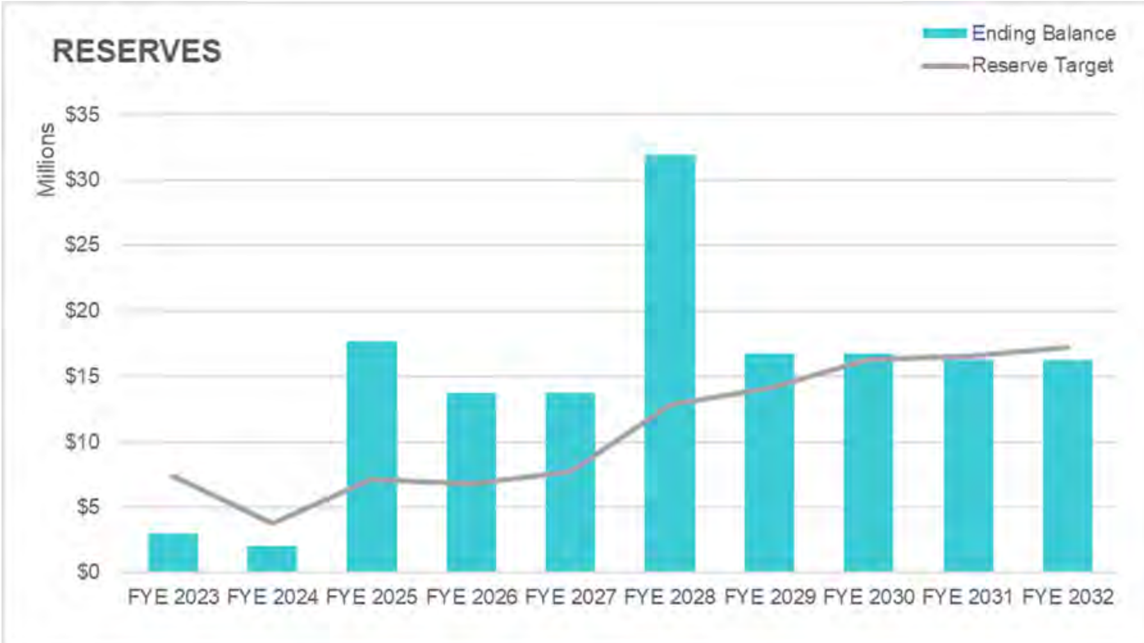


Figure 1-9 shows the proposed financial plan for the Delta-Mendota subbasin. The dotted line represents proposed revenues resulting from the applied revenue adjustments (**Table 1-1**, Column D). The stacked bars represent operating costs, rate-funded capital (for the SALC program), and reserve funding.

Figure 1-10 shows the projected fund balances for the Delta-Mendota subbasin. The turquoise bars represent the ending balance for all Delta-Mendota subbasin reserves, and the grey line represents the recommended reserve targets.

Figure 1-9: Delta-Mendota Subbasin Proposed Financial Plan

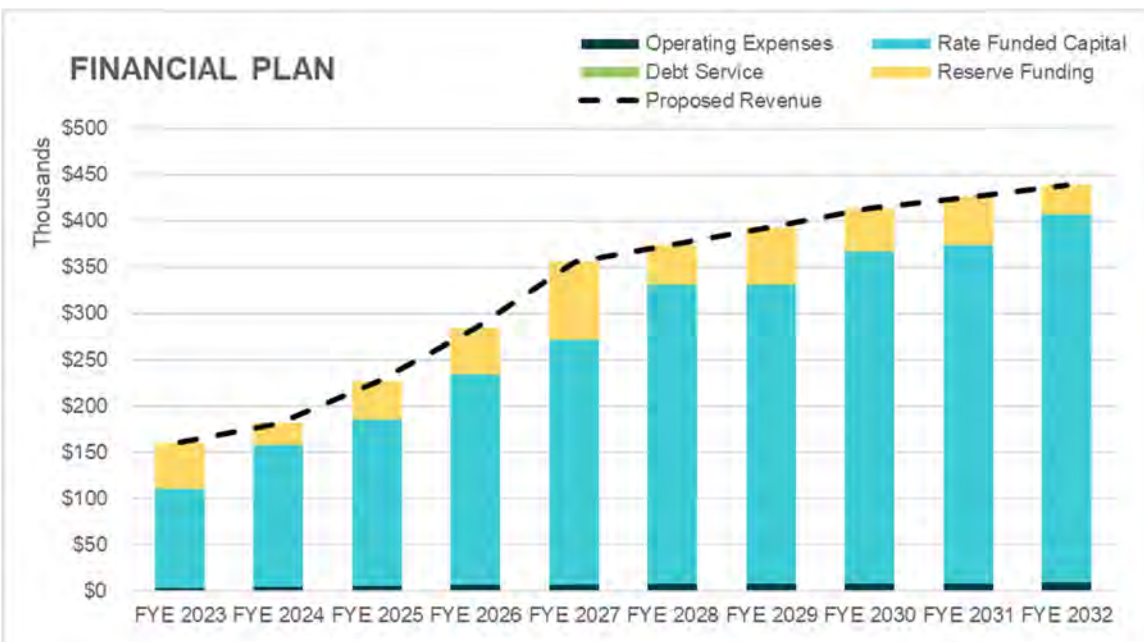
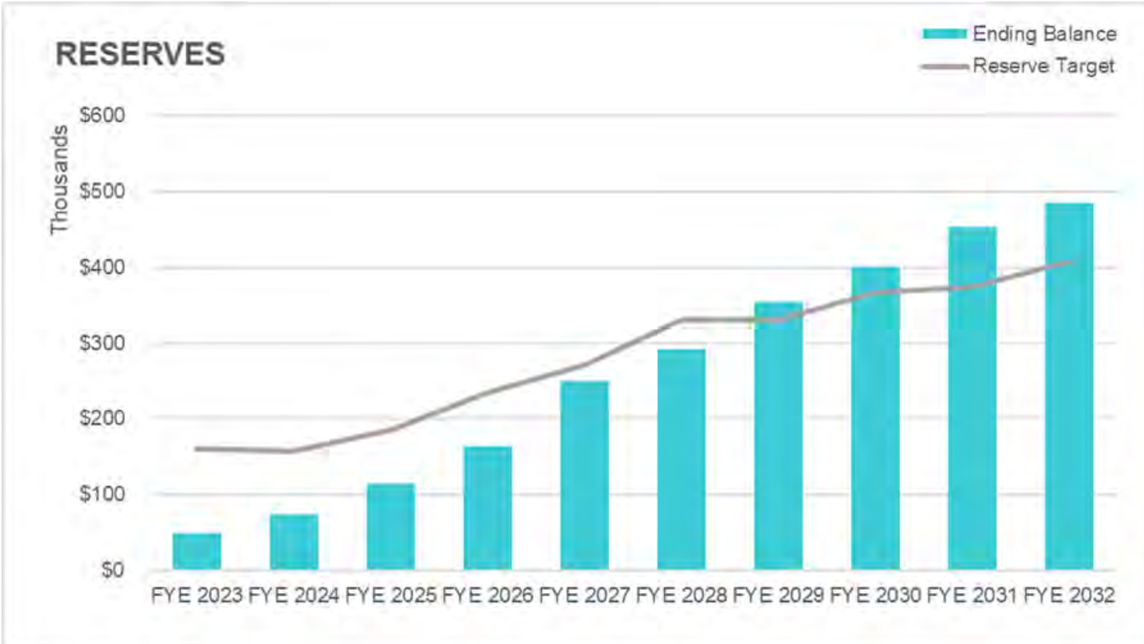


Figure 1-10: Delta-Mendota Subbasin Projected Fund Balances



Rate Structure Options

As part of the rate study process, Raftelis worked closely with County GSAs staff and received policy direction from the County GSAs Board of Directors. The County GSAs evaluated several rate structure options, which included:

1. Fixed Rate: all costs are recovered based on a fixed rate per enrolled acre (enrolled acre is defined within the main body of this report) in a farm unit[2]
2. Fixed and Volumetric Rate (Program-Based): costs are apportioned based on programs, with costs for the Recharge, Sites, and Domestic Wells activities recovered through the volumetric rate. Remaining costs are recovered based on a fixed rate per enrolled acre in a farm unit; the volumetric costs are recovered based on use within the Transition Water pool of a farm unit's water allocation
3. Fixed and Volumetric Rate (Policy-Based): costs are apportioned based on policy direction provided by the Board, with 75% of costs allocated to the fixed component and the remaining 25% allocated to the volumetric component. The fixed component allocation is recovered per enrolled acre; the volumetric costs are recovered based on use within the Transition Water pool of a farm unit's water allocation

All options were modeled and designed to recover the same amount of revenue (the cost of service). The benefits and challenges associated with the Fixed Rate and the Fixed and Volumetric Rate options were discussed at length during several public meetings with the Board of Directors and conveyed to County GSAs stakeholders in small group meetings and larger public workshops.

The potential benefits of the Fixed and Volumetric Rate options include flexibility in controlling farm unit charges and a perception of fairness by providing a direct relationship between water use and County GSAs costs.

Challenges related to the Fixed and Volumetric Rate options include reduced revenue stability for the County GSAs cost recovery; grower acceptance in measuring and validating water use estimates by farm unit; potential borrowing risks if

[2] A farm unit is defined as enrolled acres owned or managed by the same entity.

revenue streams are highly variable and uncertain in future years; and increased borrowing and administrative costs (for rate stabilization reserves, water accounting, appeals, and GSAs staffing).

Additional benefits of the Fixed Rate option include ease of customer understanding and staff administration (leading to lower costs for the County GSAs), revenue stability for the County GSAs to implement the programs in the GSP (particularly borrowing for recharge capital), and slightly lower costs to some farm units (if some farm units do not use their full Transition Water allocation the volumetric unit cost would have to be higher to recover the same amount of costs from fewer units of service).

A key challenge for the Fixed Rate option is the perceived lack of flexibility for farm units that may use less than their Transition Water allocation. However, the County GSAs has adopted a carryover provision that allows farm units to carryover their unused groundwater allocation for one year which provides additional flexibility. The farm unit affords growers additional flexibility by allowing them to allocate water within fields in the farm unit. In addition, the SALC land repurposing program allows growers to forgo irrigation and receive payments that would offset GSP charges. Based on the benefits of the Fixed Rate option relative to the Fixed and Volumetric options, the Board elected to proceed with developing a fixed rate per enrolled acre for all five years of the rate proposal.

Proposed Rates

The proposed five-year rate schedule, shown in **Table 1-2**, was developed to sustainably fund the County GSAs' costs of GSP implementation, including the costs associated with the Recharge, Sites, Domestic Wells, SALC, prudent reserves, and future debt service. The proposed rates are rounded up to the nearest dollar and will be charged per Enrolled Acre. An acre is considered Enrolled if it is within the farm unit and receiving an allocation on that acre, regardless of it being currently irrigated or currently unirrigated.

The annual rates are developed based on the annual costs of GSP implementation and represent the cost of service within each individual year; the averaged rates are designed to collect the same amount of revenue (barring differences due to the rounding of rates between the two options) over a five-year period (the cost of service over the five-year term). The County GSAs Board of Directors has elected to notice the averaged rates. Absent a majority protest, and if adopted by the Board of Directors, the GSP rates will be implemented on July 1, 2022 through July 1, 2026. The rates represent the maximum allowable for implementation in each year. For the purposes of this report, FYE 2023 relates to the year starting July 1, 2022 and ending June 30, 2023.

Table 1-2: Proposed Rates ($/Enrolled Acre)

	A	B	C	D	E	F
Line	Proposed Rates ($/Enrolled Acre)	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027
1	**Annual Rates**					
2	Madera Subbasin	$184	$200	$236	$279	$329
3	Chowchilla Subbasin	$190	$194	$202	$210	$218
4	Delta-Mendota Subbasin	$92	$104	$129	$162	$202
5						
6	**Averaged Rates**					
7	Madera Subbasin	$246	$246	$246	$246	$246
8	Chowchilla Subbasin	$203	$203	$203	$203	$203
9	Delta-Mendota Subbasin	$138	$138	$138	$138	$138

2. Key Inputs and Assumptions

This section of the report documents the key inputs and assumptions used to develop the GSP rates, which include the groundwater allocations, total and enrolled acreage, cost and revenue escalation factors, debt financing assumptions, and other assumptions.

Groundwater Allocations

The GSP documents the County GSAs' plan to reach groundwater sustainability by 2040. As a tool to assist with subbasin management and groundwater demand management, the County GSAs has adopted a five-year schedule of groundwater allocations with projected groundwater allocations beyond five years. The groundwater allocations are in inches of water[3] per acre per year and include two pools of water: Sustainable Yield (SY) and Transition Water (TW). SY refers to the native groundwater existing in the subbasins and represents a sustainable amount of annual groundwater extraction. The SY calculation includes native groundwater across the County GSAs management area in each subbasin, allocated to the total Enrolled Acres within farm units eligible to receive an allocation. TW refers to the planned depletion of groundwater storage, which will incrementally decrease during the GSP implementation period. The amount of TW available in each subbasin will equal zero by the end of the GSP implementation period in 2040.

The County GSAs adopted its five-year groundwater allocations in August 2021. Each of the three subbasins are allotted an annual amount of groundwater which is shown in **Table 2-1** as acre-feet (AF) per year. The allocations shown for FYE 2023 match the adopted allocations for Calendar Year (CY) 2022, and so forth for every year thereafter.

The groundwater allocations represent the desired outcome of implementing the GSP, which is to reduce groundwater extraction gradually to reach Sustainable Yield in 2040 through a combination of demand management and water supply augmentation. The GSP outlines the four programs (Recharge, Sites, Domestic Wells, and SALC) which if implemented, will assist the County GSAs to achieve this outcome within the timeline required by SGMA.

Enrolled Acreage

County GSAs staff provided the total acreage and enrolled acreage for each subbasin, shown in
Table 2-2. As previously described, enrolled acreage represents an acre within a farm unit that receives a groundwater allocation on that acre. Enrolled acreage estimates are based on the best available data at the end of CY 2021.

[3] Groundwater allocations are measured as evapotranspiration of applied water (ETAW).

Table 2-1: Groundwater Allocations by Subbasin (AF)

	A	B	C	D	E	F	G	H	I	J	K
Line	Groundwater Allocations (AF)	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	Allocation Year	CY 2022	CY 2023	CY 2024	CY 2025	CY 2026	CY 2027	CY 2028	CY 2029	CY 2030	CY 2031
2											
3	**Madera Subbasin**										
4	Sustainable Yield	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000
5	Transition Water	108,480	106,220	103,960	101,700	94,920	88,140	81,360	74,580	67,800	61,020
6	**Total - Madera Subbasin**	**198,480**	**196,220**	**193,960**	**191,700**	**184,920**	**178,140**	**171,360**	**164,580**	**157,800**	**151,020**
7											
8	**Chowchilla Subbasin**										
9	Sustainable Yield	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500	22,500
10	Transition Water	60,864	59,596	58,328	57,060	53,256	49,452	45,648	41,844	38,040	34,236
11	**Total - Chowchilla Subbasin**	**83,364**	**82,096**	**80,828**	**79,560**	**75,756**	**71,952**	**68,148**	**64,344**	**60,540**	**56,736**
12											
13	**Delta-Mendota Subbasin**										
14	Sustainable Yield	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
15	Transition Water	1,920	1,880	1,840	1,800	1,680	1,560	1,440	1,320	1,200	1,080
16	**Total - Delta-Mendota Subbasin**	**3,420**	**3,380**	**3,340**	**3,300**	**3,180**	**3,060**	**2,940**	**2,820**	**2,700**	**2,580**

Table 2-2: Total and Enrolled Acreage by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	Total and Enrolled Acreage	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**All Acreage**										
2	Madera Subbasin	185,000	185,000	185,000	185,000	185,000	185,000	185,000	185,000	185,000	185,000
3	Chowchilla Subbasin	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000
4	Delta-Mendota Subbasin	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
5	**Total - All Acreage**	**233,000**	**233,000**	**233,000**	**233,000**	**233,000**	**233,000**	**233,000**	**233,000**	**233,000**	**233,000**
6											
7	**Enrolled Acreage**										
8	Madera Subbasin	81,473	81,473	81,473	81,473	81,473	81,473	81,473	81,473	81,473	81,473
9	Chowchilla Subbasin	35,872	35,872	35,872	35,872	35,872	35,872	35,872	35,872	35,872	35,872
10	Delta-Mendota Subbasin	1,755	1,755	1,755	1,755	1,755	1,755	1,755	1,755	1,755	1,755
11	**Total - Enrolled Acreage**	**119,100**	**119,100**	**119,100**	**119,100**	**119,100**	**119,100**	**119,100**	**119,100**	**119,100**	**119,100**

Key Assumptions

Table 2-3 shows the cost and revenue escalation factors used to project cost and revenue increases over the study period. These escalation factors were developed with County GSAs staff input. The Salary cost escalation factor is used to project increases in staffing costs including salaries and benefits. The Capital cost escalation factor is used to project increases in capital projects and annual maintenance program costs. The General cost escalation factor is used to project all other costs. The Interest Income revenue escalation factor is used to project interest income generated on reserve funds in each subbasin.

Table 2-4 shows the debt financing assumptions for proposed debt. The proposed debt used to fund the Sites program is not issued by the County GSAs; therefore, the debt financing assumptions shown in this table do not include those used for Sites. The only program that is expected to be financed using debt issued by the County GSAs is the Recharge program. Borrowing terms were derived with input from the County GSAs' Municipal Advisory firm KNN. The debt financing assumptions includes one year of debt service to be deposited into the Debt Service Reserve Fund for each issuance in each of the subbasins, where applicable. The Debt Service Reserve Fund deposit is expected to be capitalized, meaning that the deposited amount is included in the debt issuance and total borrowing costs.

The revenues and reserve funds generated from the GSAs Admin Fee (Proposition 26 exempt fees) are used exclusively for administration costs of the GSAs and do not overlap with the costs and/or reserves required for GSP implementation. The County GSAs do not currently have any reserves, or rate revenue stream, for use in implementing the GSPs. The beginning balances for the reserve funds in each of the three subbasins will start at zero in FYE 2023. The GSP rates developed in this study (Proposition 218 fee for service) will include a component for reserve funding in each of the subbasins, which is allowed under SGMA per Water Code Section 10730 and prudent for sound financial planning and management.

Table 2-3: Cost and Revenue Escalation Assumptions

Line	A Escalation Assumptions	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Cost Escalation**										
2	Salary	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
3	Capital	0.0%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%
4	General	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
5											
6	**Revenue Escalation**										
7	Interest Income	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Table 2-4: Debt Financing Assumptions

Line	A Debt Financing Assumptions	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Proposed Debt**										
2	Interest	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
3	Term (# of Years)	30	30	30	30	30	30	30	30	30	30
4	Issuance Cost	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
5	Debt Service Reserve (# of Years)	1	1	1	1	1	1	1	1	1	1

3. Groundwater Recharge Facilities

This section of the report documents information and cost estimates related to the proposed Recharge projects including design, environmental permitting, construction, water rights acquisition, monitoring, and future operating costs of groundwater recharge facilities in the Madera and Chowchilla subbasins. The program cost estimates were developed and provided by DE. Numbers shown in the tables of this section are rounded up to the nearest integer. Therefore, hand calculations based on the displayed numbers, such as summing or multiplying, may not equal the exact results shown.

Program Background

The Recharge program involves building groundwater recharge facilities that harness flood flows to recharge the critically overdrawn Madera and Chowchilla subbasins. Surface water available for recharge from flood flows is estimated to be available approximately every three years on average (35% chance of flood flows in each year). While contingent on further design details, groundwater recharge may be conducted on existing farmed acreage (Flood-MAR) or in dedicated recharge basins in various areas of the subbasins. The exact location of recharge facilities is influenced by a variety of factors including proximity to existing conveyance, suitable geology, desirability of volunteered lands, landowner interest, and availability of water rights, among others.

The capital project plan includes five projects each for the Madera and Chowchilla subbasins. The expected water yields are specific to each individual project. The recharge projects include future operating and maintenance (O&M), design costs, capital construction costs, and future debt service. For purposes of this rate study the County GSAs, Raftelis, and DE have made informed estimates of outside contributions from grants and in-kind private landowner contributions, which offset (i.e. reduce) the costs to the County GSAs and therefore the proposed rates. Future variance from the assumptions set-forth herein have the potential to impact future rates.

Capital Program Costs

Table 3-1 shows the estimated capital project costs for Projects 1 through 5 in the Madera and Chowchilla subbasins. The capital project cost estimates include portions for design and construction of each project (Columns B and C). The total cost (Column D) is offset by the estimated grant funding (Column E) and private landowner contribution amounts (Column F)[4]. Landowner contributions reduce the net cost to the County GSA; however, the amount of groundwater recharge credit is allocated based on the proportional costs paid for by the County GSAs (design and construction costs less grants) and private landowners (landowner contributions only).

[4] Landowner contribution estimates are based on the draft technical memorandum provided by DE in May 2021.

Table 3-1: Recharge Capital Project Costs

	A	B	C	D	E	F	G
Line	Recharge Project Costs	Planning & Design	Construction	Total Cost	Grants	Landowner Contributions	Net Cost
1	**Madera Subbasin**						
2	Project 1	$1,100,000	$5,470,000	**$6,570,000**	($4,197,600)	($1,665,600)	**$706,800**
3	Project 2	$8,340,000	$18,210,000	**$26,550,000**	($4,000,000)	($2,139,789)	**$20,410,211**
4	Project 3	$8,330,000	$18,250,000	**$26,580,000**	($4,000,000)	($2,139,789)	**$20,440,211**
5	Project 4	$8,000,000	$17,620,000	**$25,620,000**	($4,000,000)	($2,139,789)	**$19,480,211**
6	Project 5	$7,950,000	$16,960,000	**$24,910,000**	($4,000,000)	($2,057,490)	**$18,852,510**
7	**Total - Madera Subbasin**	**$33,720,000**	**$76,510,000**	**$110,230,000**	**($20,197,600)**	**($10,142,457)**	**$79,889,943**
8							
9	**Chowchilla Subbasin**						
10	Project 1	$1,600,000	$5,300,000	**$6,900,000**	($4,197,600)	($1,912,581)	**$789,819**
11	Project 2	$5,280,000	$12,020,000	**$17,300,000**	($4,000,000)	($720,000)	**$12,580,000**
12	Project 3	$4,410,000	$9,680,000	**$14,090,000**	($4,000,000)	($360,000)	**$9,730,000**
13	Project 4	$7,290,000	$15,640,000	**$22,930,000**	($4,000,000)	($360,000)	**$18,570,000**
14	Project 5	$4,450,000	$9,810,000	**$14,260,000**	($4,000,000)	($600,000)	**$9,660,000**
15	**Total - Chowchilla Subbasin**	**$23,030,000**	**$52,450,000**	**$75,480,000**	**($20,197,600)**	**($3,952,581)**	**$51,329,819**

Table 3-2 shows the capital project cost allocations by subbasin for the Recharge program. Based on discussion with County GSAs staff and other consultants involved in this work, the estimated grant funding will be used to offset the design and construction costs of each recharge project. Cost allocations for grants (Column D) and landowner contributions (Column E) are equal to the funding amounts from each respective source (**Table 3-1**, Columns E and F, respectively) divided by the total cost (**Table 3-1**, Column D). The remaining cost allocations (Columns B and C) are divided between design and construction based on the proportion of costs within each category (**Table 3-1**, Columns B and C). The following formula is used to calculate the design cost allocation percentage for Project 1 in Madera Subbasin (Line 2):

*Design allocation (Column B, Line 2) = [Net cost (**Table 3-1**, Column G, Line 2) / Total cost (**Table 3-1**, Column D, Line 2)] x [Design cost (**Table 3-1**, Column B, Line 2) / Total cost (**Table 3-1**, Column D, Line 2)]*

Table 3-2: Recharge Capital Project Cost Allocations

Line	A Recharge Cost Percentages	B Planning & Design	C Construction	D Grants	E Landowner Contributions	F Total
1	**Madera Subbasin**					
2	Project 1	1.8%	9.0%	63.9%	25.4%	100.0%
3	Project 2	24.1%	52.7%	15.1%	8.1%	100.0%
4	Project 3	24.1%	52.8%	15.0%	8.1%	100.0%
5	Project 4	23.7%	52.3%	15.6%	8.4%	100.0%
6	Project 5	24.2%	51.5%	16.1%	8.3%	100.0%
7	**Total - Madera Subbasin**	**22.2%**	**50.3%**	**18.3%**	**9.2%**	**100.0%**
8						
9	**Chowchilla Subbasin**					
10	Project 1	2.7%	8.8%	60.8%	27.7%	100.0%
11	Project 2	22.2%	50.5%	23.1%	4.2%	100.0%
12	Project 3	21.6%	47.4%	28.4%	2.6%	100.0%
13	Project 4	25.7%	55.2%	17.4%	1.6%	100.0%
14	Project 5	21.1%	46.6%	28.1%	4.2%	100.0%
15	**Total - Chowchilla Subbasin**	**20.7%**	**47.3%**	**26.8%**	**5.2%**	**100.0%**

Table 3-3 and **Table 3-4** show the Recharge project schedule for each subbasin for the design[5] and construction phases, respectively. Raftelis worked with DE, ESA (as a subconsultant to DE), and County GSAs staff to best estimate the commencement of planning and design (and incurred costs) based on the proposed construction schedule. The design and construction phases for Project 1 in both the Madera and Chowchilla subbasins are projected to begin in FYE 2023. Projects 2 and 3 in the Chowchilla subbasin will begin immediately thereafter in FYE 2024. Projects 4 and 5 in the Chowchilla subbasin and Projects 2 and 3 in the Madera subbasin will begin in FYE 2027. Afterward, Projects 4 and 5 in the Madera subbasin will begin in FYE 2028. Construction for all projects in both subbasins is expected to be completed in FYE 2031.

Table 3-3: Recharge Project Schedule for Planning and Design Phase

Line	A Recharge Planning & Design	B Start Date	C End Date
1	**Madera Subbasin**		
2	Project 1	10/1/2021	12/1/2022
3	Project 2	1/1/2027	4/1/2028
4	Project 3	9/1/2027	12/1/2028
5	Project 4	5/28/2028	8/30/2029
6	Project 5	5/28/2028	8/30/2029
7			
8	**Chowchilla Subbasin**		
9	Project 1	10/1/2021	12/1/2022
10	Project 2	9/1/2023	12/1/2024
11	Project 3	9/1/2023	12/1/2024
12	Project 4	1/1/2027	4/1/2028
13	Project 5	9/1/2027	12/1/2028

[5] The start and end dates for the planning and design phase of Project 1 begin before the first year of the study period (FYE 2023). These costs are captured in FYE 2023 for the purposes of this rate study.

Table 3-4: Recharge Project Schedule for Construction Phase

Line	A Recharge Construction	B Start Date	C End Date
1	**Madera Subbasin**		
2	Project 1	1/1/2023	12/1/2023
3	Project 2	5/1/2028	4/1/2029
4	Project 3	1/1/2029	12/1/2029
5	Project 4	9/1/2029	8/1/2030
6	Project 5	9/1/2029	8/1/2030
7			
8	**Chowchilla Subbasin**		
9	Project 1	1/1/2023	12/1/2023
10	Project 2	1/1/2025	12/1/2025
11	Project 3	1/1/2025	12/1/2025
12	Project 4	5/1/2028	4/1/2029
13	Project 5	1/1/2029	12/1/2029

Table 3-5 shows the projected recharge capital project costs for the design phase during the study period. The project planning and design costs in each year are developed using the total project costs (**Table 3-1**, Column D), the design cost allocation percentages (**Table 3-2**, Column B), and the design phase schedule (**Table 3-3**). Similarly, **Table 3-6** shows the projected Recharge capital project costs for the construction phase. The project construction costs in each year are developed using the total project costs (**Table 3-1**, Column D), the construction cost allocation percentages (**Table 3-2**, Column C), and the construction phase schedule (**Table 3-4**). **Table 3-7** summarizes the capital project costs by subbasin.

Table 3-5: Recharge Capital Project Costs for Design Phase

Line	A Recharge Planning & Design Costs	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Madera Subbasin**										
2	Project 1	$118,338	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Project 2	$0	$0	$0	$0	$2,544,853	$3,866,490	$0	$0	$0	$0
4	Project 3	$0	$0	$0	$0	$0	$4,261,208	$2,144,621	$0	$0	$0
5	Project 4	$0	$0	$0	$0	$0	$450,579	$4,837,096	$795,139	$0	$0
6	Project 5	$0	$0	$0	$0	$0	$445,686	$4,784,568	$786,504	$0	$0
7	**Total - Madera Subbasin**	**$118,338**	**$0**	**$0**	**$0**	**$2,544,853**	**$9,023,963**	**$11,766,286**	**$1,581,643**	**$0**	**$0**
8											
9	**Chowchilla Subbasin**										
10	Project 1	$183,146	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	Project 2	$0	$2,554,029	$1,285,416	$0	$0	$0	$0	$0	$0	$0
12	Project 3	$0	$2,025,806	$1,019,567	$0	$0	$0	$0	$0	$0	$0
13	Project 4	$0	$0	$0	$0	$2,343,414	$3,560,436	$0	$0	$0	$0
14	Project 5	$0	$0	$0	$0	$0	$2,005,280	$1,009,236	$0	$0	$0
15	**Total - Chowchilla Subbasin**	**$183,146**	**$4,579,835**	**$2,304,983**	**$0**	**$2,343,414**	**$5,565,716**	**$1,009,236**	**$0**	**$0**	**$0**

Table 3-6: Recharge Capital Project Costs for Construction Phase

Line	A Recharge Construction Costs	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Madera Subbasin**										
2	Project 1	$318,897	$269,565	$0	$0	$0	$0	$0	$0	$0	$0
3	Project 2	$0	$0	$0	$0	$0	$2,549,048	$11,449,820	$0	$0	$0
4	Project 3	$0	$0	$0	$0	$0	$0	$7,605,458	$6,428,923	$0	$0
5	Project 4	$0	$0	$0	$0	$0	$0	$0	$12,153,926	$1,243,471	$0
6	Project 5	$0	$0	$0	$0	$0	$0	$0	$11,644,409	$1,191,342	$0
7	**Total - Madera Subbasin**	**$318,897**	**$269,565**	**$0**	**$0**	**$0**	**$2,549,048**	**$19,055,278**	**$30,227,259**	**$2,434,813**	**$0**
8											
9	**Chowchilla Subbasin**										
10	Project 1	$328,766	$277,907	$0	$0	$0	$0	$0	$0	$0	$0
11	Project 2	$0	$0	$4,736,648	$4,003,907	$0	$0	$0	$0	$0	$0
12	Project 3	$0	$0	$3,622,508	$3,062,120	$0	$0	$0	$0	$0	$0
13	Project 4	$0	$0	$0	$0	$0	$2,306,373	$10,359,776	$0	$0	$0
14	Project 5	$0	$0	$0	$0	$0	$0	$3,601,295	$3,044,189	$0	$0
15	**Total - Chowchilla Subbasin**	**$328,766**	**$277,907**	**$8,359,156**	**$7,066,027**	**$0**	**$2,306,373**	**$13,961,071**	**$3,044,189**	**$0**	**$0**

Table 3-7: Total Recharge Capital Project Costs by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	**Recharge Capital Costs**	**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**	**FYE 2027**	**FYE 2028**	**FYE 2029**	**FYE 2030**	**FYE 2031**	**FYE 2032**
1	**Design**										
2	Madera Subbasin	$118,338	$0	$0	$0	$2,544,853	$9,023,963	$11,766,286	$1,581,643	$0	$0
3	Chowchilla Subbasin	$183,146	$4,579,835	$2,304,983	$0	$2,343,414	$5,565,716	$1,009,236	$0	$0	$0
4	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Design**	**$301,484**	**$4,579,835**	**$2,304,983**	**$0**	**$4,888,268**	**$14,589,679**	**$12,775,522**	**$1,581,643**	**$0**	**$0**
6											
7	**Construction**										
8	Madera Subbasin	$318,897	$269,565	$0	$0	$0	$2,549,048	$19,055,278	$30,227,259	$2,434,813	$0
9	Chowchilla Subbasin	$328,766	$277,907	$8,359,156	$7,066,027	$0	$2,306,373	$13,961,071	$3,044,189	$0	$0
10	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Construction**	**$647,663**	**$547,472**	**$8,359,156**	**$7,066,027**	**$0**	**$4,855,421**	**$33,016,349**	**$33,271,447**	**$2,434,813**	**$0**
12											
13	**Combined Costs**										
14	Madera Subbasin	$437,235	$269,565	$0	$0	$2,544,853	$11,573,010	$30,821,564	$31,808,902	$2,434,813	$0
15	Chowchilla Subbasin	$511,912	$4,857,742	$10,664,138	$7,066,027	$2,343,414	$7,872,090	$14,970,307	$3,044,189	$0	$0
16	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	**Total - Combined Costs**	**$949,147**	**$5,127,307**	**$10,664,138**	**$7,066,027**	**$4,888,268**	**$19,445,100**	**$45,791,871**	**$34,853,091**	**$2,434,813**	**$0**

Capital Financing Plan

Table 3-8 shows the capital financing plan for the recharge facilities, by subbasin, based on the capital project costs (**Table 3-7**). Project 1 for both the Madera and Chowchilla subbasins is expected to be cash-funded from GSP rates (Lines 2 and 8). It is recommended that the County GSAs debt finance Recharge Projects 2 through 5 in both subbasins. The Recharge program involves significant short-term capital costs for long-term benefits to the County GSAs and groundwater users for generations to come; debt financing recharge capital costs reduces large upfront payments while reducing and leveling annual cash needs. Planning and design costs for Projects 2 through 5 (Lines 3 and 9) are assumed to be pre-funded with cash reserves and then reimbursed with debt proceeds just prior to construction commencement. Construction costs for Projects 2 through 5 (Lines 4 and 10) will be funded using proposed debt proceeds.

Table 3-9 shows the proposed debt financing projections for the Recharge program. These projections assume that the County GSAs will issue debt in three separate years: FYE 2025 (for Chowchilla subbasin only), FYE 2028 (for both subbasins), and FYE 2030 (for both subbasins). These years were selected to bundle borrowings based on the timing of projects and the County's ability to utilize proceeds within a three year period. The proposed debt proceeds (Lines 1-5) include the following costs for each subbasin:

- » Chowchilla subbasin Projects 2 and 3, FYE 2025 issuance: Design costs (FYE 2024 and 2025) and construction costs (FYE 2025 and 2026)
- » Madera subbasin Projects 2 and 3, FYE 2028 issuance: Design costs (FYE 2027 and 2028) and construction costs (FYE 2028 and 2029)
- » Chowchilla subbasin Projects 4 and 5, FYE 2028 issuance: Design costs (FYE 2027 and 2028) and construction costs (FYE 2028 and 2029)
- » Madera subbasin, Projects 4 and 5, FYE 2030 issuance: Design costs (FYE 2029 and 2030) and construction costs (FYE 2030 and 2031)
- » Chowchilla subbasin, Project 5, FYE 2030 issuance: Design costs (FYE 2029) and construction costs (FYE 2030)

The proposed debt issuance amounts (Lines 7-11) are equal to the proposed debt proceeds (Lines 1-5) plus capitalized issuance costs and Debt Service Reserve Fund deposits (**Table 2-4**, Lines 4-5). The proposed debt service (Lines 13-17) is calculated using the assumed interest rate and debt terms (**Table 2-4**, Lines 2-3) applied to the proposed debt issuance amounts.

Table 3-10 summarizes the Recharge capital costs by subbasin, including rate funded capital project costs (**Table 3-8**, Lines 2 and 8) and debt service (**Table 3-9**, Lines 13-17).

Table 3-8: Recharge Capital Financing Plan

Line	A Recharge Capital Financing Plan	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Madera Subbasin**										
2	Rate Funded	$437,235	$269,565	$0	$0	$0	$0	$0	$0	$0	$0
3	Design Costs for Reimbursement	$0	$0	$0	$0	$2,544,853	$9,023,963	$11,766,286	$1,581,643	$0	$0
4	Construction Costs Debt Funded	$0	$0	$0	$0	$0	$2,549,048	$19,055,278	$30,227,259	$2,434,813	$0
5	**Total - Madera Subbasin**	**$437,235**	**$269,565**	**$0**	**$0**	**$2,544,853**	**$11,573,010**	**$30,821,564**	**$31,808,902**	**$2,434,813**	**$0**
6											
7	**Chowchilla Subbasin**										
8	Rate Funded	$511,912	$277,907	$0	$0	$0	$0	$0	$0	$0	$0
9	Design Costs for Reimbursement	$0	$4,579,835	$2,304,983	$0	$2,343,414	$5,565,716	$1,009,236	$0	$0	$0
10	Construction Costs Debt Funded	$0	$0	$8,359,156	$7,066,027	$0	$2,306,373	$13,961,071	$3,044,189	$0	$0
11	**Total - Chowchilla Subbasin**	**$511,912**	**$4,857,742**	**$10,664,138**	**$7,066,027**	**$2,343,414**	**$7,872,090**	**$14,970,307**	**$3,044,189**	**$0**	**$0**

Table 3-9: Recharge Debt Funding Projections

Line	A Recharge Debt Funding	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Debt Proceeds**										
2	Madera Subbasin	$0	$0	$0	$0	$0	$33,173,142	$0	$46,010,001	$0	$0
3	Chowchilla Subbasin	$0	$0	$22,310,000	$0	$0	$24,176,575	$0	$4,053,425	$0	$0
4	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Debt Proceeds**	**$0**	**$0**	**$22,310,000**	**$0**	**$0**	**$57,349,717**	**$0**	**$50,063,426**	**$0**	**$0**
6											
7	**Debt Issuance**										
8	Madera Subbasin	$0	$0	$0	$0	$0	$36,059,779	$0	$50,013,667	$0	$0
9	Chowchilla Subbasin	$0	$0	$24,251,356	$0	$0	$26,280,355	$0	$4,406,143	$0	$0
10	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Debt Issuance**	**$0**	**$0**	**$24,251,356**	**$0**	**$0**	**$62,340,134**	**$0**	**$54,419,810**	**$0**	**$0**
12											
13	**Debt Service**										
14	Madera Subbasin	$0	$0	$0	$0	$0	$2,345,740	$2,345,740	$5,599,201	$5,599,201	$5,599,201
15	Chowchilla Subbasin	$0	$0	$1,577,585	$1,577,585	$1,577,585	$3,287,160	$3,287,160	$3,573,786	$3,573,786	$3,573,786
16	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	**Total - Debt Service**	**$0**	**$0**	**$1,577,585**	**$1,577,585**	**$1,577,585**	**$5,632,901**	**$5,632,901**	**$9,172,987**	**$9,172,987**	**$9,172,987**

Table 3-10: Recharge Financed Capital (Cash Needs) by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	Recharge Capital Cash Needs	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Rate Funded**										
2	Madera Subbasin	$437,235	$269,565	$0	$0	$0	$0	$0	$0	$0	$0
3	Chowchilla Subbasin	$511,912	$277,907	$0	$0	$0	$0	$0	$0	$0	$0
4	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Rate Funded**	**$949,147**	**$547,472**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
6											
7	**Debt Service**										
8	Madera Subbasin	$0	$0	$0	$0	$0	$2,345,740	$2,345,740	$5,599,201	$5,599,201	$5,599,201
9	Chowchilla Subbasin	$0	$0	$1,577,585	$1,577,585	$1,577,585	$3,287,160	$3,287,160	$3,573,786	$3,573,786	$3,573,786
10	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Debt Service**	**$0**	**$0**	**$1,577,585**	**$1,577,585**	**$1,577,585**	**$5,632,901**	**$5,632,901**	**$9,172,987**	**$9,172,987**	**$9,172,987**
12											
13	**Recharge Capital Costs**										
14	Madera Subbasin	$437,235	$269,565	$0	$0	$0	$2,345,740	$2,345,740	$5,599,201	$5,599,201	$5,599,201
15	Chowchilla Subbasin	$511,912	$277,907	$1,577,585	$1,577,585	$1,577,585	$3,287,160	$3,287,160	$3,573,786	$3,573,786	$3,573,786
16	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	**Total - Recharge Capital Costs**	**$949,147**	**$547,472**	**$1,577,585**	**$1,577,585**	**$1,577,585**	**$5,632,901**	**$5,632,901**	**$9,172,987**	**$9,172,987**	**$9,172,987**

Operating Costs

Table 3-11 shows the operating costs associated with each recharge project in each subbasin, estimated by DE. The project-specific operating costs begin during the final year of construction for each respective project and are escalated each year using the General cost escalation factor (**Table 2-3**, Line 4).

Table 3-12 summarizes the operating costs for the Recharge program by subbasin. The project operating costs (**Table 3-11**) are consolidated by subbasin. DE estimated additional water supply costs for each subbasin (Lines 7-11), which are inflated in each year based on the General cost escalation factor (**Table 2-3**, Line 4). County GSAs staff provided additional staffing costs required to administer the Recharge program, which includes costs for two additional full-time employees (FTEs) that are inflated based on the Salary cost escalation factor (**Table 2-3**, Line 2). The staffing costs are allocated to the subbasins based on the proportion of project and water supply operating costs between the subbasins. FYE 2023 staffing costs are allocated between the Madera and Chowchilla subbasins using the proportion of costs in FYE 2024, in lieu of project and water supply operating costs in FYE 2023.

Table 3-11: Recharge Operating Costs by Project

	A	B	C	D	E	F	G	H	I	J	K
Line	Recharge Operating Costs by Project	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Madera Subbasin**										
2	Project 1	$0	$43,300	$44,599	$45,937	$47,315	$48,735	$50,197	$51,702	$53,254	$54,851
3	Project 2	$0	$0	$0	$0	$0	$0	$187,500	$193,125	$198,919	$204,886
4	Project 3	$0	$0	$0	$0	$0	$0	$0	$175,100	$180,353	$185,764
5	Project 4	$0	$0	$0	$0	$0	$0	$0	$0	$159,600	$164,388
6	Project 5	$0	$0	$0	$0	$0	$0	$0	$0	$170,900	$176,027
7	**Total - Madera Subbasin**	**$0**	**$43,300**	**$44,599**	**$45,937**	**$47,315**	**$48,735**	**$237,697**	**$419,927**	**$763,025**	**$785,916**
8											
9	**Chowchilla Subbasin**										
10	Project 1	$0	$35,900	$36,977	$38,086	$39,229	$40,406	$41,618	$42,866	$44,152	$45,477
11	Project 2	$0	$0	$0	$93,100	$95,893	$98,770	$101,733	$104,785	$107,928	$111,166
12	Project 3	$0	$0	$0	$95,100	$97,953	$100,892	$103,918	$107,036	$110,247	$113,554
13	Project 4	$0	$0	$0	$0	$0	$0	$147,200	$151,616	$156,164	$160,849
14	Project 5	$0	$0	$0	$0	$0	$0	$0	$64,000	$65,920	$67,898
15	**Total - Chowchilla Subbasin**	**$0**	**$35,900**	**$36,977**	**$226,286**	**$233,075**	**$240,067**	**$394,469**	**$470,303**	**$484,412**	**$498,945**

Table 3-12: Recharge Operating Costs by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	Recharge Operating Costs	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Project Operating Costs**										
2	Madera Subbasin	$0	$43,300	$44,599	$45,937	$47,315	$48,735	$237,697	$419,927	$763,025	$785,916
3	Chowchilla Subbasin	$0	$35,900	$36,977	$226,286	$233,075	$240,067	$394,469	$470,303	$484,412	$498,945
4	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Project Operating Costs**	**$0**	**$79,200**	**$81,576**	**$272,223**	**$280,390**	**$288,802**	**$632,166**	**$890,231**	**$1,247,438**	**$1,284,861**
6											
7	**Water Supply Costs**										
8	Madera Subbasin	$0	$768,300	$791,349	$815,089	$839,542	$864,728	$890,670	$917,390	$944,912	$973,259
9	Chowchilla Subbasin	$0	$0	$0	$0	$0	$0	$0	$645,000	$664,350	$684,281
10	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Water Supply Costs**	**$0**	**$768,300**	**$791,349**	**$815,089**	**$839,542**	**$864,728**	**$890,670**	**$1,562,390**	**$1,609,262**	**$1,657,540**
12											
13	**Staffing Costs**										
14	Madera Subbasin	$123,011	$129,162	$135,620	$43,953	$46,151	$48,458	$113,373	$149,341	$203,337	$213,504
15	Chowchilla Subbasin	$101,989	$107,088	$112,442	$216,513	$227,338	$238,705	$188,148	$167,257	$129,090	$135,545
16	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	**Total - Staffing Costs**	**$225,000**	**$236,250**	**$248,063**	**$260,466**	**$273,489**	**$287,163**	**$301,522**	**$316,598**	**$332,427**	**$349,049**
18											
19	**Combined Operating Costs**										
20	Madera Subbasin	$123,011	$940,762	$971,568	$904,979	$933,008	$961,921	$1,241,740	$1,486,659	$1,911,275	$1,972,680
21	Chowchilla Subbasin	$101,989	$142,988	$149,419	$442,799	$460,413	$478,772	$582,618	$1,282,560	$1,277,853	$1,318,770
22	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
23	**Total - Combined Operating Costs**	**$225,000**	**$1,083,750**	**$1,120,988**	**$1,347,778**	**$1,393,421**	**$1,440,693**	**$1,824,358**	**$2,769,219**	**$3,189,127**	**$3,291,450**

Each of the Recharge projects in the Madera and Chowchilla subbasins is expected to yield a different volume of water during wet years when flood flows will be available. **Table 3-13** shows the predicted additional water from each recharge project in both subbasins. The predicted additional water in AF (Column C) is reduced by the landowners' share of water based on the proportion of landowner contributions (**Table 3-2**, Column E) to result in the net additional water in AF to the County GSAs (Column E). The additional water from each recharge project represents the estimated volume of water recharged in each year that flood flows are available.

Table 3-13: Estimated Additional Water from Recharge Projects

Line	A Additional Water from Recharge	B Project Completed	C Additional Water (AF)	D Less Landowners' Share (AF)	E Net Additional Water (AF)
1	**Madera Subbasin**				
2	Project 1	FYE 2024	11,150	(2,827)	8,323
3	Project 2	FYE 2029	28,129	(2,267)	25,862
4	Project 3	FYE 2030	26,145	(2,105)	24,040
5	Project 4	FYE 2031	24,162	(2,018)	22,144
6	Project 5	FYE 2031	25,965	(2,145)	23,820
7	**Total - Madera Subbasin**		**115,551**	**(11,361)**	**104,190**
8					
9	**Chowchilla Subbasin**				
10	Project 1	FYE 2024	8,294	(2,299)	5,995
11	Project 2	FYE 2026	14,244	(593)	13,651
12	Project 3	FYE 2026	16,048	(410)	15,638
13	Project 4	FYE 2029	21,998	(345)	21,653
14	Project 5	FYE 2030	19,449	(818)	18,631
15	**Total - Chowchilla Subbasin**		**80,033**	**(4,466)**	**75,567**

Table 3-14 shows the additional, new water generated from each recharge project for both subbasins. Based on hydrologic estimates provided by County GSAs staff, there is a 35% chance that any given year is a wet year, providing available flood flows for recharge. This means that on average a recharge year will occur approximately once every three years. The first wet year is projected for FYE 2024 (Column C). The additional water generated by each project is based on the amount of net additional water in AF (**Table 3-13**, Column E). If a wet year coincides with a project completion year (like Project 1), then the amount of water generated by that project in the first year will be prorated based on the estimated month of project completion. Projects 4 and 5 in the Madera subbasin are completed in FYE 2031 but do not generate additional water until the next wet year in FYE 2033, which is outside of the planning horizon shown in this study.

Table 3-15 shows the predicted additional water from recharge projects by subbasin (**Table 3-14**, Lines 9 and 17) and the annualized volume of water available from recharge projects each year.

Table 3-14: Predicted Additional Water from Recharge Projects by Year (Gross Volume)

Line	A Additional Water from Recharge	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	Year Type	Dry Year	Wet Year	Dry Year	Dry Year	Wet Year	Dry Year	Dry Year	Wet Year	Dry Year	Dry Year
2											
3	**Madera Subbasin**										
4	Project 1	0	4,855	0	0	8,323	0	0	8,323	0	0
5	Project 2	0	0	0	0	0	0	0	25,862	0	0
6	Project 3	0	0	0	0	0	0	0	14,023	0	0
7	Project 4	0	0	0	0	0	0	0	0	0	0
8	Project 5	0	0	0	0	0	0	0	0	0	0
9	**Total - Madera Subbasin**	**0**	**4,855**	**0**	**0**	**8,323**	**0**	**0**	**48,209**	**0**	**0**
10											
11	**Chowchilla Subbasin**										
12	Project 1	0	3,497	0	0	5,995	0	0	5,995	0	0
13	Project 2	0	0	0	0	13,651	0	0	13,651	0	0
14	Project 3	0	0	0	0	15,638	0	0	15,638	0	0
15	Project 4	0	0	0	0	0	0	0	21,653	0	0
16	Project 5	0	0	0	0	0	0	0	10,868	0	0
17	**Total - Chowchilla Subbasin**	**0**	**3,497**	**0**	**0**	**35,284**	**0**	**0**	**67,805**	**0**	**0**

Table 3-15: Predicted Additional Water from Recharge Projects by Year (Annualized Volume)

Line	A Additional Water from Recharge	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Predicted by Subbasin**										
2	Madera Subbasin	0	4,855	0	0	8,323	0	0	48,209	0	0
3	Chowchilla Subbasin	0	3,497	0	0	35,284	0	0	67,805	0	0
4	Delta-Mendota Subbasin	0	0	0	0	0	0	0	0	0	0
5	**Total - Projected by Subbasin**	**0**	**8,352**	**0**	**0**	**43,607**	**0**	**0**	**116,013**	**0**	**0**
6											
7	**Average by Subbasin**										
8	Madera Subbasin	0	1,618	1,618	1,618	2,774	2,774	2,774	16,070	16,070	16,070
9	Chowchilla Subbasin	0	1,166	1,166	1,166	11,761	11,761	11,761	22,602	22,602	22,602
10	Delta-Mendota Subbasin	0	0	0	0	0	0	0	0	0	0
11	**Total - Average by Subbasin**	**0**	**2,784**	**2,784**	**2,784**	**14,536**	**14,536**	**14,536**	**38,671**	**38,671**	**38,671**

Figure 3-1 and **Figure 3-2** show the predicted annualized volume of water from recharge projects for the Madera and Chowchilla subbasins, respectively.

Figure 3-1: Predicted Additional Water from Recharge Projects for Madera Subbasin

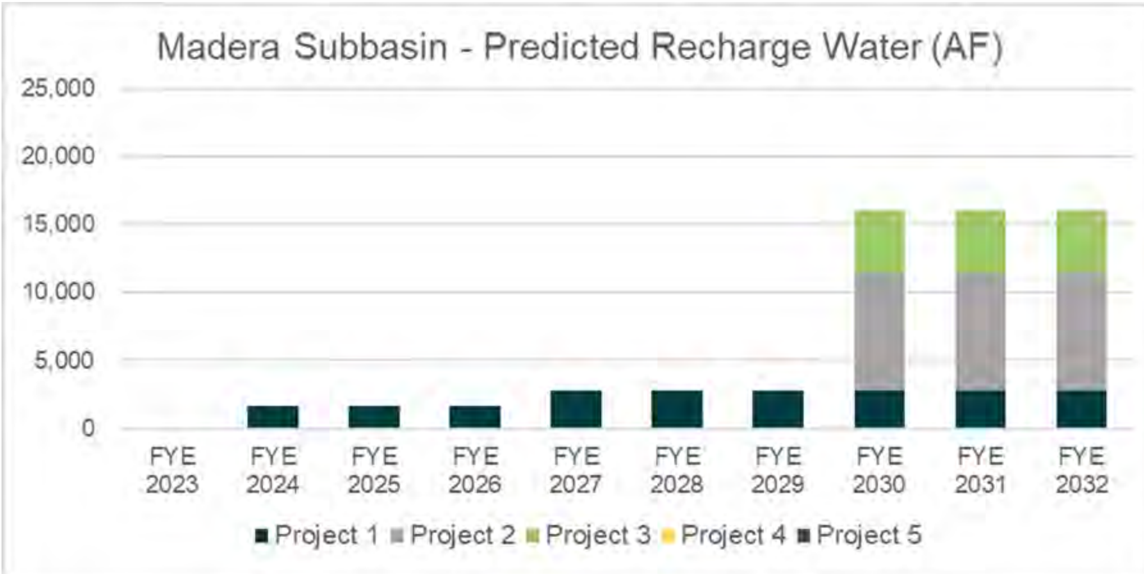
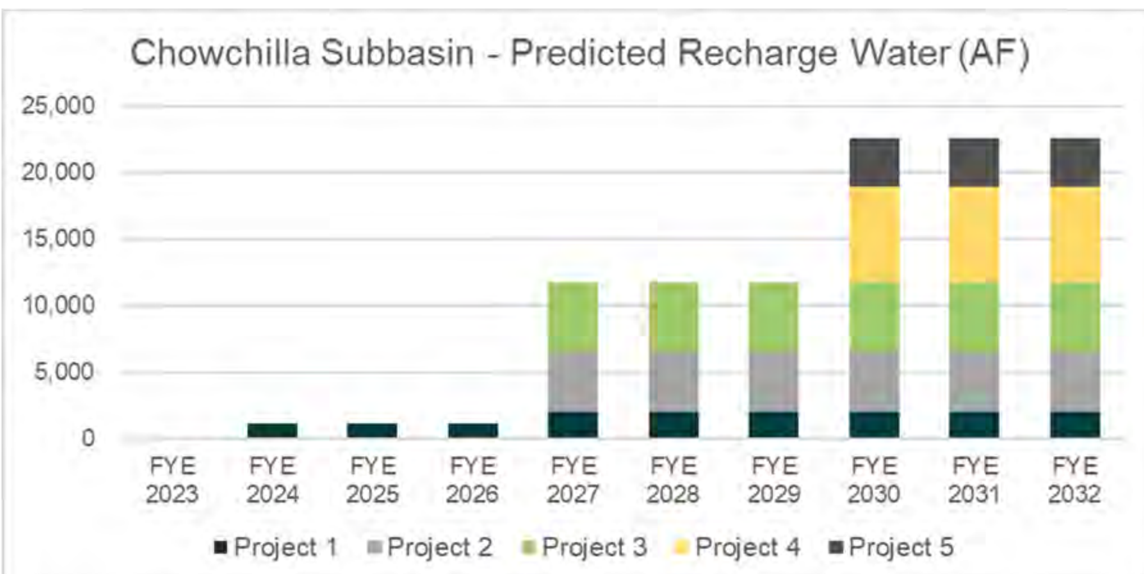


Figure 3-2: Predicted Additional Water from Recharge Projects for Chowchilla Subbasin



Program Summary

Table 3-16 summarizes the operating and capital costs of the recharge program by subbasin. Operating costs (Lines 1-5) include project-specific operating costs, water supply costs, and staffing costs (**Table 3-12**). Capital costs (Lines 7-11) include rate funded project costs and debt service costs (**Table 3-10**). The sum of the operating and capital components within the table represent the annual cash needs of the County GSAs for recharge.

Table 3-16: Recharge Costs by Subbasin

Line	A Recharge Costs	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Operating Costs**										
2	Madera Subbasin	$123,011	$940,762	$971,568	$904,979	$933,008	$961,921	$1,241,740	$1,486,659	$1,911,275	$1,972,680
3	Chowchilla Subbasin	$101,989	$142,988	$149,419	$442,799	$460,413	$478,772	$582,618	$1,282,560	$1,277,853	$1,318,770
4	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Operating Costs**	**$225,000**	**$1,083,750**	**$1,120,988**	**$1,347,778**	**$1,393,421**	**$1,440,693**	**$1,824,358**	**$2,769,219**	**$3,189,127**	**$3,291,450**
6											
7	**Capital Costs**										
8	Madera Subbasin	$437,235	$269,565	$0	$0	$0	$2,345,740	$2,345,740	$5,599,201	$5,599,201	$5,599,201
9	Chowchilla Subbasin	$511,912	$277,907	$1,577,585	$1,577,585	$1,577,585	$3,287,160	$3,287,160	$3,573,786	$3,573,786	$3,573,786
10	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Capital Costs**	**$949,147**	**$547,472**	**$1,577,585**	**$1,577,585**	**$1,577,585**	**$5,632,901**	**$5,632,901**	**$9,172,987**	**$9,172,987**	**$9,172,987**

4. Sites Reservoir

This section of the report documents information and cost estimates related to new water supplies from participation in Sites. New water and costs of Sites participation is apportioned to the Madera and Chowchilla subbasins. The program cost estimates and financing scenarios in this section were developed and provided by the internal financing team at the Sites Project Authority. Numbers shown in the tables of this section are rounded up to the nearest integer. Therefore, hand calculations based on the displayed numbers, such as summing or multiplying, may not equal the exact results shown.

Program Background

Located in the Western Sacramento Valley, the Sites Reservoir will capture and store winter stream flows of the Sacramento River. These flows will be captured below existing storage facilities and are not reliant on snowmelt runoff, like most existing storage. This makes the project more resilient in the face of future climate. Sites will provide off-stream storage and water supply for use in dry years. Sites expects to begin construction in FYE 2025 and to complete construction sometime in FYE 2030. On this timeline, the reservoir will begin filling in FYE 2031, with the first water deliveries for members available starting in FYE 2033. Sites is currently in permitting and has recently submitted a Revised Environmental Impact Report/Supplemental Draft Environmental Impact Statement. Most recently, the United States Environmental Protection Agency (US EPA) has formally invited the Sites to apply for a $2.2 billion low-interest loan through the Water Infrastructure Finance and Innovation Act (WIFIA).

The County GSAs has submitted a letter of intent to participate in Sites reservoir at an annual yield of 10,000 AF per year (AFY). The volumes and costs would then be apportioned between the Madera and Chowchilla subbasins. The County GSAs will have the option of conveying water from Sites to recharge facilities using existing infrastructure or exchanging water received from the Sites program with another agency.

Capital Program Costs

Table 4-1 shows the County GSAs' cost allocation for Sites. The County GSAs are allotted 10,000 AF of annual water yield once deliveries begin. 10,000 AF is equal to approximately 6%[6] of total Sites water yield, after accounting for the share of yield allocated to the State and Federal governments as participants in the project. Therefore, the County GSAs will be responsible for 6% of Sites costs, which include passed-through debt service on design and construction capital as well as future O&M costs once the reservoir has entered operations.

Table 4-1: County GSAs Sites Allocation

	A	B	C
Line	Sites Costs Allocation	AF of Water	% of Costs
1	Total Annual Yield - Local Participants	167,620	100%
2	County GSAs Participation (Annual Yield)	10,000	6%

Table 4-2 shows the cost allocation for the Sites program between the subbasins. The Madera and Chowchilla subbasins are expected to participate in the program; the Delta-Mendota subbasin will not participate. The allocation between the Madera and Chowchilla subbasins is based on the proportion of enrolled acreage within each subbasin (
Table 2-2, Lines 7-11).

[6] Exact estimated allocation is 5.97%.

Table 4-2: Sites Water Allocation by Subbasin

	A	B	C
Line	Sites Water Allocation	Enrolled Acreage	% of Water
1	**Allocation by Subbasin**		
2	Madera Subbasin	81,473	69%
3	Chowchilla Subbasin	35,872	31%
4	Delta-Mendota Subbasin	0	0%
5	**Total - Allocation by Subbasin**	**117,345**	**100%**

Table 4-3 shows the amount of Sites water in AF allocated to each subbasin. The County GSAs portion is reduced by the expected water loss, which includes water lost through evaporation in conveyance and delta carriage requirements. The net amount of Sites water available to the County GSAs (Line 3) is allocated between the subbasins based on the proportion of enrolled acreage for the participating subbasins (**Table 4-2**, Column C).

Table 4-3: Sites Water by Subbasin

	A	B
Line	Sites Water Allocation	AF of Water
1	County GSAs Portion	10,000
2	Expected Water Loss	(3,377)
3	County GSAs Supply with Loss	6,623
4		
5	**Sites Water by Subbasin**	
6	Madera Subbasin	4,598
7	Chowchilla Subbasin	2,025
8	Delta-Mendota Subbasin	0
9	**Total - Sites Water by Subbasin**	**6,623**

Sites staff provided several financing cases, ranging from worst case (no federally subsidized loans and higher long-term interest rates) to best case (very large federally subsidized loans and lower interest rates). Raftelis worked with County GSAs staff and KNN to determine the most appropriate case for use in the rate study. Between Cases 1-5 (worst case to best case) provided at the time of the study[7], Raftelis recommends using Case 2, which uses interest rates based on historical averages and assumes a moderate amount of federally subsidized loans.

Table 4-4 shows the Sites financing assumptions, by financing instrument, provided by Sites staff, for Case 2. The available financing instruments for Sites include lower cost, federally subsidized loans like WIFIA, United States Department of Agriculture (USDA) loans, and higher cost revenue bonds. **Table 4-5** shows the proposed debt issuance by type for Sites Reservoir construction. The estimates shown are for the entire Sites project funded by local participants, not the portion that is ultimately allocated to the County GSAs.

[7] On March 17, 2022 Sites was formally invited to apply for a $2.2 billion WIFIA loan. Subsequently Sites has completed preliminary internal modeling for a financing Case 6. Based on future direction from Sites and the results of the WIFIA process, future County GSAs financial updates may recommend modifying the Sites financing assumptions.

Table 4-4: Sites Debt Financing Assumptions by Debt Type

Line	A Sites Financing Assumptions	B Term (# of Years)	C Interest Rate
1	WIFIA Loan	35	3.500%
2	USDA Loan	40	3.875%
3	Revenue Bonds	40	5.000%

Table 4-5: Sites Debt Financing Plan by Debt Type

Line	A Sites Debt Financing	B Total Debt Issuance	C Principal Start Year
1	**Proposed Debt (All Sites)**		
2	WIFIA Loan	$600,000,000	FYE 2032
3	USDA Loan	$439,559,000	FYE 2030
4	Revenue Bonds	$2,237,000,000	varies
5	**Total - Proposed Debt (All Sites)**	**$3,276,559,000**	

Table 4-6 shows the projected drawdown of proceeds from each debt issuance for each year, which equals the total debt issuance shown in the debt financing plan (**Table 4-5**). The projected drawdown schedule was provided by Sites staff and is current as of the fall of 2021. The WIFIA loan will have three separate drawdowns starting in FYE 2026 and ending in FYE 2028. The USDA loan will be utilized in FYE 2030. Revenue bonds will be issued annually from FYE 2027 through FYE 2032.

Table 4-7 shows the calculated debt service associated with each debt type based on the debt drawdown projections (**Table 4-6**) for the entire Sites program. WIFIA loan payments are for interest expenses only until the principal start year of FYE 2032 (**Table 4-5**, Column C, Line 2) when construction for the Sites Reservoir is completed. The WIFIA interest expense increases each year based on the drawdown schedule. Starting in FYE 2032, the WIFIA loan of $600 million is consolidated and full debt service payments will begin, which include principal and interest payments based on the WIFIA loan debt financing assumptions (**Table 4-4**, Line 1). Based on direction from Sites staff, WIFIA loan interest payments are not capitalized but paid throughout the construction period. USDA loan repayments begin in the issuance year, FYE 2030, and are based on the USDA loan debt financing assumptions (**Table 4-4**, Line 2). Debt service payments for revenue bonds begin during each issuance year from FYE 2027 to FYE 2032 and are based on the revenue bond debt financing assumptions (**Table 4-4**, Line 3). The County GSAs portion of debt service payments is equal to its water supply allocation (**Table 4-1**, Column C, Line 2) or approximately 6% of the total.

Table 4-8 shows the capital costs for Sites participation by subbasin. Capital costs for Sites include the following three components:

1. A participant buy-in, which is a one-time cost paid by new participants to put them on par with existing participants for project costs incurred to date
2. Three years of cash funded capital to pay for additional planning and design costs prior to construction commencement (also known as cash calls)
3. The County GSAs' portion of Sites future debt service payments

Based on cost estimates provided by Sites staff, the participant buy-in is $208.50 per AF of Sites water allocation and the cash calls are $100, $140, and $160 per AF of Sites water for the first three years. The capital costs are allocated to each subbasin (Lines 7-11) based on each participating subbasin's proportion of enrolled acreage (**Table 4-2**, Column C).

Table 4-6: Sites Debt Drawdown

	A	B	C	D	E	F	G	H	I	J	K
Line	Sites Debt Drawdown	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Proposed Debt (All Sites)**										
2	WIFIA Loan	$0	$0	$0	$77,626,941	$313,251,811	$209,121,248	$0	$0	$0	$0
3	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$439,559,000	$0	$0
4	Revenue Bonds	$0	$0	$0	$0	$378,000,000	$710,000,000	$754,000,000	$75,000,000	$268,000,000	$52,000,000
5	**Total - Proposed Debt (All Sites)**	**$0**	**$0**	**$0**	**$77,626,941**	**$691,251,811**	**$919,121,248**	**$754,000,000**	**$514,559,000**	**$268,000,000**	**$52,000,000**

Table 4-7: Sites Debt Service

	A	B	C	D	E	F	G	H	I	J	K
Line	Sites Debt Service	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Proposed Debt (All Sites)**										
2	WIFIA Loan	$0	$0	$0	$2,716,943	$13,680,756	$21,000,000	$21,000,000	$21,000,000	$21,000,000	$29,999,008
3	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$21,796,655	$21,796,655	$21,796,655
4	Revenue Bonds	$0	$0	$0	$0	$22,029,145	$63,406,639	$107,348,373	$111,719,235	$127,337,782	$130,368,247
5	**Total - Proposed Debt (All Sites)**	**$0**	**$0**	**$0**	**$2,716,943**	**$35,709,901**	**$84,406,639**	**$128,348,373**	**$154,515,890**	**$170,134,437**	**$182,163,910**
6											
7	**Proposed Debt (County GSA)**	**$0**	**$0**	**$0**	**$163,017**	**$2,142,594**	**$5,064,398**	**$7,700,902**	**$9,270,953**	**$10,208,066**	**$10,929,835**

Table 4-8: Sites Capital Costs by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	Sites Capital Costs	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Combined Costs**										
2	Participant Buy-In	$2,085,000	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Cash Call (Design/Planning)	$1,000,000	$1,400,000	$1,600,000	$0	$0	$0	$0	$0	$0	$0
4	Capital (Debt Service)	$0	$0	$0	$163,017	$2,142,594	$5,064,398	$7,700,902	$9,270,953	$10,208,066	$10,929,835
5	**Total - Combined Costs**	**$3,085,000**	**$1,400,000**	**$1,600,000**	**$163,017**	**$2,142,594**	**$5,064,398**	**$7,700,902**	**$9,270,953**	**$10,208,066**	**$10,929,835**
6											
7	**Capital Costs by Subbasin**										
8	Madera Subbasin	$2,141,925	$972,024	$1,110,885	$113,183	$1,487,610	$3,516,227	$5,346,760	$6,436,851	$7,087,492	$7,588,618
9	Chowchilla Subbasin	$943,075	$427,976	$489,115	$49,834	$654,984	$1,548,171	$2,354,142	$2,834,102	$3,120,574	$3,341,217
10	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Capital Costs by Subbasin**	**$3,085,000**	**$1,400,000**	**$1,600,000**	**$163,017**	**$2,142,594**	**$5,064,398**	**$7,700,902**	**$9,270,953**	**$10,208,066**	**$10,929,835**

Operating Costs

The operating costs of Sites are anticipated to begin in FYE 2033, which is the first year of water deliveries based on the current construction schedule. The County GSAs are responsible for its proportionate share of fixed and variable costs associated with operating the Sites Reservoir, equal to its percentage allocation of total available Sites water. There are no operating costs for Sites within the ten-year planning horizon shown in this report, which ends in FYE 2032.

Program Summary

Table 4-9 summarizes the costs of the Sites program for each subbasin over the study period. The capital costs (Lines 7-11) include the participant buy-in, cash calls, and allocated debt service costs (**Table 4-8**) for the Madera and Chowchilla subbasins.

Table 4-9: Sites Costs by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	**Sites Costs**	**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**	**FYE 2027**	**FYE 2028**	**FYE 2029**	**FYE 2030**	**FYE 2031**	**FYE 2032**
1	**Operating Costs**										
2	Madera Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	Chowchilla Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Operating Costs**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
6											
7	**Capital Costs**										
8	Madera Subbasin	$2,141,925	$972,024	$1,110,885	$113,183	$1,487,610	$3,516,227	$5,346,760	$6,436,851	$7,087,492	$7,588,618
9	Chowchilla Subbasin	$943,075	$427,976	$489,115	$49,834	$654,984	$1,548,171	$2,354,142	$2,834,102	$3,120,574	$3,341,217
10	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Capital Costs**	**$3,085,000**	**$1,400,000**	**$1,600,000**	**$163,017**	**$2,142,594**	**$5,064,398**	**$7,700,902**	**$9,270,953**	**$10,208,066**	**$10,929,835**

5. Domestic Well Mitigation

This section of the report documents information and cost estimates related to the Domestic Well Mitigation program to replace de-watered groundwater wells within the Madera and Chowchilla subbasins. The program cost estimates were developed and provided by Luhdorff & Scalmanini Consulting Engineers. Domestic well replacement counts are based on estimates at the time of this study. Therefore, the counts between this study and the final technical memorandum (included in the Appendix) may be different; dry well counts for the County GSAs in the Chowchilla subbasin vary by one dry well a year. Numbers shown in the tables of this section are rounded up to the nearest integer. Therefore, hand calculations based on the displayed numbers, such as summing or multiplying, may not equal the exact results shown.

Program Background

The Domestic Wells program involves replacing wells that have run dry (de-watered) due to chronic overdraft within the Madera and Chowchilla subbasins. The program will fund deeper well replacement for homeowners. LSCE conducted a database analysis and modeling exercise to estimate the number of potential dry wells, in each subbasin, over the GSP implementation period. The model utilized existing well datasets including DWR well construction records, County well permits, and assessor parcel data. Next the model applied parameters based on historical hydrology and both average year and dry year starts to the GSP implementation period to estimate the number of dry wells within the set for two different future climate scenarios.

Capital Program Costs

There are several GSAs that manage the Madera and Chowchilla subbasins respectively. For the Domestic Well Mitigation program, the County GSAs is only responsible for its proportionate share of the average volume of groundwater shortage (overdraft) with the remainder the funding responsibility of the other managing GSAs, subject to the subbasin GSPs. **Table 5-1** shows the percentage of dry wells allocated to the County GSAs based on the historical, present, and future overdraft within each subbasin. For example, the County GSAs are responsible for 73% of the dry domestic wells in the Madera subbasin as the County's management acreage is responsible for 73% of the subbasin's total overdraft. LSCE modeled the groundwater conditions and associated overdraft for each subbasin from 1989 to 2040, using historical data and future projections. There is no Domestic Well Mitigation program proposed in the Delta-Mendota subbasin.

Table 5-1: County GSAs Dry Well Allocation

	A	B	C	D
Line	Dry Well Allocation	County GSAs %	Other GSA %	Total
1	Madera Subbasin	73%	27%	100%
2	Chowchilla Subbasin	53%	47%	100%
3	Delta Mendota Subbasin	N/A	N/A	N/A

LSCE provided three scenarios to estimate the number of dry wells within each five-year period starting in 2020 and ending in 2039: Average Year Start to the GSP implementation period, Dry Year Start to the GSP implementation period, and the average of the Average Year and Dry Year Start sequences. The Dry Year Start scenario results in a greater total number of dry wells over the entire GSP implementation period and a greater proportion of dry wells in the first ten years. Based on current conditions and recent hydrology, Raftelis and County GSAs staff utilized the Dry Year Start sequence to estimate dry wells and therefore the timing and magnitude of Domestic Wells program costs. The number of dry wells is spread out evenly over each five-year period, except for the first five-year period from 2020 to

2024, which is spread out over three years from FYE 2023 to FYE 2025, an acknowledgement that there is currently a backlog of de-watered domestic wells.

Table 5-2 shows the estimated dry wells within each subbasin (Lines 1-5) and the proportionate number of dry wells that the County GSAs will replace (Lines 7-11). The number of dry wells within the County GSAs' jurisdiction is based on its proportionate share of the average volume of groundwater shortage within each subbasin (**Table 5-1**, Column B) multiplied by the number of total dry wells in each subbasin.

Table 5-3 shows the estimated capital costs of the Domestic Wells program. The cost to replace a well (Line 1) is based on local estimates of replacement (re-drilling) costs, which is escalated in each year based on the Capital cost escalation factor (**Table 2-3**, Line 3). At the time of estimate, costs ranged between $25,000 and $35,000 to replace a domestic well and the average of the two is utilized as the starting cost in year one. The capital costs by subbasin (Lines 3-7) are calculated by multiplying the number of County GSAs' dry wells in each subbasin (**Table 5-2**, Lines 7-11) by the cost to replace a well in that year (Line 1).

Table 5-2: Estimated Dry Wells for Dry Year Sequence

Line	A Dry Wells (Dry Year Sequence)	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**All Dry Wells**										
2	Madera Subbasin	142	142	142	203	203	203	203	203	27	27
3	Chowchilla Subbasin	33	33	33	14	14	14	14	14	0	0
4	Delta Mendota Subbasin	0	0	0	0	0	0	0	0	0	0
5	**Total - All Dry Wells**	**175**	**175**	**175**	**217**	**217**	**217**	**217**	**217**	**27**	**27**
6											
7	**County GSAs Dry Wells**										
8	Madera Subbasin	104	104	104	149	149	149	149	149	20	20
9	Chowchilla Subbasin	17	17	17	7	7	7	7	7	0	0
10	Delta Mendota Subbasin	0	0	0	0	0	0	0	0	0	0
11	**Total - County GSAs Dry Wells**	**121**	**121**	**121**	**156**	**156**	**156**	**156**	**156**	**20**	**20**

Table 5-3: Domestic Wells Capital Costs by Subbasin

Line	A Domestic Wells Capital Costs	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	Cost to Replace a Well	$30,960	$31,951	$32,973	$34,028	$35,117	$36,241	$37,401	$38,597	$39,833	$41,107
2											
3	**Capital Costs by Subbasin**										
4	Madera Subbasin	$3,229,074	$3,332,405	$3,439,042	$5,071,792	$5,234,089	$5,401,580	$5,574,431	$5,752,813	$782,247	$807,279
5	Chowchilla Subbasin	$532,507	$549,547	$567,132	$250,834	$258,861	$267,145	$275,693	$284,516	$4,195	$4,329
6	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	**Total - Capital Costs by Subbasin**	**$3,761,581**	**$3,881,951**	**$4,006,174**	**$5,322,627**	**$5,492,951**	**$5,668,725**	**$5,850,124**	**$6,037,328**	**$786,441**	**$811,607**

Operating Costs

Table 5-4 shows the operating costs associated with the Domestic Wells program which includes program management costs. The program management costs are estimated based on 10% of the Domestic Wells program capital costs (**Table 5-3**) based on estimates from County GSAs staff. As programmatic details are refined within the County GSAs and between other GSAs and partners, more informed estimates for project management will be possible.

Program Summary

Table 5-5 summarizes the costs of the Domestic Well Mitigation program for all subbasins within the study period. The operating costs include estimated program management costs (**Table 5-4**), and the capital costs include estimated costs to replace dry wells within each subbasin based on the Dry Year sequence (**Table 5-3**).

Table 5-4: Domestic Wells Operating Costs by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	Domestic Wells Operating Costs	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Program Management Costs**										
2	Madera Subbasin	$322,907	$333,240	$343,904	$507,179	$523,409	$540,158	$557,443	$575,281	$78,225	$80,728
3	Chowchilla Subbasin	$53,251	$54,955	$56,713	$25,083	$25,886	$26,714	$27,569	$28,452	$419	$433
4	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Program Management Costs**	**$376,158**	**$388,195**	**$400,617**	**$532,263**	**$549,295**	**$566,873**	**$585,012**	**$603,733**	**$78,644**	**$81,161**

Table 5-5: Domestic Wells Costs by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	Domestic Wells Costs	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Operating Costs**										
2	Madera Subbasin	$322,907	$333,240	$343,904	$507,179	$523,409	$540,158	$557,443	$575,281	$78,225	$80,728
3	Chowchilla Subbasin	$53,251	$54,955	$56,713	$25,083	$25,886	$26,714	$27,569	$28,452	$419	$433
4	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Operating Costs**	**$376,158**	**$388,195**	**$400,617**	**$532,263**	**$549,295**	**$566,873**	**$585,012**	**$603,733**	**$78,644**	**$81,161**
6											
7	**Capital Costs**										
8	Madera Subbasin	$3,229,074	$3,332,405	$3,439,042	$5,071,792	$5,234,089	$5,401,580	$5,574,431	$5,752,813	$782,247	$807,279
9	Chowchilla Subbasin	$532,507	$549,547	$567,132	$250,834	$258,861	$267,145	$275,693	$284,516	$4,195	$4,329
10	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Capital Costs**	**$3,761,581**	**$3,881,951**	**$4,006,174**	**$5,322,627**	**$5,492,951**	**$5,668,725**	**$5,850,124**	**$6,037,328**	**$786,441**	**$811,607**

6. Sustainable Agricultural Land Conservation Program

This section of the report documents information and cost estimates related to the SALC program. SALC will provide direct incentive payments to parcel owners with Enrolled Acres in a farm unit within the County GSAs management areas to forgo irrigation and repurpose lands to other non-irrigated uses. The program's estimated enrollment and costs were developed and provided by ERA Economics. Numbers shown in the tables of this section are rounded up to the nearest integer. Therefore, hand calculations based on the displayed numbers, such as summing or multiplying, may not equal the exact results shown.

Program Background

The SALC program would repurpose current and formerly irrigated lands by providing incentive payments to forgo irrigation and repurpose lands to other, non-irrigated uses. Land repurposing is a strategy to comply with SGMA requirements that is being considered widely throughout the San Joaquin Valley. The SALC program as designed is voluntary. Parcel owners could elect to enroll lands in the program for a one year (annual) period. Parcel owners would re-enroll each year to continue receiving the incentive payments. When an acre is enrolled in SALC, the water allocation for that acre is removed from the farm unit (and therefore the total farm unit water allocation). At the direction of the Board of Directors, the SALC program is initially designed to ramp up over time to achieve approximately 50% of the GSPs' planned demand management target specified in the GSPs, at full GSP implementation (2040).

Capital Program Costs

Table 6-1 shows the capital program costs of the SALC program, which was provided by ERA Economics. The capital program costs include all incentive payments to lands that choose to enroll in SALC based on the estimated program enrollment in each year. These are referred to as capital costs as the County GSAs are "purchasing" an asset in the water allocation tied to each acre of land enrolled in the program. Land within the County GSAs' that has never been irrigated is not eligible to receive incentive payments in the SALC program; only acres that have opted into a farm unit are eligible. The incentive payments are specific to each subbasin, and year, based on unique subbasin characteristics.

Operating Costs

Table 6-2 shows the operating costs of the SALC program which are program management costs. The total costs of program management (Line 5) were provided by County GSAs staff and represent two additional FTEs who will support the SALC program directly. The program management costs are allocated between the three subbasins based on the proportion of capital program costs (i.e., SALC enrollment and payments) associated with each subbasin.

Table 6-1: SALC Capital Costs by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	SALC Capital Costs	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Payments for Irrigated Acres**										
2	Madera Subbasin	$5,093,252	$5,977,600	$6,922,016	$7,891,378	$8,846,763	$9,827,295	$10,070,531	$10,835,598	$11,676,918	$12,558,207
3	Chowchilla Subbasin	$1,328,233	$1,515,260	$1,687,198	$1,891,726	$2,218,831	$2,619,571	$2,979,758	$3,348,975	$3,681,419	$4,013,877
4	Delta Mendota Subbasin	$106,785	$152,585	$180,475	$227,871	$263,746	$322,690	$322,690	$358,251	$365,141	$398,276
5	**Total - Payments for Irrigated Acres**	**$6,528,270**	**$7,645,446**	**$8,789,689**	**$10,010,975**	**$11,329,340**	**$12,769,557**	**$13,372,979**	**$14,542,824**	**$15,723,478**	**$16,970,360**

Table 6-2: SALC Operating Costs by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	SALC Operating Costs	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Program Management Costs**										
2	Madera Subbasin	$196,294	$206,549	$218,448	$229,591	$238,807	$247,124	$253,905	$263,779	$276,061	$288,836
3	Chowchilla Subbasin	$51,190	$52,358	$53,245	$55,038	$59,895	$65,874	$75,128	$81,527	$87,035	$92,318
4	Delta Mendota Subbasin	$4,116	$5,272	$5,696	$6,630	$7,119	$8,115	$8,136	$8,721	$8,633	$9,160
5	**Total - Program Management Costs**	**$251,600**	**$264,180**	**$277,389**	**$291,258**	**$305,821**	**$321,112**	**$337,168**	**$354,026**	**$371,728**	**$390,314**

SALC Enrolled Acreage and Groundwater Demand Reduction

Table 6-3 shows the enrolled acreage and estimated reduction in groundwater demand. The number of acres enrolled in SALC gradually increases over the GSP implementation period to achieve approximately 50% of the demand management targets in each subbasin by 2040. Lands that enroll in SALC would forgo irrigation, which would reduce groundwater demand. As a result, the volume of water (groundwater demand reduction) increases over time as well. However, Transition Water is decreasing over time, and as such the number of acres enrolled in the SALC program must increase at a faster rate to achieve additional reduction in groundwater demand.

Program Summary

Table 6-4 summarizes the operating and capital costs of the SALC program. Operating costs include program management costs (**Table 6-2**) and capital costs include incentive payments for enrolled lands (**Table 6-1**).

Table 6-3: SALC Acres and Groundwater Demand Reduction (AF)

Line	A SALC Enrolled	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Enrolled Acreage**										
2	Madera Subbasin	6,724	8,079	9,444	10,863	12,595	14,482	15,625	16,837	18,180	19,615
3	Chowchilla Subbasin	1,869	2,176	2,492	2,794	3,235	3,723	4,210	4,784	5,398	6,128
4	Delta Mendota Subbasin	154	217	251	318	363	446	464	521	544	610
5	**Total - Enrolled Acreage**	**8,746**	**10,472**	**12,187**	**13,976**	**16,193**	**18,651**	**20,299**	**22,142**	**24,122**	**26,354**
6											
7	**Groundwater Demand Reduction (AF)**										
8	Madera Subbasin	15,700	18,650	21,550	24,500	27,400	30,350	31,500	32,600	33,750	34,850
9	Chowchilla Subbasin	4,100	4,700	5,300	5,850	6,450	7,050	7,550	8,100	8,600	9,150
10	Delta Mendota Subbasin	250	350	400	500	550	650	650	700	700	750
11	**Total - Groundwater Demand Reduction (AF)**	**20,050**	**23,700**	**27,250**	**30,850**	**34,400**	**38,050**	**39,700**	**41,400**	**43,050**	**44,750**

Table 6-4: SALC Costs by Subbasin

Line	A SALC Costs	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Operating Costs**										
2	Madera Subbasin	$196,294	$206,549	$218,448	$229,591	$238,807	$247,124	$253,905	$263,779	$276,061	$288,836
3	Chowchilla Subbasin	$51,190	$52,358	$53,245	$55,038	$59,895	$65,874	$75,128	$81,527	$87,035	$92,318
4	Delta Mendota Subbasin	$4,116	$5,272	$5,696	$6,630	$7,119	$8,115	$8,136	$8,721	$8,633	$9,160
5	**Total - Operating Costs**	**$251,600**	**$264,180**	**$277,389**	**$291,258**	**$305,821**	**$321,112**	**$337,168**	**$354,026**	**$371,728**	**$390,314**
6											
7	**Capital Costs**										
8	Madera Subbasin	$5,093,252	$5,977,600	$6,922,016	$7,891,378	$8,846,763	$9,827,295	$10,070,531	$10,835,598	$11,676,918	$12,558,207
9	Chowchilla Subbasin	$1,328,233	$1,515,260	$1,687,198	$1,891,726	$2,218,831	$2,619,571	$2,979,758	$3,348,975	$3,681,419	$4,013,877
10	Delta Mendota Subbasin	$106,785	$152,585	$180,475	$227,871	$263,746	$322,690	$322,690	$358,251	$365,141	$398,276
11	**Total - Capital Costs**	**$6,528,270**	**$7,645,446**	**$8,789,689**	**$10,010,975**	**$11,329,340**	**$12,769,557**	**$13,372,979**	**$14,542,824**	**$15,723,478**	**$16,970,360**

7. Financial Plan

This section of the report consolidates the costs estimates and assumptions for the Recharge, Sites, Domestic Wells, and SALC programs in the prior sections. The resulting financial plans for the three subbasins are designed to recover the costs of the programs outlined in the GSP, contribute to reserve funds within the ten-year planning horizon presented in this report, and ensure adequate debt service coverage for required future borrowings. Numbers shown in the tables of this section are rounded up to the nearest integer. Therefore, hand calculations based on the displayed numbers, such as summing or multiplying, may not equal the exact results shown.

While the rate proposal is for a five-year period (the maximum allowable by Proposition 218), the tables and figures in this section show a ten-year planning horizon, as rates for years one through five are partially informed by costs and revenue needs in years six through ten. The Financial Plan and Rate Model developed by Raftelis has modeled expenses, revenue needs, and projected rates to 2040.

Reserve Policies

The County GSAs do not currently have reserve funds available for GSP implementation within each of the three subbasins. Reserve funds allow the County GSAs to meet its ongoing cash needs for operating and capital expenses, derive a revenue base for future debt service coverage, and mitigate the financial risks associated with emergency situations and future uncertainty. Since the reserves for each subbasin starts at zero at the beginning of the study period, the financial plans developed in this study allow the County GSAs to build its reserves incrementally over a five to ten year period. This provides sound financial management tools while mitigating the impacts of reserve funding on rates. Raftelis recommends the following reserve policy:

- Operating Reserve: equal to one year of annual revenue needs. The operating reserve provides working capital for the County GSAs to pay routine costs mindful that the revenue stream from rates will only be received from the County twice per year
- Capital Reserve: equal to a five-year average of rate funded capital projects to be implemented by the County GSAs. This includes recharge capital costs that are not funded by debt as well as Domestic Well program capital costs
- Debt Service Reserve: equal to one year of annual debt service, as an assumed requirement of borrowing
- Rate Stabilization Reserve: equal to 25% of annual debt service. This provides increased security to bondholders while the County GSAs are in its infancy, with a new rate structure, new revenue stream, and uncertainty in future enrolled acreage if farm units choose to opt-out acreage in future years

The above policy targets translate into specific dollar values for each subbasin's financial plan based on the programs, costs, and timing of costs in each. The specific dollar values can be found in the cash flow tables further in this section or the report and graphically in the fund balance figures. Having a financial reserve policy is important for maintaining financial solvency, for providing long-term financial management, and for enhancing transparency with ratepayers. The ultimate goal of the reserve policy is to reasonably mitigate risk while minimizing rate impacts.

Capital Program Costs

Table 7-1 summarizes the capital costs of the four programs for each of the subbasins, which includes the costs recharge facilities (**Table 3-10**, Lines 1-5), Sites Reservoir (**Table 4-9**, Lines 7-11), domestic well mitigation (**Table 5-5**, Lines 7-11), and SALC (**Table 6-4**, Lines 7-11). **Table 7-2** shows the debt service costs associated with the programs, which includes the costs for the recharge projects (**Table 3-10**, Lines 7-11).

Operating Costs

Table 7-3 shows the operating costs related to the Madera County Flood Control and Water Conservation Agency (MCFCWCA), provided by County GSAs staff based on information from April 2021. These operating costs are associated with GSP implementation but are not related to the four programs. The MCFCWCA costs shown in this table are for the County GSAs share only.

Administration costs are escalated each year based on the Salary cost escalation factor (**Table 2-3**, Line 2), equipment and materials costs are escalated by the General cost escalation factor (**Table 2-3**, Line 4), and the annual maintenance program costs are escalated by the Capital escalation factor (**Table 2-3**, Line 3).

Table 7-4 shows the estimated legal costs related to each subbasin, provided by County GSAs staff. The legal costs shown include costs for general legal services and potential adjudication of the Madera subbasin. Costs are escalated by the General cost escalation factor (**Table 2-3**, Line 4). General legal costs are split between the Madera and Chowchilla subbasins based on the proportion of enrolled acreage between the two subbasins (
Table 2-2).

Table 7-5 summarizes the operating costs of the four programs for each of the subbasins, which includes the costs for recharge facilities (**Table 3-16**, Lines 1-5), Sites Reservoir (**Table 4-9**, Lines 1-5), domestic wells mitigation (**Table 5-5**, Lines 1-5), and SALC (**Table 6-4**, 1-5).

Table 7-1: Programmatic Capital Costs by Subbasin

Line	A Capital Costs by Program	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Recharge Costs**										
2	Madera Subbasin	$437,235	$269,565	$0	$0	$0	$0	$0	$0	$0	$0
3	Chowchilla Subbasin	$511,912	$277,907	$0	$0	$0	$0	$0	$0	$0	$0
4	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Recharge Costs**	**$949,147**	**$547,472**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
6											
7	**Sites Costs**										
8	Madera Subbasin	$2,141,925	$972,024	$1,110,885	$113,183	$1,487,610	$3,516,227	$5,346,760	$6,436,851	$7,087,492	$7,588,618
9	Chowchilla Subbasin	$943,075	$427,976	$489,115	$49,834	$654,984	$1,548,171	$2,354,142	$2,834,102	$3,120,574	$3,341,217
10	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Sites Costs**	**$3,085,000**	**$1,400,000**	**$1,600,000**	**$163,017**	**$2,142,594**	**$5,064,398**	**$7,700,902**	**$9,270,953**	**$10,208,066**	**$10,929,835**
12											
13	**Domestic Wells Costs**										
14	Madera Subbasin	$3,229,074	$3,332,405	$3,439,042	$5,071,792	$5,234,089	$5,401,580	$5,574,431	$5,752,813	$782,247	$807,279
15	Chowchilla Subbasin	$532,507	$549,547	$567,132	$250,834	$258,861	$267,145	$275,693	$284,516	$4,195	$4,329
16	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	**Total - Domestic Wells Costs**	**$3,761,581**	**$3,881,951**	**$4,006,174**	**$5,322,627**	**$5,492,951**	**$5,668,725**	**$5,850,124**	**$6,037,328**	**$786,441**	**$811,607**
18											
19	**SALC Costs**										
20	Madera Subbasin	$5,093,252	$5,977,600	$6,922,016	$7,891,378	$8,846,763	$9,827,295	$10,070,531	$10,835,598	$11,676,918	$12,558,207
21	Chowchilla Subbasin	$1,328,233	$1,515,260	$1,687,198	$1,891,726	$2,218,831	$2,619,571	$2,979,758	$3,348,975	$3,681,419	$4,013,877
22	Delta Mendota Subbasin	$106,785	$152,585	$180,475	$227,871	$263,746	$322,690	$322,690	$358,251	$365,141	$398,276
23	**Total - SALC Costs**	**$6,528,270**	**$7,645,446**	**$8,789,689**	**$10,010,975**	**$11,329,340**	**$12,769,557**	**$13,372,979**	**$14,542,824**	**$15,723,478**	**$16,970,360**

Table 7-2: Programmatic Debt Service by Subbasin

Line	A Debt Service by Program	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Recharge Debt Service**										
2	Madera Subbasin	$0	$0	$0	$0	$0	$2,345,740	$2,345,740	$5,599,201	$5,599,201	$5,599,201
3	Chowchilla Subbasin	$0	$0	$1,577,585	$1,577,585	$1,577,585	$3,287,160	$3,287,160	$3,573,786	$3,573,786	$3,573,786
4	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Recharge Debt Service**	**$0**	**$0**	**$1,577,585**	**$1,577,585**	**$1,577,585**	**$5,632,901**	**$5,632,901**	**$9,172,987**	**$9,172,987**	**$9,172,987**

Table 7-3: MCFCWCA Operating Expenses by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	MCFCWCA Expenses	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Madera Subbasin**										
2	Administration	$28,047	$29,450	$30,922	$32,468	$34,092	$35,796	$37,586	$39,465	$41,439	$43,511
3	Equipment & Materials	$5,464	$5,627	$5,796	$5,970	$6,149	$6,334	$6,524	$6,719	$6,921	$7,129
4	Annual Maintenance Programs	$13,371	$13,799	$14,241	$14,696	$15,167	$15,652	$16,153	$16,670	$17,203	$17,754
5	**Total - Madera Subbasin**	**$46,882**	**$48,876**	**$50,959**	**$53,135**	**$55,408**	**$57,782**	**$60,263**	**$62,855**	**$65,563**	**$68,393**
6											
7	**Chowchilla Subbasin**										
8	Administration	$70,340	$73,857	$77,550	$81,428	$85,499	$89,774	$94,263	$98,976	$103,925	$109,121
9	Equipment & Materials	$13,702	$14,113	$14,537	$14,973	$15,422	$15,885	$16,361	$16,852	$17,357	$17,878
10	Annual Maintenance Programs	$44,740	$46,172	$47,650	$49,174	$50,748	$52,372	$54,048	$55,777	$57,562	$59,404
11	**Total - Chowchilla Subbasin**	**$128,783**	**$134,143**	**$139,736**	**$145,575**	**$151,669**	**$158,031**	**$164,672**	**$171,605**	**$178,844**	**$186,403**
12											
13	**Delta-Mendota Subbasin**										
14	Administration	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
15	Equipment & Materials	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
16	Annual Maintenance Programs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	**Total - Delta-Mendota Subbasin**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
18											
19	**MCFCWCA Expenses by Subbasin**										
20	Madera Subbasin	$46,882	$48,876	$50,959	$53,135	$55,408	$57,782	$60,263	$62,855	$65,563	$68,393
21	Chowchilla Subbasin	$128,783	$134,143	$139,736	$145,575	$151,669	$158,031	$164,672	$171,605	$178,844	$186,403
22	Delta-Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
23	**Total - MCFCWCA Expenses by Subbasin**	**$175,665**	**$183,019**	**$190,696**	**$198,710**	**$207,077**	**$215,813**	**$224,934**	**$234,460**	**$244,407**	**$254,796**

Table 7-4: Legal Costs by Subbasin

	A	B	C	D	E	F	G	H	I	J	K
Line	Legal Costs	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Legal Costs by Subbasin**										
2	Madera Subbasin	$1,347,152	$1,387,566	$1,429,193	$1,472,069	$1,516,231	$1,561,718	$1,608,569	$426,953	$439,761	$452,954
3	Chowchilla Subbasin	$152,848	$157,434	$162,157	$167,022	$172,032	$177,193	$182,509	$187,984	$193,624	$199,433
4	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Legal Costs by Subbasin**	**$1,500,000**	**$1,545,000**	**$1,591,350**	**$1,639,091**	**$1,688,263**	**$1,738,911**	**$1,791,078**	**$614,937**	**$633,385**	**$652,387**

Table 7-5: Programmatic O&M Costs by Subbasin

Line	A O&M Costs by Program	B FYE 2023	C FYE 2024	D FYE 2025	E FYE 2026	F FYE 2027	G FYE 2028	H FYE 2029	I FYE 2030	J FYE 2031	K FYE 2032
1	**Recharge Costs**										
2	Madera Subbasin	$123,011	$940,762	$971,568	$904,979	$933,008	$961,921	$1,241,740	$1,486,659	$1,911,275	$1,972,680
3	Chowchilla Subbasin	$101,989	$142,988	$149,419	$442,799	$460,413	$478,772	$582,618	$1,282,560	$1,277,853	$1,318,770
4	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5	**Total - Recharge Costs**	**$225,000**	**$1,083,750**	**$1,120,988**	**$1,347,778**	**$1,393,421**	**$1,440,693**	**$1,824,358**	**$2,769,219**	**$3,189,127**	**$3,291,450**
6											
7	**Sites Costs**										
8	Madera Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9	Chowchilla Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	**Total - Sites Costs**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
12											
13	**Domestic Wells Costs**										
14	Madera Subbasin	$322,907	$333,240	$343,904	$507,179	$523,409	$540,158	$557,443	$575,281	$78,225	$80,728
15	Chowchilla Subbasin	$53,251	$54,955	$56,713	$25,083	$25,886	$26,714	$27,569	$28,452	$419	$433
16	Delta Mendota Subbasin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
17	**Total - Domestic Wells Costs**	**$376,158**	**$388,195**	**$400,617**	**$532,263**	**$549,295**	**$566,873**	**$585,012**	**$603,733**	**$78,644**	**$81,161**
18											
19	**SALC Costs**										
20	Madera Subbasin	$196,294	$206,549	$218,448	$229,591	$238,807	$247,124	$253,905	$263,779	$276,061	$288,836
21	Chowchilla Subbasin	$51,190	$52,358	$53,245	$55,038	$59,895	$65,874	$75,128	$81,527	$87,035	$92,318
22	Delta Mendota Subbasin	$4,116	$5,272	$5,696	$6,630	$7,119	$8,115	$8,136	$8,721	$8,633	$9,160
23	**Total - SALC Costs**	**$251,600**	**$264,180**	**$277,389**	**$291,258**	**$305,821**	**$321,112**	**$337,168**	**$354,026**	**$371,728**	**$390,314**

Madera Subbasin Financial Plan

Table 7-6 shows the proposed financial plan for the Madera subbasin over the ten-year planning horizon. The proposed rate revenue in FYE 2023 (Column B, Line 4) is equal to the total expenses for that year (Column B, Line 31) since this is the inaugural year of costs for the County GSAs as a self-sustaining entity. The first year includes direct operating, capital, and program management costs as well as $2 million in initial reserve funding. The proposed revenue adjustments for each subsequent year (Line 1) are then applied to the rate revenues generated in prior years to determine the additional revenue from revenue adjustments (Line 5). Revenue adjustments are effective in July of every fiscal year, resulting in a full year of adjusted revenue in each year. Interest income (Line 6) is calculated based on the projected fund balances in the subbasin and the interest earnings assumptions (**Table 2-3**, Line 7).

As mentioned above, the proposed financial plan includes direct reserve funding in FYE 2023 (Column B, Line 29) to initiate the Madera subbasin reserves starting in the first year. Total expenses (Line 31) are equal to the sum of operating costs (Line 16), debt service (Line 20), capital costs (Line 27), and additional reserve funding (Line 29). The net cash flow (Line 33) is equal to the difference between total revenues (Line 7) and total expenses (Line 31). Net operating revenue (Line 35) is equal to total revenues (Line 7) less operating costs (Line 16) and less Sites capital costs (Line 24). Debt service coverage (Line 37) is calculated by dividing net operating revenue (Line 35) by annual debt service (Line 20) in each applicable year. The required debt coverage ratio (Line 38) is 125%; the calculated debt service coverage is well above the required ratio in all years of the study. Operating costs (Lines 9-16) are from **Table 7-3**, **Table 7-4**, and **Table 7-5**. Debt service costs (Lines 18-20) are from **Table 7-2**. Capital costs (Lines 22-27) are from **Table 7-1**.

Table 7-7 shows the projected fund balances for the Madera subbasin over the study period for the Operating, Capital, and Debt Service Reserves. All reserves start at zero in FYE 2023 (Column B, Lines 2, 11, and 19). Rate revenues (Line 3) are equal to the sum of rate revenues and additional revenue adjustments (**Table 7-6**, Lines 4-5).

Capital costs are shown as an expense to the Operating Reserve (Line 7), equal to the amount of rate-funded capital in each year (**Table 7-6**, Line 27), and an inflow to the Capital Reserve (Line 13). Debt proceeds (Line 12) are from the planned debt issuances for recharge facilities (**Table 3-9**, Line 2). Capital costs paid from the Capital Reserve (Line 14) are inclusive of capital project costs that are debt financed. Projecting the Capital Reserve balance in this way ensures that the Madera subbasin will have adequate funds even when funding recharge design costs upfront. The design costs for recharge Projects 2 through 5 are then reimbursed using the proposed debt proceeds. The transfer to the Debt Service Reserve (Line 15) is equal to one year of debt service for any planned debt issuances for recharge facilities and is deposited into the Debt Service Reserve (Line 20).

Due to the timing of debt proceeds (Line 12) and capital project costs (Line 14), the projected fund balances (Line 23) for the Madera subbasin are higher than the reserve target (Line 24) in FYE 2028 due to the inclusion of debt proceeds and lower than the target in FYE 2029. However, the Madera subbasin will achieve its reserve target starting in FYE 2031.

Table 7-6: Madera Subbasin Proposed Financial Plan

	A	B	C	D	E	F	G	H	I	J	K
Line	**Madera Subbasin Financial Plan**	**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**	**FYE 2027**	**FYE 2028**	**FYE 2029**	**FYE 2030**	**FYE 2031**	**FYE 2032**
1	Proposed Revenue Adjustments		9.0%	18.0%	18.0%	18.0%	4.0%	4.0%	4.0%	4.0%	4.0%
2											
3	**Revenues**										
4	Rate Revenues	$14,937,733	$14,937,733	$14,937,733	$14,937,733	$14,937,733	$14,937,733	$14,937,733	$14,937,733	$14,937,733	$14,937,733
5	Revenue Adjustments	$0	$1,344,396	$4,275,179	$7,733,503	$11,814,326	$12,884,408	$13,997,294	$15,154,695	$16,358,392	$17,610,237
6	Interest Income	$10,000	$34,168	$72,212	$128,708	$188,994	$354,286	$349,641	$288,943	$377,090	$401,239
7	**Total - Revenues**	**$14,947,733**	**$16,316,297**	**$19,285,124**	**$22,799,944**	**$26,941,053**	**$28,176,427**	**$29,284,668**	**$30,381,371**	**$31,673,215**	**$32,949,210**
8											
9	**Operating Costs**										
10	MCFCWCA Expenses	$46,882	$48,876	$50,959	$53,135	$55,408	$57,782	$60,263	$62,855	$65,563	$68,393
11	Legal Costs	$1,347,152	$1,387,566	$1,429,193	$1,472,069	$1,516,231	$1,561,718	$1,608,569	$426,953	$439,761	$452,954
12	Recharge Costs	$123,011	$940,762	$971,568	$904,979	$933,008	$961,921	$1,241,740	$1,486,659	$1,911,275	$1,972,680
13	Sites Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
14	Domestic Wells Costs	$322,907	$333,240	$343,904	$507,179	$523,409	$540,158	$557,443	$575,281	$78,225	$80,728
15	SALC Costs	$196,294	$206,549	$218,448	$229,591	$238,807	$247,124	$253,905	$263,779	$276,061	$288,836
16	**Total - Operating Costs**	**$2,036,247**	**$2,916,994**	**$3,014,072**	**$3,166,953**	**$3,266,863**	**$3,368,703**	**$3,721,920**	**$2,815,526**	**$2,770,884**	**$2,863,590**
17											
18	**Debt Service**										
19	Recharge Debt Service	$0	$0	$0	$0	$0	$2,345,740	$2,345,740	$5,599,201	$5,599,201	$5,599,201
20	**Total - Debt Service**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,345,740**	**$2,345,740**	**$5,599,201**	**$5,599,201**	**$5,599,201**
21											
22	**Capital Costs**										
23	Recharge Costs	$437,235	$269,565	$0	$0	$0	$0	$0	$0	$0	$0
24	Sites Costs	$2,141,925	$972,024	$1,110,885	$113,183	$1,487,610	$3,516,227	$5,346,760	$6,436,851	$7,087,492	$7,588,618
25	Domestic Wells Costs	$3,229,074	$3,332,405	$3,439,042	$5,071,792	$5,234,089	$5,401,580	$5,574,431	$5,752,813	$782,247	$807,279
26	SALC Costs	$5,093,252	$5,977,600	$6,922,016	$7,891,378	$8,846,763	$9,827,295	$10,070,531	$10,835,598	$11,676,918	$12,558,207
27	**Total - Capital Costs**	**$10,901,486**	**$10,551,594**	**$11,471,942**	**$13,076,353**	**$15,568,462**	**$18,745,103**	**$20,991,722**	**$23,025,262**	**$19,546,657**	**$20,954,104**
28											
29	**Additional Reserve Funding**	**$2,000,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
30											
31	**Total - Expenses**	**$14,937,733**	**$13,468,588**	**$14,486,015**	**$16,243,306**	**$18,835,325**	**$24,459,547**	**$27,059,383**	**$31,439,990**	**$27,916,742**	**$29,416,895**
32											
33	**Net Cash Flow**	**$10,000**	**$2,847,708**	**$4,799,109**	**$6,556,638**	**$8,105,728**	**$3,716,880**	**$2,225,285**	**($1,058,619)**	**$3,756,474**	**$3,532,315**
34											
35	**Net Operating Revenue**	**$10,769,561**	**$12,427,278**	**$15,160,166**	**$19,519,808**	**$22,186,581**	**$21,291,496**	**$20,215,988**	**$21,128,993**	**$21,814,840**	**$22,497,002**
36											
37	**Debt Service Coverage**						908%	862%	377%	390%	402%
38	Debt Coverage Requirement	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%

Table 7-7: Madera Subbasin Projected Fund Balances

	A	B	C	D	E	F	G	H	I	J	K
Line	Madera Subbasin Fund Balances	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Operating Reserve**										
2	Beginning Balance	$0	$2,010,000	$4,857,708	$9,656,817	$16,213,455	$24,319,183	$28,036,064	$30,261,349	$29,202,731	$32,959,204
3	Rate Revenue	$14,937,733	$16,282,129	$19,212,912	$22,671,236	$26,752,059	$27,822,141	$28,935,027	$30,092,428	$31,296,125	$32,547,970
4	Interest Income	$10,000	$34,168	$72,212	$128,708	$188,994	$354,286	$349,641	$288,943	$377,090	$401,239
5	Operating Costs	($2,036,247)	($2,916,994)	($3,014,072)	($3,166,953)	($3,266,863)	($3,368,703)	($3,721,920)	($2,815,526)	($2,770,884)	($2,863,590)
6	Debt Service	$0	$0	$0	$0	$0	($2,345,740)	($2,345,740)	($5,599,201)	($5,599,201)	($5,599,201)
7	Capital Costs	($10,901,486)	($10,551,594)	($11,471,942)	($13,076,353)	($15,568,462)	($18,745,103)	($20,991,722)	($23,025,262)	($19,546,657)	($20,954,104)
8	**Ending Balance**	**$2,010,000**	**$4,857,708**	**$9,656,817**	**$16,213,455**	**$24,319,183**	**$28,036,064**	**$30,261,349**	**$29,202,731**	**$32,959,204**	**$36,491,519**
9											
10	**Capital Reserve**										
11	Beginning Balance	$0	$0	$0	$0	$0	($2,544,853)	$19,055,278	($11,766,286)	$2,434,813	$0
12	Debt Proceeds	$0	$0	$0	$0	$0	$35,518,883	$0	$49,263,462	$0	$0
13	Transfer from Operating Reserve	$10,901,486	$10,551,594	$11,471,942	$13,076,353	$15,568,462	$18,745,103	$20,991,722	$23,025,262	$19,546,657	$20,954,104
14	Capital Costs	($10,901,486)	($10,551,594)	($11,471,942)	($13,076,353)	($18,113,315)	($30,318,114)	($51,813,286)	($54,834,164)	($21,981,470)	($20,954,104)
15	Transfer to Debt Service Reserve	$0	$0	$0	$0	$0	($2,345,740)	$0	($3,253,461)	$0	$0
16	**Ending Balance**	**$0**	**$0**	**$0**	**$0**	**($2,544,853)**	**$19,055,278**	**($11,766,286)**	**$2,434,813**	**$0**	**$0**
17											
18	**Debt Service Reserve**										
19	Beginning Balance	$0	$0	$0	$0	$0	$0	$2,345,740	$2,345,740	$5,599,201	$5,599,201
20	Transfer from Capital Reserve	$0	$0	$0	$0	$0	$2,345,740	$0	$3,253,461	$0	$0
21	**Ending Balance**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,345,740**	**$2,345,740**	**$5,599,201**	**$5,599,201**	**$5,599,201**
22											
23	**Total Fund Balances**	**$2,010,000**	**$4,857,708**	**$9,656,817**	**$16,213,455**	**$21,774,330**	**$49,437,083**	**$20,840,804**	**$37,236,745**	**$38,558,405**	**$42,090,720**
24	**Reserve Target**	**$19,140,373**	**$18,018,283**	**$19,430,201**	**$21,650,248**	**$23,384,357**	**$31,055,392**	**$32,741,534**	**$40,246,035**	**$35,749,682**	**$37,093,386**
25	*Operating (1 yr of revenue needs)*	*$14,937,733*	*$13,468,588*	*$14,486,015*	*$16,243,306*	*$18,835,325*	*$24,459,547*	*$27,059,383*	*$31,439,990*	*$27,916,742*	*$29,416,895*
26	*Capital (5 yr avg. rate funded capital)*	*$4,202,640*	*$4,549,695*	*$4,944,187*	*$5,406,941*	*$4,549,032*	*$3,663,670*	*$2,749,976*	*$1,807,044*	*$833,938*	*$677,489*
27	*Debt Service (1 yr of debt service)*	*$0*	*$0*	*$0*	*$0*	*$0*	*$2,345,740*	*$2,345,740*	*$5,599,201*	*$5,599,201*	*$5,599,201*
28	*Rate Stabilization (25% of debt service)*	*$0*	*$0*	*$0*	*$0*	*$0*	*$586,435*	*$586,435*	*$1,399,800*	*$1,399,800*	*$1,399,800*

Figure 7-1 shows the proposed financial plan for the Madera subbasin in graphical format. The dotted line represents proposed revenues (**Table 7-6**, Line 7). The stacked bars represent operating costs (**Table 7-6**, Line 16), debt service costs (**Table 7-6**, Line 20), rate-funded capital costs (**Table 7-6**, Line 27), and reserve funding (**Table 7-6**, Lines 29 and 33).

Figure 7-2 shows the projected fund balances for the Madera subbasin. The turquoise bars represent the ending balances for all Madera subbasin reserves (**Table 7-7**, Line 23), and the grey line represents the reserve targets (**Table 7-7**, Line 24).

Figure 7-1: Madera Subbasin Proposed Financial Plan

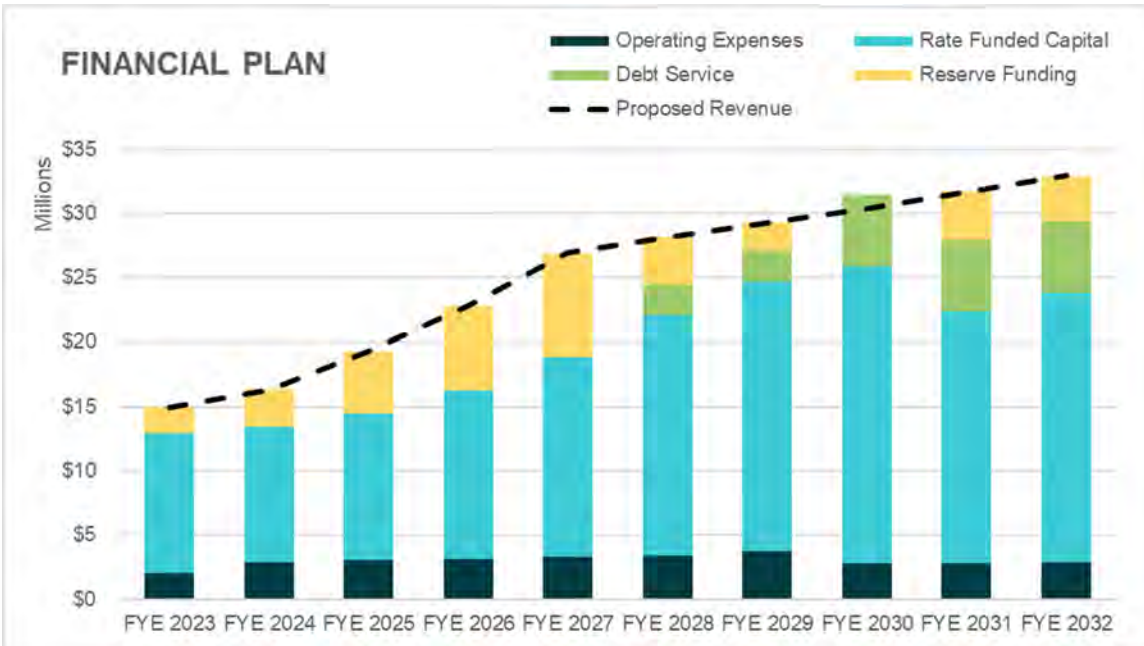
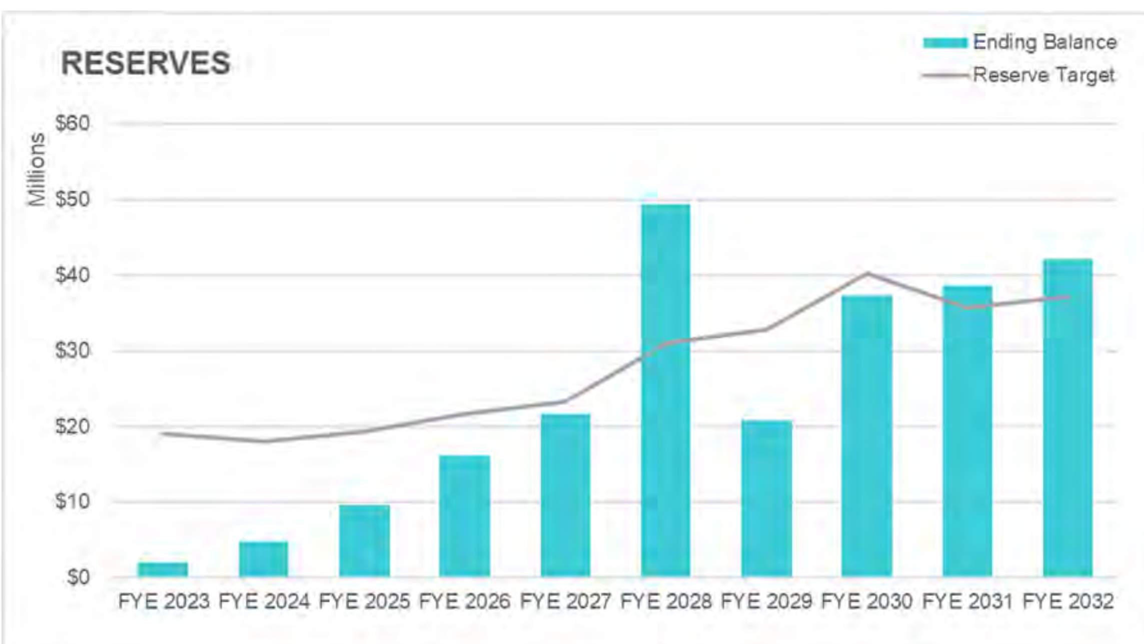


Figure 7-2: Madera Subbasin Projected Fund Balances



Chowchilla Subbasin Financial Plan

Table 7-8 shows the proposed financial plan for the Chowchilla subbasin over the ten-year planning horizon. The proposed rate revenue in FYE 2023 (Column B, Line 4) is equal to the total expenses for that year (Column B, Line 31) since this is the inaugural year of costs for the County GSAs as a self-sustaining entity. The first year includes direct operating, capital, and program management costs as well as $3 million in initial reserve funding for financial reserves and cash needs for immediate recharge design costs. The proposed revenue adjustments for each subsequent year (Line 1) are then applied to the rate revenues generated in prior years to determine the additional revenue from revenue adjustments (Line 5). Revenue adjustments are effective in July of every fiscal year, resulting in a full year of adjusted revenue in each year. Interest income (Line 6) is calculated based on the projected fund balances in the subbasin and the interest earnings assumptions (**Table 2-3**, Line 7).

The proposed financial plan includes additional reserve funding in FYE 2023 (Column B, Line 29) to build the Chowchilla subbasin reserves starting in the first year. Total expenses (Line 31) are equal to the sum of operating costs (Line 16), debt service (Line 20), capital costs (Line 27), and additional reserve funding (Line 29). The net cash flow (Line 33) is equal to the difference between total revenues (Line 7) and total expenses (Line 31). Net operating revenue (Line 35) is equal to total revenues (Line 7) less operating costs (Line 16) and less Sites capital costs (Line 24). Debt service coverage (Line 37) is calculated by dividing net operating revenue (Line 35) by annual debt service (Line 20) in each applicable year. The required debt coverage ratio (Line 38) is 125%; the calculated debt service coverage is above the required ratio in all years of the study. Operating costs (Lines 9-16) are from **Table 7-3**, **Table 7-4**, and **Table 7-5**. Debt service costs (Lines 18-20) are from **Table 7-2**. Capital costs (Lines 22-27) are from **Table 7-1**.

Table 7-9 shows the projected fund balances for the Chowchilla subbasin over the study period for the Operating, Capital, and Debt Service Reserves. All reserves start at zero in FYE 2023 (Column B, Lines 2, 11, and 19). Rate revenues (Line 3) are equal to the sum of rate revenues and additional revenue adjustments (**Table 7-8**, Lines 4-5).

Capital costs are shown as an expense to the Operating Reserve (Line 7), equal to the amount of rate-funded capital in each year (**Table 7-8**, Line 27), and an inflow to the Capital Reserve (Line 13). Debt proceeds (Line 12) are from the planned debt issuances for recharge facilities (**Table 3-9**, Line 3). Capital costs paid from the Capital Reserve (Line 14) are inclusive of capital project costs that are debt financed. Projecting the Capital Reserve balance in this way ensures that the Chowchilla subbasin will have adequate funds even when funding recharge design costs upfront. The design costs for Recharge Projects 2 through 5 are then reimbursed using the proposed debt proceeds. The transfer to the Debt Service Reserve (Line 15) is equal to one year of debt service for any planned debt issuances for the Recharge program and is deposited into the Debt Service Reserve (Line 20).

Due to the timing of debt proceeds (Line 12) and capital project costs (Line 14), the projected fund balances (Line 23) for the Chowchilla subbasin are higher than the reserve target (Line 24) in FYE 2025 through FYE 2028. Fund balances decrease after FYE 2028 and remain near the reserve target for each subsequent year through FYE 2032.

Table 7-8: Chowchilla Subbasin Proposed Financial Plan

	A	B	C	D	E	F	G	H	I	J	K
Line	Chowchilla Subbasin Financial Plan	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	Proposed Revenue Adjustments		2.0%	4.0%	4.0%	4.0%	10.0%	10.0%	10.0%	10.0%	10.0%
2											
3	**Revenues**										
4	Rate Revenues	$6,803,788	$6,803,788	$6,803,788	$6,803,788	$6,803,788	$6,803,788	$6,803,788	$6,803,788	$6,803,788	$6,803,788
5	Revenue Adjustments	$0	$136,076	$413,670	$702,369	$1,002,615	$1,783,255	$2,641,959	$3,586,534	$4,625,566	$5,768,502
6	Interest Income	$15,000	$25,387	$98,671	$156,624	$136,778	$227,422	$242,290	$166,907	$164,597	$162,010
7	**Total - Revenues**	**$6,818,788**	**$6,965,251**	**$7,316,129**	**$7,662,781**	**$7,943,180**	**$8,814,465**	**$9,688,037**	**$10,557,229**	**$11,593,951**	**$12,734,299**
8											
9	**Operating Costs**										
10	MCFCWCA Expenses	$128,783	$134,143	$139,736	$145,575	$151,669	$158,031	$164,672	$171,605	$178,844	$186,403
11	Legal Costs	$152,848	$157,434	$162,157	$167,022	$172,032	$177,193	$182,509	$187,984	$193,624	$199,433
12	Recharge Costs	$101,989	$142,988	$149,419	$442,799	$460,413	$478,772	$582,618	$1,282,560	$1,277,853	$1,318,770
13	Sites Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
14	Domestic Wells Costs	$53,251	$54,955	$56,713	$25,083	$25,886	$26,714	$27,569	$28,452	$419	$433
15	SALC Costs	$51,190	$52,358	$53,245	$55,038	$59,895	$65,874	$75,128	$81,527	$87,035	$92,318
16	**Total - Operating Costs**	**$488,061**	**$541,878**	**$561,271**	**$835,517**	**$869,895**	**$906,584**	**$1,032,495**	**$1,752,127**	**$1,737,775**	**$1,797,357**
17											
18	**Debt Service**										
19	Recharge Debt Service	$0	$0	$1,577,585	$1,577,585	$1,577,585	$3,287,160	$3,287,160	$3,573,786	$3,573,786	$3,573,786
20	**Total - Debt Service**	**$0**	**$0**	**$1,577,585**	**$1,577,585**	**$1,577,585**	**$3,287,160**	**$3,287,160**	**$3,573,786**	**$3,573,786**	**$3,573,786**
21											
22	**Capital Costs**										
23	Recharge Costs	$511,912	$277,907	$0	$0	$0	$0	$0	$0	$0	$0
24	Sites Costs	$943,075	$427,976	$489,115	$49,834	$654,984	$1,548,171	$2,354,142	$2,834,102	$3,120,574	$3,341,217
25	Domestic Wells Costs	$532,507	$549,547	$567,132	$250,834	$258,861	$267,145	$275,693	$284,516	$4,195	$4,329
26	SALC Costs	$1,328,233	$1,515,260	$1,687,198	$1,891,726	$2,218,831	$2,619,571	$2,979,758	$3,348,975	$3,681,419	$4,013,877
27	**Total - Capital Costs**	**$3,315,727**	**$2,770,690**	**$2,743,445**	**$2,192,394**	**$3,132,677**	**$4,434,887**	**$5,609,593**	**$6,467,592**	**$6,806,188**	**$7,359,422**
28											
29	**Additional Reserve Funding**	**$3,000,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
30											
31	**Total - Expenses**	**$6,803,788**	**$3,312,567**	**$4,882,302**	**$4,605,497**	**$5,580,158**	**$8,628,632**	**$9,929,249**	**$11,793,506**	**$12,117,749**	**$12,730,566**
32											
33	**Net Cash Flow**	**$15,000**	**$3,652,683**	**$2,433,827**	**$3,057,284**	**$2,363,023**	**$185,833**	**($241,212)**	**($1,236,277)**	**($523,798)**	**$3,734**
34											
35	**Net Operating Revenue**	**$5,387,652**	**$5,995,397**	**$6,265,743**	**$6,777,430**	**$6,418,301**	**$6,359,709**	**$6,301,399**	**$5,970,999**	**$6,735,602**	**$7,595,725**
36											
37	**Debt Service Coverage**			397%	430%	407%	193%	192%	167%	188%	213%
38	Debt Coverage Requirement	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%

Table 7-9: Chowchilla Subbasin Projected Fund Balances

	A	B	C	D	E	F	G	H	I	J	K
Line	Chowchilla Subbasin Fund Balances	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Operating Reserve**										
2	Beginning Balance	$0	$3,015,000	$6,667,683	$9,101,510	$12,158,794	$14,521,817	$14,707,650	$14,466,438	$13,230,161	$12,706,363
3	Rate Revenue	$6,803,788	$6,939,863	$7,217,458	$7,506,156	$7,806,402	$8,587,043	$9,445,747	$10,390,322	$11,429,354	$12,572,289
4	Interest Income	$15,000	$25,387	$98,671	$156,624	$136,778	$227,422	$242,290	$166,907	$164,597	$162,010
5	Operating Costs	($488,061)	($541,878)	($561,271)	($835,517)	($869,895)	($906,584)	($1,032,495)	($1,752,127)	($1,737,775)	($1,797,357)
6	Debt Service	$0	$0	($1,577,585)	($1,577,585)	($1,577,585)	($3,287,160)	($3,287,160)	($3,573,786)	($3,573,786)	($3,573,786)
7	Capital Costs	($3,315,727)	($2,770,690)	($2,743,445)	($2,192,394)	($3,132,677)	($4,434,887)	($5,609,593)	($6,467,592)	($6,806,188)	($7,359,422)
8	**Ending Balance**	**$3,015,000**	**$6,667,683**	**$9,101,510**	**$12,158,794**	**$14,521,817**	**$14,707,650**	**$14,466,438**	**$13,230,161**	**$12,706,363**	**$12,710,097**
9											
10	**Capital Reserve**										
11	Beginning Balance	$0	$0	($4,579,835)	$7,066,027	$0	($2,343,414)	$13,961,071	($1,009,236)	$0	$0
12	Debt Proceeds	$0	$0	$23,887,585	$0	$0	$25,886,150	$0	$4,340,051	$0	$0
13	Transfer from Operating Reserve	$3,315,727	$2,770,690	$2,743,445	$2,192,394	$3,132,677	$4,434,887	$5,609,593	$6,467,592	$6,806,188	$7,359,422
14	Capital Costs	($3,315,727)	($7,350,525)	($13,407,584)	($9,258,421)	($5,476,092)	($12,306,977)	($20,579,900)	($9,511,781)	($6,806,188)	($7,359,422)
15	Transfer to Debt Service Reserve	$0	$0	($1,577,585)	$0	$0	($1,709,575)	$0	($286,626)	$0	$0
16	**Ending Balance**	**$0**	**($4,579,835)**	**$7,066,027**	**$0**	**($2,343,414)**	**$13,961,071**	**($1,009,236)**	**$0**	**$0**	**$0**
17											
18	**Debt Service Reserve**										
19	Beginning Balance	$0	$0	$0	$1,577,585	$1,577,585	$1,577,585	$3,287,160	$3,287,160	$3,573,786	$3,573,786
20	Transfer from Capital Reserve	$0	$0	$1,577,585	$0	$0	$1,709,575	$0	$286,626	$0	$0
21	**Ending Balance**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
22											
23	**Total Fund Balances**	**$3,015,000**	**$2,087,848**	**$17,745,123**	**$13,736,380**	**$13,755,988**	**$31,955,881**	**$16,744,362**	**$16,803,947**	**$16,280,150**	**$16,283,883**
24	**Reserve Target**	**$7,393,528**	**$3,746,852**	**$7,178,217**	**$6,844,888**	**$7,770,222**	**$12,904,758**	**$14,152,839**	**$16,321,162**	**$16,589,453**	**$17,201,431**
25	*Operating (1 yr of revenue needs)*	*$6,803,788*	*$3,312,567*	*$4,882,302*	*$4,605,497*	*$5,580,158*	*$8,628,632*	*$9,929,249*	*$11,793,506*	*$12,117,749*	*$12,730,566*
26	*Capital (5 yr avg. rate funded capital)*	*$589,740*	*$434,285*	*$323,933*	*$267,410*	*$218,082*	*$167,175*	*$114,640*	*$60,423*	*$4,472*	*$3,633*
27	*Debt Service (1 yr of debt service)*	*$0*	*$0*	*$1,577,585*	*$1,577,585*	*$1,577,585*	*$3,287,160*	*$3,287,160*	*$3,573,786*	*$3,573,786*	*$3,573,786*
28	*Rate Stabilization (25% of debt service)*	*$0*	*$0*	*$394,396*	*$394,396*	*$394,396*	*$821,790*	*$821,790*	*$893,447*	*$893,447*	*$893,447*

Figure 7-3 shows the proposed financial plan for the Chowchilla subbasin in graphical format. The dotted line represents proposed revenues (**Table 7-8**, Line 7). The stacked bars represent operating costs (**Table 7-8**, Line 16), debt service costs (**Table 7-8**, Line 20), rate-funded capital costs (**Table 7-8**, Line 27), and reserve funding (**Table 7-8**, Lines 29 and 33).

Figure 7-4 shows the projected fund balances for the Chowchilla subbasin. The turquoise bars represent the ending balances for all Chowchilla subbasin reserves (**Table 7-9**, Line 23), and the grey line represents the reserve targets (**Table 7-9**, Line 24).

Figure 7-3: Chowchilla Subbasin Proposed Financial Plan

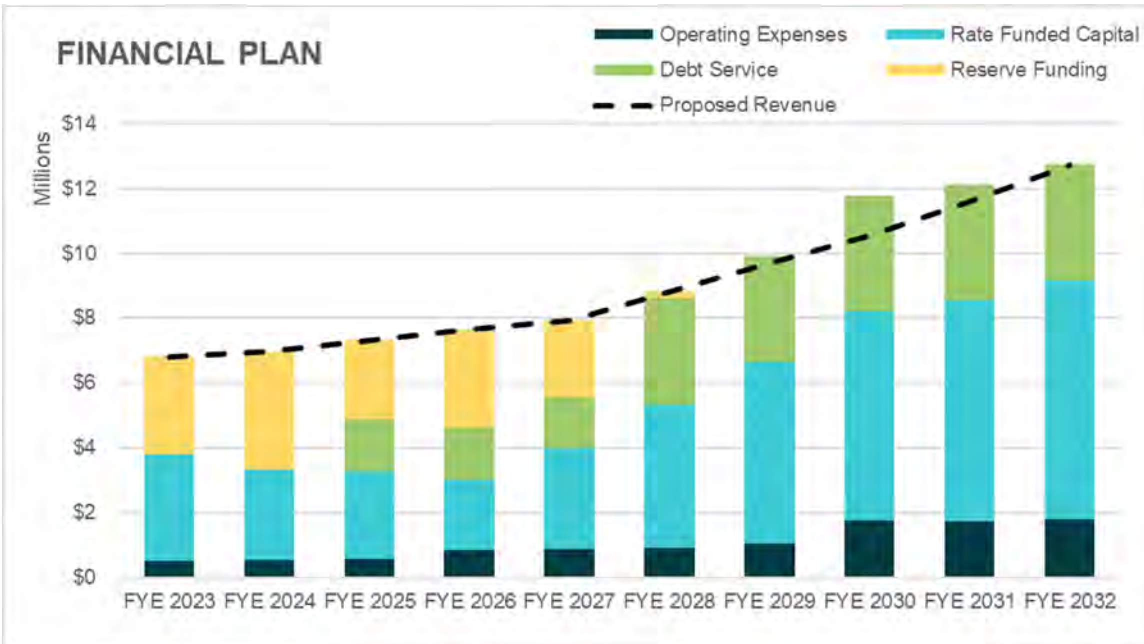
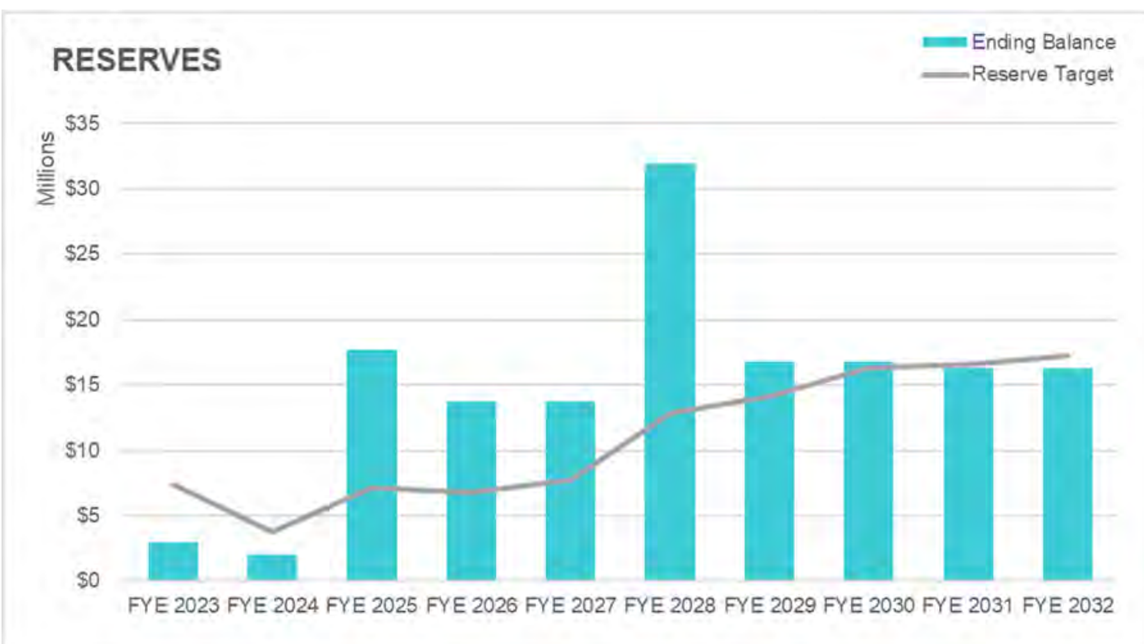


Figure 7-4: Chowchilla Subbasin Projected Fund Balances



Delta-Mendota Subbasin Financial Plan

Table 7-10 shows the proposed financial plan for the Delta-Mendota subbasin over the ten-year study period. The proposed rate revenue in FYE 2023 (Column B, Line 4) is equal to the total expenses for that year (Column B, Line 31) since this is the inaugural year of costs for the County GSAs as a self-sustaining entity. The first year includes direct operating, capital, and program management costs as well as $50,000 in initial reserve funding.

The proposed revenue adjustments for every subsequent year (Line 1) are then applied to the rate revenues generated in prior years to determine the additional revenue from revenue adjustments (Line 5). Revenue adjustments are effective in July of every fiscal year, resulting in a full year of adjusted revenue for each year. Interest income (Line 6) is calculated based on the projected fund balances in the subbasin and the interest earnings assumptions (**Table 2-3**, Line 7).

The proposed financial plan includes additional reserve funding in FYE 2023 (Column B, Line 29) to build the Delta-Mendota subbasin reserves starting in the first year. Total expenses (Line 31) are equal to the sum of operating costs (Line 16), capital costs (Line 27), and additional reserve funding (Line 29). The net cash flow (Line 33) is equal to the difference between total revenues (Line 7) and total expenses (Line 31). Net operating revenue (Line 35) is equal to total revenues (Line 7) less operating costs (Line 16). The Delta-Mendota subbasin is not expected to have any debt service throughout the study period. Operating costs (Lines 9-16) are from **Table 7-3**, **Table 7-4**, and **Table 7-5**. Capital costs (Lines 22-27) are from **Table 7-1**.

Table 7-11 shows the projected fund balances for the Delta-Mendota subbasin over the study period for the Operating, Capital, and Debt Service Reserves. All reserves start at zero in FYE 2023 (Column B, Lines 2, 11, and 19). Rate revenues (Line 3) are equal to the sum of rate revenues and additional revenue adjustments (**Table 7-10**, Lines 4-5). Capital costs are shown as an expense to the Operating Reserve (Line 7), equal to the amount of rate-funded capital in each year (**Table 7-10**, Line 27), and an inflow to the Capital Reserve (Line 13). The proposed financial plan shows that the County GSAs will build its reserves for the Delta-Mendota subbasin (Line 23) and meet its reserve target (Line 24) starting in FYE 2029.

Table 7-10: Delta-Mendota Subbasin Proposed Financial Plan

	A	B	C	D	E	F	G	H	I	J	K
Line	**Delta-Mendota Subbasin Financial Plan**	**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**	**FYE 2027**	**FYE 2028**	**FYE 2029**	**FYE 2030**	**FYE 2031**	**FYE 2032**
1	Proposed Revenue Adjustments		12.5%	25.0%	25.0%	25.0%	5.0%	5.0%	5.0%	3.0%	3.0%
2											
3	**Revenues**										
4	Rate Revenues	$160,901	$160,901	$160,901	$160,901	$160,901	$160,901	$160,901	$160,901	$160,901	$160,901
5	Revenue Adjustments	$0	$20,113	$65,366	$121,933	$192,641	$210,318	$228,879	$248,368	$260,646	$273,293
6	Interest Income	$250	$618	$941	$1,392	$2,061	$2,697	$3,221	$3,760	$4,248	$4,663
7	**Total - Revenues**	**$161,151**	**$181,632**	**$227,208**	**$284,226**	**$355,603**	**$373,916**	**$393,001**	**$413,029**	**$425,795**	**$438,856**
8											
9	**Operating Costs**										
10	MCFCWCA Expenses	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
11	Legal Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
12	Recharge Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
13	Sites Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
14	Domestic Wells Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
15	SALC Costs	$4,116	$5,272	$5,696	$6,630	$7,119	$8,115	$8,136	$8,721	$8,633	$9,160
16	**Total - Operating Costs**	**$4,116**	**$5,272**	**$5,696**	**$6,630**	**$7,119**	**$8,115**	**$8,136**	**$8,721**	**$8,633**	**$9,160**
17											
18	**Debt Service**										
19	Recharge Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20	**Total - Debt Service**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
21											
22	**Capital Costs**										
23	Recharge Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
24	Sites Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
25	Domestic Wells Costs	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
26	SALC Costs	$106,785	$152,585	$180,475	$227,871	$263,746	$322,690	$322,690	$358,251	$365,141	$398,276
27	**Total - Capital Costs**	**$106,785**	**$152,585**	**$180,475**	**$227,871**	**$263,746**	**$322,690**	**$322,690**	**$358,251**	**$365,141**	**$398,276**
28											
29	**Additional Reserve Funding**	**$50,000**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
30											
31	**Total - Expenses**	**$160,901**	**$157,857**	**$186,171**	**$234,500**	**$270,865**	**$330,805**	**$330,826**	**$366,972**	**$373,774**	**$407,436**
32											
33	**Net Cash Flow**	**$250**	**$23,774**	**$41,037**	**$49,725**	**$84,738**	**$43,112**	**$62,175**	**$46,056**	**$52,021**	**$31,420**
34											
35	**Net Operating Revenue**	**$157,035**	**$176,359**	**$221,512**	**$277,596**	**$348,484**	**$365,802**	**$384,865**	**$404,307**	**$417,162**	**$429,696**
36											
37	**Debt Service Coverage**										
38	Debt Coverage Requirement	125%	125%	125%	125%	125%	125%	125%	125%	125%	125%

Table 7-11: Delta-Mendota Subbasin Projected Fund Balances

	A	B	C	D	E	F	G	H	I	J	K
Line	**Delta-Mendota Subbasin Fund Balances**	**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**	**FYE 2027**	**FYE 2028**	**FYE 2029**	**FYE 2030**	**FYE 2031**	**FYE 2032**
1	**Operating Reserve**										
2	Beginning Balance	$0	$50,250	$74,024	$115,061	$164,787	$249,524	$292,636	$354,811	$400,867	$452,888
3	Rate Revenue	$160,901	$181,013	$226,267	$282,834	$353,542	$371,219	$389,780	$409,269	$421,547	$434,193
4	Interest Income	$250	$618	$941	$1,392	$2,061	$2,697	$3,221	$3,760	$4,248	$4,663
5	Operating Costs	($4,116)	($5,272)	($5,696)	($6,630)	($7,119)	($8,115)	($8,136)	($8,721)	($8,633)	($9,160)
6	Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7	Capital Costs	($106,785)	($152,585)	($180,475)	($227,871)	($263,746)	($322,690)	($322,690)	($358,251)	($365,141)	($398,276)
8	**Ending Balance**	**$50,250**	**$74,024**	**$115,061**	**$164,787**	**$249,524**	**$292,636**	**$354,811**	**$400,867**	**$452,888**	**$484,308**
9											
10	**Capital Reserve**										
11	Beginning Balance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
12	Debt Proceeds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
13	Transfer from Operating Reserve	$106,785	$152,585	$180,475	$227,871	$263,746	$322,690	$322,690	$358,251	$365,141	$398,276
14	Capital Costs	($106,785)	($152,585)	($180,475)	($227,871)	($263,746)	($322,690)	($322,690)	($358,251)	($365,141)	($398,276)
15	Transfer to Debt Service Reserve	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
16	**Ending Balance**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
17											
18	**Debt Service Reserve**										
19	Beginning Balance	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20	Transfer from Capital Reserve	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
21	**Ending Balance**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
22											
23	**Total Fund Balances**	**$50,250**	**$74,024**	**$115,061**	**$164,787**	**$249,524**	**$292,636**	**$354,811**	**$400,867**	**$452,888**	**$484,308**
24	**Reserve Target**	**$160,901**	**$157,857**	**$186,171**	**$234,500**	**$270,865**	**$330,805**	**$330,826**	**$366,972**	**$373,774**	**$407,436**
25	*Operating (1 yr of revenue needs)*	*$160,901*	*$157,857*	*$186,171*	*$234,500*	*$270,865*	*$330,805*	*$330,826*	*$366,972*	*$373,774*	*$407,436*
26	*Capital (5 yr avg. rate funded capital)*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
27	*Debt Service (1 yr of debt service)*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*
28	*Rate Stabilization (25% of debt service)*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*	*$0*

Figure 7-5 shows the proposed financial plan for the Delta-Mendota subbasin in graphical format. The dotted line represents proposed revenues (**Table 7-10**, Line 7). The stacked bars represent operating costs (**Table 7-10**, Line 16), rate-funded capital costs (**Table 7-10**, Line 27), and reserve funding (**Table 7-10**, Lines 29 and 33).

Figure 7-6 shows the projected fund balances for the Delta-Mendota subbasin. The turquoise bars represent the ending balances for all Delta-Mendota subbasin reserves (**Table 7-11**, Line 23), and the grey line represents the reserve targets (**Table 7-11**, Line 24).

Figure 7-5: Delta-Mendota Subbasin Proposed Financial Plan

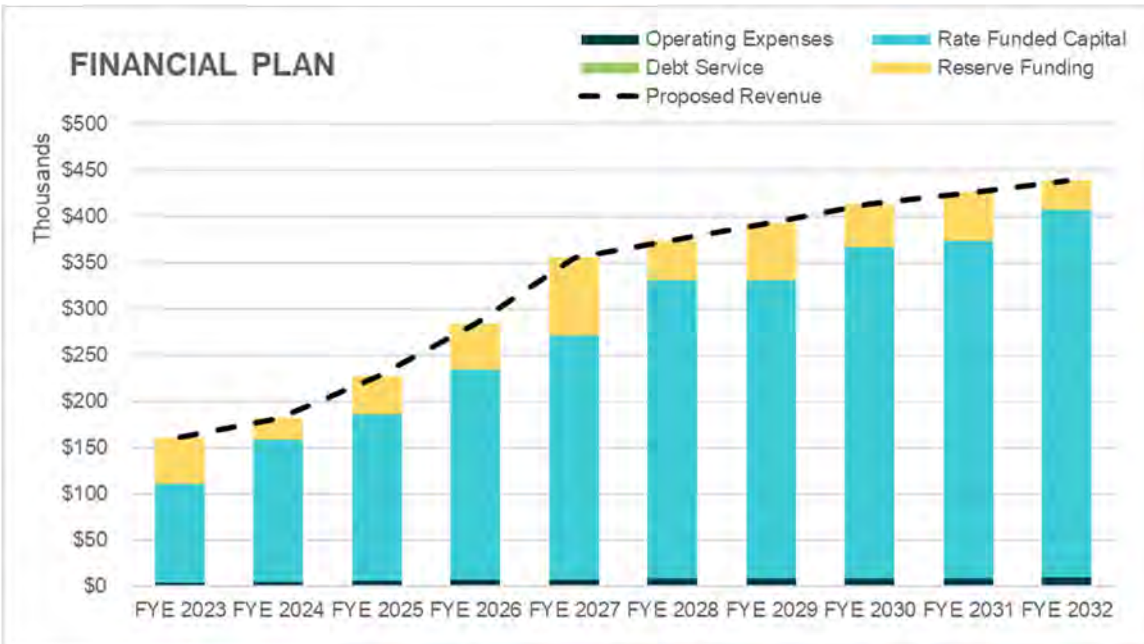
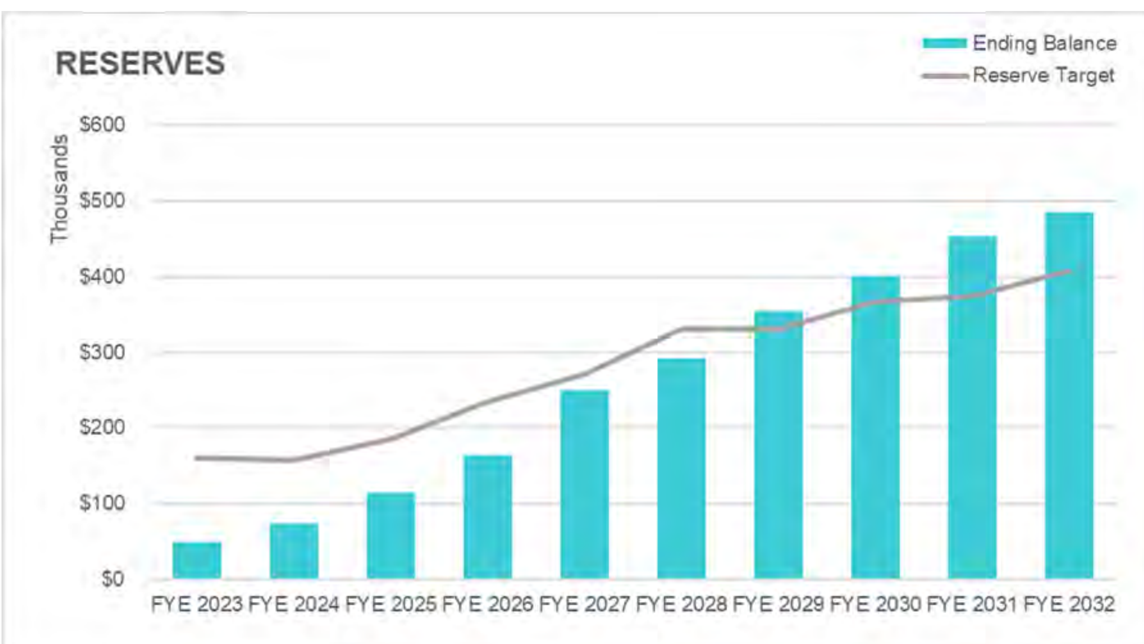


Figure 7-6: Delta-Mendota Subbasin Projected Fund Balances



8. Rate Design

This section of the report describes the process of designing and calculating the GSP rates for the Madera, Chowchilla, and Delta-Mendota subbasins. Numbers shown in the tables of this section are rounded up to the nearest integer. Therefore, hand calculations based on the displayed numbers, such as summing or multiplying, may not equal the exact results shown.

Rate Structure Options

As part of the rate study process, Raftelis worked closely with County GSAs staff and received policy direction from the County GSAs Board of Directors. The County GSAs evaluated several rate structure options, which included:

1. Fixed Rate: all costs are recovered based on a fixed rate per enrolled acre (enrolled acre is defined within the main body of this report) in a farm unit.
2. Fixed and Volumetric Rate (Program-Based): costs are apportioned based on programs, with costs for the Recharge, Sites, and Domestic Wells activities recovered through the volumetric rate. Remaining costs are recovered based on a fixed rate per enrolled acre in a farm unit; the volumetric costs are recovered based on use within the Transition Water pool of a farm unit's water allocation
3. Fixed and Volumetric Rate (Policy-Based): costs are apportioned based on policy direction provided by the Board, with 75% of costs allocated to the fixed component and the remaining 25% allocated to the volumetric component. The fixed component allocation is recovered per enrolled acre; the volumetric costs are recovered based on use within the Transition Water pool of a farm unit's water allocation

All options were modeled and designed to recover the same amount of revenue (the cost of service). The benefits and challenges associated with the Fixed Rate and the Fixed and Volumetric Rate options were discussed at length during several public meetings with the Board of Directors and conveyed to County GSAs stakeholders in small group meetings and larger public workshops.

The potential benefits of the Fixed and Volumetric Rate options include flexibility in controlling farm unit charges and a perception of fairness by providing a direct relationship between water use and GSAs costs.

Challenges related to the Fixed and Volumetric Rate options include reduced revenue stability for the County GSAs cost recovery; grower acceptance in measuring and validating water use estimates by farm unit; potential borrowing risks if revenue streams are highly variable and uncertain in future years; and increased borrowing and administrative costs (for rate stabilization reserves, water accounting, appeals, and County GSAs staffing).

Additional benefits of the Fixed Rate option include ease of customer understanding and staff administration (leading to lower costs to the County GSAs), revenue stability for the County GSAs to implement the programs in the GSP (particularly borrowing for recharge capital), and slightly lower costs to some farm units (if some farm units do not use their full Transition Water allocation the volumetric unit cost would have to be higher to recover the same amount of costs from fewer units of service).

A key challenge for the Fixed Rate option is the perceived lack of flexibility for farm units that may use less than their Transition Water allocation. However, the County GSAs has adopted a carryover provision that allows farm units to carryover their unused groundwater allocation for one year which provides additional flexibility. The farm unit affords growers additional flexibility by allowing them to allocate water within fields in the farm unit. In addition, the SALC land repurposing program allows growers to forgo irrigation and receive payments that would offset GSP charges. Based on the benefits of the Fixed Rate option relative to the Fixed and Volumetric options, the Board elected to proceed with developing a fixed rate per enrolled acre for all five years of the rate proposal.

Revenue Requirement

The annual revenue requirement, or the amount of revenue to be recovered from rates, is based on the results of the financial plans in the previous section and represents the cost of service in each rate year. **Table 8-1** shows the annual revenue requirements for each year of the five-year rate period for the Madera (**Table 7-7**, Line 3), Chowchilla (**Table 7-9**, Line 3), and Delta-Mendota subbasins (**Table 7-11**, Line 3).

Table 8-1: Annual Revenue Requirements by Subbasin

	A	B	C	D	E	F
Line	**Revenue Requirement**	**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**	**FYE 2027**
1	Madera Subbasin	$14,937,733	$16,282,129	$19,212,912	$22,671,236	$26,752,059
2	Chowchilla Subbasin	$6,803,788	$6,939,863	$7,217,458	$7,506,156	$7,806,402
3	Delta-Mendota Subbasin	$160,901	$181,013	$226,267	$282,834	$353,542

Units of Service

The units of service for this study, or the units upon which the proposed rates are based, are Enrolled Acres. **Table 8-2** shows the enrolled acreage in the Madera, Chowchilla, and Delta-Mendota subbasins (
Table 2-2) for the current water allocation year (CY 2022). To reiterate, Enrolled Acres are those within a farm unit that receive a water allocation on that acre, regardless of the acre being currently irrigated or currently unirrigated. Enrolled acreage was provided by County GSAs staff after the close of the enrollment period at the end of CY 2021.

Table 8-2: Enrolled Acreage by Subbasin

	A	B	C	D	E	F
Line	**Enrolled Acreage**	**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**	**FYE 2027**
1	Madera Subbasin	81,473	81,473	81,473	81,473	81,473
2	Chowchilla Subbasin	35,872	35,872	35,872	35,872	35,872
3	Delta-Mendota Subbasin	1,755	1,755	1,755	1,755	1,755

Proposed Rates

The proposed five-year rate schedule, shown in **Table 8-3**, was developed to fund the County GSAs' costs for GSP implementation, including the costs associated with recharge, Sites, domestic well mitigation, and SALC. The proposed rates are calculated by dividing the revenue requirement (**Table 8-1**) by the units of service (**Table 8-2**) for each subbasin. The proposed rates are rounded up to the nearest dollar and are charged per Enrolled Acre.

The annual rates were developed based on the annual costs of GSP implementation; the averaged rates were designed to collect the same amount of revenue (barring differences due to the rounding of rates between the two options) over a five-year period. The County GSAs Board elected to notice the averaged rates in April 2022. If no majority protest exists, and if adopted by the Board, the GSP rates will be implemented on July 1 starting in 2022 through July 1, 2026.

Table 8-3: Proposed Rates ($/Enrolled Acre)

	A	B	C	D	E	F
Line	Proposed Rates ($/Enrolled Acre)	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027
1	**Annual Rates**					
2	Madera Subbasin	$184	$200	$236	$279	$329
3	Chowchilla Subbasin	$190	$194	$202	$210	$218
4	Delta-Mendota Subbasin	$92	$104	$129	$162	$202
5						
6	**Averaged Rates**					
7	Madera Subbasin	$246	$246	$246	$246	$246
8	Chowchilla Subbasin	$203	$203	$203	$203	$203
9	Delta-Mendota Subbasin	$138	$138	$138	$138	$138

Modified Cash Flows

The annual rates (**Table 8-3**, Lines 1-4) are based on the actual revenue requirements resulting from the financial plans of each subbasin. The County GSAs Board has opted to move forward with the averaged rates (**Table 8-3**, Lines 6-9) which keeps the GSP rates stable (i.e. the same rate) throughout the five-year period. The revenue generation from annual rates and averaged rates are approximately equal over the five-year period (they are slightly different due to rounding) but will differ for each specific year. This means that the averaged rates will generate a higher amount of revenue in the early years - when compared to the requirement in the early years - and a lower amount of revenue compared to the requirement in the latter years. **Table 8-4** shows the proposed revenue generation from averaged rates, which is equal to the averaged rates (**Table 8-3**, Lines 6-9) multiplied by the enrolled acreage (**Table 8-2**) for each subbasin.

Table 8-4: Proposed Revenues from Averaged Rates

	A	B	C	D	E	F
Line	Revenues with Averaged Rates	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027
1	Madera Subbasin	$20,042,353	$20,042,353	$20,042,353	$20,042,353	$20,042,353
2	Chowchilla Subbasin	$7,282,016	$7,282,016	$7,282,016	$7,282,016	$7,282,016
3	Delta-Mendota Subbasin	$242,179	$242,179	$242,179	$242,179	$242,179

Table 8-5 shows the modified cash flow for the Madera subbasin based on averaged rates (**Table 8-4**, Line 1). The projected fund balances are shown for revenues generated from averaged rates (Line 16) compared to the financial plan (Line 17). Actual revenue generation for either the annual or averaged rate options will be slightly higher than those projected in the financial plan due to rounding.

Table 8-5: Madera Subbasin Modified Cash Flow with Averaged Rates

	A	B	C	D	E	F
Line	**Madera Subbasin Modified Cash Flow**	**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**	**FYE 2027**
1	**Revenues**					
2	Rate Revenues with Averaged Rates	$20,042,353	$20,042,353	$20,042,353	$20,042,353	$20,042,353
3	Interest Income	$10,000	$34,168	$72,212	$128,708	$188,994
4	**Total - Revenues**	**$20,052,353**	**$20,076,521**	**$20,114,565**	**$20,171,061**	**$20,231,347**
5						
6	**Expenses**					
7	Operating Costs	$2,036,247	$2,916,994	$3,014,072	$3,166,953	$3,266,863
8	Debt Service	$0	$0	$0	$0	$0
9	Capital Costs	$10,901,486	$10,551,594	$11,471,942	$13,076,353	$15,568,462
10	Reserve Funding	$2,000,000	$0	$0	$0	$0
11	**Total - Expenses**	**$14,937,733**	**$13,468,588**	**$14,486,015**	**$16,243,306**	**$18,835,325**
12						
13	**Net Cash Flow**	**$5,114,620**	**$6,607,932**	**$5,628,550**	**$3,927,754**	**$1,396,022**
14						
15	**Projected Fund Balances**					
16	Averaged Rates	**$7,114,620**	**$13,722,552**	**$19,351,102**	**$23,278,857**	**$22,130,026**
17	Financial Plan	$2,010,000	$4,857,708	$9,656,817	$16,213,455	$21,774,330

Table 8-6 shows the modified cash flow for the Chowchilla subbasin based on averaged rates (**Table 8-4**, Line 2). The projected fund balances are shown for revenues generated from averaged rates (Line 16) compared to the financial plan (Line 17). Actual revenue generation for either the annual or averaged rate options will be slightly higher than those projected in the financial plan due to rounding. The debt coverage ratio for the Chowchilla subbasin is above the coverage requirement for the study period (Line 19).

Table 8-6: Chowchilla Subbasin Modified Cash Flow with Averaged Rates

	A	B	C	D	E	F
Line	**Chowchilla Subbasin Modified Cash Flow**	**FYE 2023**	**FYE 2024**	**FYE 2025**	**FYE 2026**	**FYE 2027**
1	**Revenues**					
2	Rate Revenues with Averaged Rates	$7,282,016	$7,282,016	$7,282,016	$7,282,016	$7,282,016
3	Interest Income	$15,000	$25,387	$98,671	$156,624	$136,778
4	**Total – Revenues**	**$7,297,016**	**$7,307,403**	**$7,380,687**	**$7,438,640**	**$7,418,794**
5						
6	**Expenses**					
7	Operating Costs	$488,061	$541,878	$561,271	$835,517	$869,895
8	Debt Service	$0	$0	$1,577,585	$1,577,585	$1,577,585
9	Capital Costs	$3,315,727	$2,770,690	$2,743,445	$2,192,394	$3,132,677
10	Reserve Funding	$3,000,000	$0	$0	$0	$0
11	**Total – Expenses**	**$6,803,788**	**$3,312,567**	**$4,882,302**	**$4,605,497**	**$5,580,158**
12						
13	**Net Cash Flow**	**$493,228**	**$3,994,836**	**$2,498,385**	**$2,833,144**	**$1,838,636**
14						
15	**Projected Fund Balances**					
16	Averaged Rates	**$3,493,228**	**$2,908,230**	**$18,630,062**	**$14,397,179**	**$13,892,401**
17	Financial Plan	$3,015,000	$2,087,848	$17,745,123	$13,736,380	$13,755,988
18						
19	**Debt Service Coverage**			**401%**	**415%**	**374%**

Table 8-7 shows the modified cash flow for the Delta-Mendota subbasin based on averaged rates (**Table 8-4**, Line 3). The projected fund balances are shown for revenues generated from averaged rates (Line 16) compared to the financial plan (Line 17). Actual revenue generation for either the annual or averaged rate options will be slightly higher than those projected in the financial plan due to rounding.

Table 8-7: Delta-Mendota Subbasin Modified Cash Flow with Averaged Rates

	A	B	C	D	E	F
Line	Delta-Mendota Subbasin Modified Cash Flow	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027
1	**Revenues**					
2	Rate Revenues with Averaged Rates	$242,179	$242,179	$242,179	$242,179	$242,179
3	Interest Income	$250	$618	$941	$1,392	$2,061
4	**Total - Revenues**	**$242,429**	**$242,797**	**$243,120**	**$243,571**	**$244,240**
5						
6	**Expenses**					
7	Operating Costs	$4,116	$5,272	$5,696	$6,630	$7,119
8	Debt Service	$0	$0	$0	$0	$0
9	Capital Costs	$106,785	$152,585	$180,475	$227,871	$263,746
10	Reserve Funding	$50,000	$0	$0	$0	$0
11	**Total - Expenses**	**$160,901**	**$157,857**	**$186,171**	**$234,500**	**$270,865**
12						
13	**Net Cash Flow**	**$81,528**	**$84,940**	**$56,949**	**$9,071**	**($26,625)**
14						
15	**Projected Fund Balances**					
16	Averaged Rates	**$131,528**	**$216,468**	**$273,417**	**$282,488**	**$255,863**
17	Financial Plan	$50,250	$74,024	$115,061	$164,787	$249,524

APPENDIX A:
Additional Financial Information

Appendix: 20-Year Projections

The tables and graphs in this appendix show the projected 20-year revenue adjustments, rates, and fund balances for the three subbasins and were developed based on the best data available at the time of the study. Forecasts beyond the typical five to ten year period are a product of inputs and assumptions that are available today, meaning that there is a high likelihood that the values will change in the future and the results may no longer be accurate. The financial forecasting period of this study is from FYE 2023 to FYE 2032; the adopted rate schedule is from FYE 2023 through FYE 2027. The values shown in these tables and graphs are for reference purposes only.

Table A-1: Madera Subbasin 20-Year Revenue Adjustments and Rates

Line	A Madera Subbasin	B Revenue Adjustments	C Proposed Rates
1	FYE 2023		$184
2	FYE 2024	9.0%	$200
3	FYE 2025	18.0%	$236
4	FYE 2026	18.0%	$279
5	FYE 2027	18.0%	$329
6	FYE 2028	4.0%	$342
7	FYE 2029	4.0%	$356
8	FYE 2030	4.0%	$371
9	FYE 2031	4.0%	$386
10	FYE 2032	4.0%	$402
11	FYE 2033	4.0%	$419
12	FYE 2034	3.0%	$432
13	FYE 2035	3.0%	$445
14	FYE 2036	3.0%	$459
15	FYE 2037	3.0%	$473
16	FYE 2038	3.0%	$488
17	FYE 2039	3.0%	$503
18	FYE 2040	3.0%	$519
19	FYE 2041	3.0%	$535

Figure A-1: Madera Subbasin 20-Year Projected Fund Balances

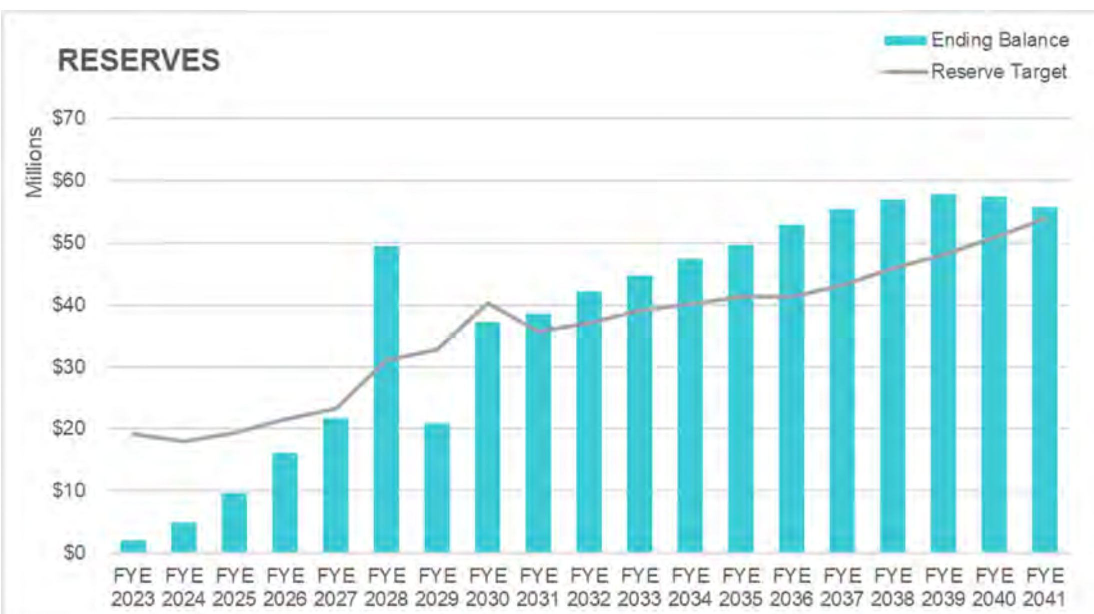


Table A-2: Chowchilla Subbasin 20-Year Revenue Adjustments and Rates

	A	B	C
Line	Chowchilla Subbasin	Revenue Adjustments	Proposed Rates
1	FYE 2023		$190
2	FYE 2024	2.0%	$194
3	FYE 2025	4.0%	$202
4	FYE 2026	4.0%	$210
5	FYE 2027	4.0%	$218
6	FYE 2028	10.0%	$240
7	FYE 2029	10.0%	$264
8	FYE 2030	10.0%	$291
9	FYE 2031	10.0%	$321
10	FYE 2032	10.0%	$354
11	FYE 2033	7.0%	$379
12	FYE 2034	7.0%	$406
13	FYE 2035	7.0%	$435
14	FYE 2036	7.0%	$466
15	FYE 2037	4.0%	$485
16	FYE 2038	4.0%	$505
17	FYE 2039	4.0%	$526
18	FYE 2040	4.0%	$548
19	FYE 2041	4.0%	$570

Figure A-2: Chowchilla Subbasin 20-Year Projected Fund Balances

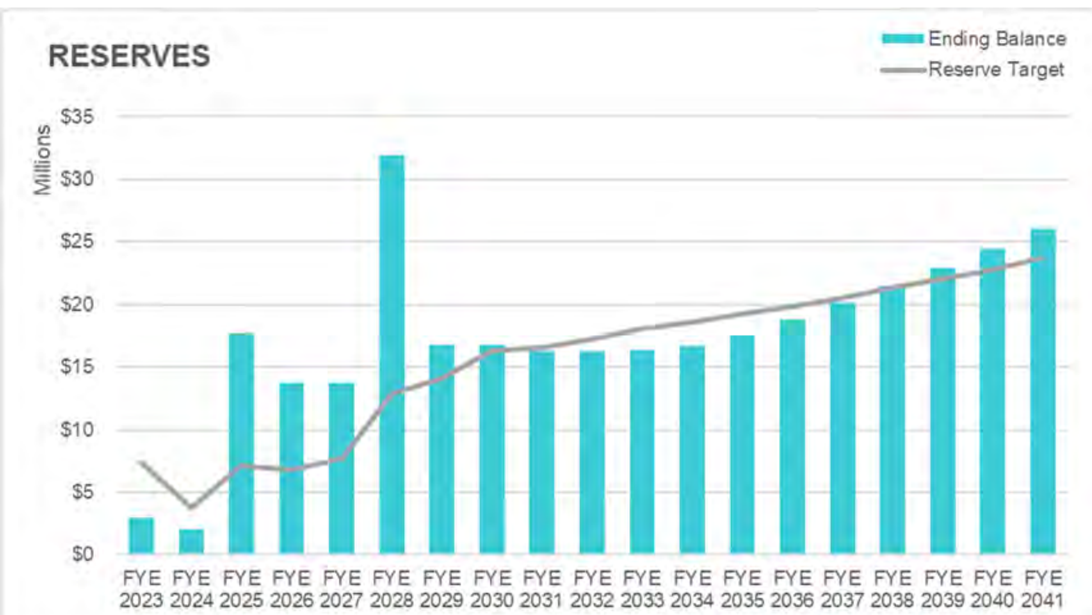
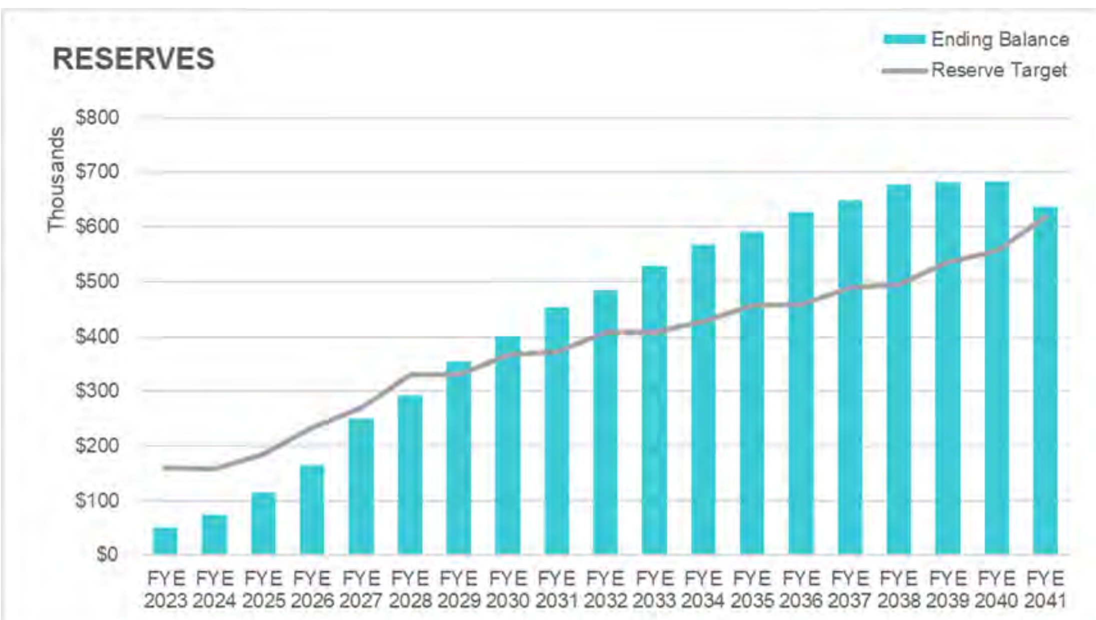


Table A-3: Delta-Mendota Subbasin 20-Year Revenue Adjustments and Rates

Line	A Delta-Mendota Subbasin	B Revenue Adjustments	C Proposed Rates
1	FYE 2023		$92
2	FYE 2024	12.5%	$104
3	FYE 2025	25.0%	$129
4	FYE 2026	25.0%	$162
5	FYE 2027	25.0%	$202
6	FYE 2028	5.0%	$212
7	FYE 2029	5.0%	$223
8	FYE 2030	5.0%	$235
9	FYE 2031	3.0%	$243
10	FYE 2032	3.0%	$251
11	FYE 2033	3.0%	$259
12	FYE 2034	3.0%	$267
13	FYE 2035	3.0%	$276
14	FYE 2036	3.0%	$285
15	FYE 2037	3.0%	$294
16	FYE 2038	3.0%	$303
17	FYE 2039	3.0%	$313
18	FYE 2040	3.0%	$323
19	FYE 2041	3.0%	$333

Figure A-3: Delta-Mendota Subbasin 20-Year Projected Fund Balances



Appendix: Recharge Debt Service Calculations

The table in this appendix shows the debt service for Recharge by issuance and subbasin.

Table A-4: Recharge Debt Service Detail

	A	B	C	D	E	F	G	H	I	J	K	L
Line	Recharge Debt Service Detail	Issuance Amount	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Madera Subbasin**											
2	FYE 2028 Issuance	$36,059,779	$0	$0	$0	$0	$0	$2,345,740	$2,345,740	$2,345,740	$2,345,740	$2,345,740
3	FYE 20230 Issuance	$50,013,667	$0	$0	$0	$0	$0	$0	$0	$3,253,461	$3,253,461	$3,253,461
4	**Total - Madera Subbasin**	**$86,073,446**	**$0**	**$0**	**$0**	**$0**	**$0**	**$2,345,740**	**$2,345,740**	**$5,599,201**	**$5,599,201**	**$5,599,201**
5												
6	**Chowchilla Subbasin**											
7	FYE 2025 Issuance	$24,251,356	$0	$0	$1,577,585	$1,577,585	$1,577,585	$1,577,585	$1,577,585	$1,577,585	$1,577,585	$1,577,585
8	FYE 2028 Issuance	$26,280,355	$0	$0	$0	$0	$0	$1,709,575	$1,709,575	$1,709,575	$1,709,575	$1,709,575
9	FYE 2030 Issuance	$4,406,143	$0	$0	$0	$0	$0	$0	$0	$286,626	$286,626	$286,626
10	**Total - Chowchilla Subbasin**	**$54,937,854**	**$0**	**$0**	**$1,577,585**	**$1,577,585**	**$1,577,585**	**$3,287,160**	**$3,287,160**	**$3,573,786**	**$3,573,786**	**$3,573,786**

Appendix: Sites Alternative Debt Cases

This appendix shows the alternative cases for Sites debt, as provided by the internal financing team at the Sites Water Authority.

Table A-5: Sites Financing Assumptions, Case 1 (Historical Rates without WIFIA)

	A	B	C	D
Line	Sites Case 1 Assumptions	Issuance	Term (# of Years)	Interest Rate
1	Interim Loan	$383,071,581	1	3.750%
2	WIFIA Loan	$0	35	0.000%
3	USDA Loan	$439,559,000	40	3.875%
4	Revenue Bonds	$2,831,000,000	40	5.000%

Table A-6: Sites Debt Service, Case 1 (Historical Rates without WIFIA)

	A	B	C	D	E	F	G	H	I	J	K
Line	Sites Case 1 Debt Service	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Annual Drawdown**										
2	Interim Loan	$0	$0	$0	$70,626,941	$312,444,640	$0	$0	$0	$0	$0
3	WIFIA Loan	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$439,559,000	$0	$0
5	Revenue Bonds	$0	$0	$0	$0	$976,000,000	$709,000,000	$753,000,000	$74,000,000	$268,000,000	$51,000,000
6											
7	**Debt Service**										
8	Interim Loan	$0	$0	$0	$2,648,510	$11,716,674	$0	$0	$0	$0	$0
9	WIFIA Loan	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$21,796,655	$21,796,655	$21,796,655
11	Revenue Bonds	$0	$0	$0	$0	$56,879,485	$98,198,702	$142,082,157	$146,394,741	$162,013,288	$164,985,474
12	**Total - Debt Service**	**$0**	**$0**	**$0**	**$2,648,510**	**$68,596,159**	**$98,198,702**	**$142,082,157**	**$168,191,396**	**$183,809,943**	**$186,782,129**
13											
14	**Debt Service (County GSAs)**	**$0**	**$0**	**$0**	**$158,911**	**$4,115,770**	**$5,891,922**	**$8,524,929**	**$10,091,484**	**$11,028,597**	**$11,206,928**

Table A-7: Sites Financing Assumptions, Case 3 (Current Rates without WIFIA)

	A	B	C	D
Line	Sites Case 3 Assumptions	Issuance	Term (# of Years)	Interest Rate
1	Interim Loan	$383,677,120	1	2.500%
2	WIFIA Loan	$0	35	0.000%
3	USDA Loan	$439,559,000	40	2.250%
4	Revenue Bonds	$2,859,000,000	40	3.500%

Table A-8: Sites Debt Service, Case 3 (Current Rates without WIFIA)

	A	B	C	D	E	F	G	H	I	J	K
Line	Sites Case 3 Debt Service	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Annual Drawdown**										
2	Interim Loan	$0	$0	$0	$70,626,941	$313,050,180	$0	$0	$0	$0	$0
3	WIFIA Loan	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
4	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$439,559,000	$0	$0
5	Revenue Bonds	$0	$0	$0	$0	$982,000,000	$715,000,000	$759,000,000	$79,000,000	$271,000,000	$53,000,000
6											
7	**Debt Service**										
8	Interim Loan	$0	$0	$0	$1,765,674	$7,826,254	$0	$0	$0	$0	$0
9	WIFIA Loan	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$16,781,210	$16,781,210	$16,781,210
11	Revenue Bonds	$0	$0	$0	$0	$45,984,391	$79,465,898	$115,007,805	$118,707,161	$131,397,354	$133,879,200
12	**Total - Debt Service**	**$0**	**$0**	**$0**	**$1,765,674**	**$53,810,646**	**$79,465,898**	**$115,007,805**	**$135,488,371**	**$148,178,564**	**$150,660,410**
13											
14	**Debt Service (County GSAs)**	**$0**	**$0**	**$0**	**$105,940**	**$3,228,639**	**$4,767,954**	**$6,900,468**	**$8,129,302**	**$8,890,714**	**$9,039,625**

Table A-9: Sites Financing Assumptions, Case 4 (Current Rates with WIFIA)

	A	B	C	D
Line	Sites Case 4 Assumptions	Issuance	Term (# of Years)	Interest Rate
1	Interim Loan	$0	1	0.000%
2	WIFIA Loan	$600,000,000	35	2.380%
3	USDA Loan	$439,559,000	40	2.250%
4	Revenue Bonds	$2,261,000,000	40	3.500%

Table A-10: Sites Debt Service, Case 4 (Current Rates with WIFIA)

	A	B	C	D	E	F	G	H	I	J	K
Line	Sites Case 4 Debt Service	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Annual Drawdown**										
2	Interim Loan	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	WIFIA Loan	$0	$0	$0	$77,626,941	$313,251,812	$209,121,248	$0	$0	$0	$0
4	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$439,559,000	$0	$0
5	Revenue Bonds	$0	$0	$0	$0	$382,000,000	$716,000,000	$759,000,000	$80,000,000	$271,000,000	$53,000,000
6											
7	**Debt Service**										
8	Interim Loan	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9	WIFIA Loan	$0	$0	$0	$1,847,521	$9,302,914	$14,280,000	$14,280,000	$14,280,000	$14,280,000	$25,454,825
10	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$16,781,210	$16,781,210	$16,781,210
11	Revenue Bonds	$0	$0	$0	$0	$17,888,022	$51,416,356	$86,958,263	$90,704,446	$103,394,639	$105,876,485
12	**Total - Debt Service**	**$0**	**$0**	**$0**	**$1,847,521**	**$27,190,936**	**$65,696,356**	**$101,238,263**	**$121,765,656**	**$134,455,849**	**$148,112,520**
13											
14	**Debt Service (County GSAs)**	**$0**	**$0**	**$0**	**$110,851**	**$1,631,456**	**$3,941,781**	**$6,074,296**	**$7,305,939**	**$8,067,351**	**$8,886,751**

Table A-11: Sites Financing Assumptions, Case 5 (Current Rates with Large WIFIA)

	A	B	C	D
Line	Sites Case 5 Assumptions	Issuance	Term (# of Years)	Interest Rate
1	Interim Loan	$0	1	0.000%
2	WIFIA Loan	$1,446,286,537	35	2.380%
3	USDA Loan	$439,559,000	40	2.250%
4	Revenue Bonds	$1,418,000,000	40	3.500%

Table A-12: Sites Debt Service, Case 5 (Current Rates with Large WIFIA)

	A	B	C	D	E	F	G	H	I	J	K
Line	Sites Case 5 Debt Service	FYE 2023	FYE 2024	FYE 2025	FYE 2026	FYE 2027	FYE 2028	FYE 2029	FYE 2030	FYE 2031	FYE 2032
1	**Annual Drawdown**										
2	Interim Loan	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3	WIFIA Loan	$0	$0	$0	$77,626,941	$313,251,812	$581,785,334	$473,622,450	$0	$0	$0
4	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$439,559,000	$0	$0
5	Revenue Bonds	$0	$0	$0	$0	$0	$253,000,000	$760,000,000	$80,000,000	$272,000,000	$53,000,000
6											
7	**Debt Service**										
8	Interim Loan	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
9	WIFIA Loan	$0	$0	$0	$1,847,521	$9,302,914	$23,149,405	$34,421,620	$34,421,620	$34,421,620	$61,358,285
10	USDA Loan	$0	$0	$0	$0	$0	$0	$0	$16,781,210	$16,781,210	$16,781,210
11	Revenue Bonds	$0	$0	$0	$0	$0	$11,847,302	$47,436,037	$51,182,220	$63,919,240	$66,401,086
12	**Total - Debt Service**	**$0**	**$0**	**$0**	**$1,847,521**	**$9,302,914**	**$34,996,708**	**$81,857,657**	**$102,385,049**	**$115,122,070**	**$144,540,581**
13											
14	**Debt Service (County GSAs)**	**$0**	**$0**	**$0**	**$110,851**	**$558,175**	**$2,099,802**	**$4,911,459**	**$6,143,103**	**$6,907,324**	**$8,672,435**

APPENDIX B:
Technical Memoranda

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Technical Memorandum

Preliminary Project Cost Estimates for the Madera County GSA Recharge Program

Prepared for: Stephanie Anagnoson
Director of Water and Natural Resources
Madera County GSA

Prepared by: Tommy Ostrowski, Senior Engineer
Reviewed by: John Davids, Principal Engineer

Date: February 16, 2022

1.0 - Introduction

The Madera County Groundwater Sustainability Agencies (GSAs) (collectively referred to as "Madera County GSA") are currently implementing Groundwater Sustainability Plans (GSPs) for the Chowchilla, Madera, and Delta-Mendota Subbasins to achieve groundwater sustainability by 2040. The GSPs include a mix of projects and management actions that will lead to sustainable groundwater management. A key component of these GSPs is the development of projects that enable groundwater recharge through in-lieu practices, Flood-MAR, and dedicated recharge basins. This Technical Memorandum (TM) provides a summary of the preliminary project concepts and associated estimated costs proposed for inclusion in the Madera County GSA Recharge Program (Recharge Program). The descriptions and costs are conceptual in nature and Davids Engineering, Inc. (DE) will refine in future design phases.

2.0 - Water Sources and Project Areas

The development of the Recharge Program identified potential water sources in the Chowchilla and Madera Subbasins to meet the recharge goals. Two primary water sources were identified: Flood releases from Millerton Reservoir that are conveyed through the Eastside/Chowchilla Bypass (Bypass) during high flow events, and un-storable water in Millerton Reservoir that is available for diversion through the Madera Canal under Section 215 of the US Bureau of Reclamation's Reclamation Reform Act of 1982. "Un-storable water" is defined as irrigation water to be released due to flood control criteria or un-managed flood flows.

In general, diversions from the Bypass are possible under a temporary or permanent appropriative water right (WR) that requires approval of the State Water Resources Control Board and is subject to flow availability and environmental constraints. The Triangle T Water District (TTWD) submitted an application for a permanent appropriative right for groundwater recharge within the TTWD service area and adjacent parcels in the Red Top area. The TTWD WR specifies 37 Points of Diversion (PODs) and a Place of Use (POU) totaling approximately 47,762 acres. Project planning completed to date assumed that nine (9) of the 37 PODS are dedicated to the TTWD GSA and nine (9) are outside of the Madera County GSA. The remaining 19 PODs could be used (following the construction of necessary infrastructure) to divert from the Bypass and conduct recharge on parcels within the POU and other parcels within the Madera County GSA. It was assumed that the Madera County GSA and

TTWD will work collaboratively on an operating agreement to facilitate future use of these 19 PODs. The Madera County GSA plans to apply for additional water rights from the Bypass as part of the Recharge Program.

Diversions of Section 215 water would utilize the Madera Canal for conveyance and the existing facilities of the Chowchilla Water District (CWD) and the Madera Irrigation District (MID)[1] for distribution and delivery to lands within the Madera County GSA that have been identified through the Recharge Program planning process. Applications for Section 215 water would be made by the Madera County GSA. Madera County has a contract for Section 215 water and has applied for an expanded place of use to use that water for recharge in the Madera County GSA.

Figures 1 and 2 of Appendix A show project areas within the Madera County GSA for the Chowchilla and Madera Subbasins, respectively. In general, the Bypass would be the primary water source targeted for recharge on the westside of the subbasins, and Section 215 water used on the east sides of the subbasins. Table 1 provides a summary of the water sources and project areas targeted for recharge projects.

Table 1. Water Sources, Supply Contract, Conveyance, and Project Area summary for each region of each subbasin.

Subbasin	Region	Primary Water Source	Water Supply Contract Mechanism	Conveyance	Project Areas
Chowchilla	**Westside**	Eastside/ Chowchilla Bypass	Appropriative Water Rights(s) held by TTWD and Madera Co.	Eastside/ Chowchilla Bypass	WR POU's, Recharge Interest Forms adjacent to Bypass and within County GSA.
Chowchilla	**Eastside**	Section 215 Water	Contract with USBR	Madera Canal/ Chowchilla WD	Recharge Interest Forms adjacent to CWD but within County GSA.
Madera	**Westside**	Eastside/ Chowchilla Bypass	Appropriative Water Rights(s) held by Madera County	Eastside/ Chowchilla Bypass	WR POU's, Recharge Interest Forms adjacent to Bypass and within County GSA.
Madera	**Eastside**	Section 215 Water	Contract with USBR	Madera Canal/ Madera ID	Recharge Interest Forms adjacent to MID, but within County GSA.

3.0 - Recharge Project Concepts and Criteria

Recharge concepts proposed for the Recharge Program can generally be categorized as dedicated recharge basins or Flood-MAR. Both concepts are described below in more detail.

Dedicated recharge basin concepts generally include an impoundment constructed from site-sourced earth that would be excavated and compacted to create the embankments. Water diversion and conveyance infrastructure will be constructed to fill the basin and enable recharge through gravity percolation. Dedicated recharge basins would be permanent features and vary in size (area and volume) depending on land availability, water availability, site soil conditions, and other criteria to be identified during the preliminary design phases.

[1] Use of District facilities is subject to available capacity and the discretion of their respective governing body.

Flood-MAR concepts include diversion and distribution infrastructure to facilitate interconnection with existing irrigation systems or water conveyance infrastructure to deliver surface water to lands for direct application and continuous recharge for defined periods of time. No significant earthwork other than for construction of the diversion and conveyance works was assumed to be required.

Each Project or Project Area includes one or more monitoring wells to assess recharge performance.

Table 2 includes basic design criteria assumed for development of conceptual projects.

Table 2. Preliminary design criteria used to prepare Project cost estimates.

Criteria	Value	Source
Recharge rate	0.35 Acre-feet per Acre per Day	LSCE, Preliminary Recharge Potential Assessment
Diversion Duration	50 days	Approximated from water supply availability analysis and TTWD WR Application
POD Flow Capacity	20 cubic feet per second (CFS)	Per Prop 68 10% Designs
Target Recharge Volume (1 in 3 Years)	79,200 AF (Chowchilla SB) 114,150 AF (Madera SB)	Per Madera County GSA 2020 GSP

4.0 - Cost Estimating Approach

Preliminary estimates of project costs were developed using both analogous and parametric cost estimating methods based on the 10% Designs and associated cost estimates for similar projects concepts prepared by the DE team for the County's Proposition 68 grant application (Appendix B) in early 2021. In some cases, total component costs (e.g., Pump Station) from the grant application were used directly assuming similar infrastructure would be constructed for other projects of similar type and objective. In other cases, unit costs from the grant application were used and applied to quantities specific to the projects. The project costs noted herein represent order of magnitude cost estimates and will be updated as part of subsequent design efforts to reflect final project components and materials costs at the time.

1. Project Elements and Quantities

- **Points of Diversion** – The total number of PODs required was estimated by dividing the total target recharge volume for each subbasin by the volumetric capacity of each POD. POD capacity was based on the preliminary design criteria for diversion flow capacity and diversion duration.
- **Recharge Project Type** – Assumed that approximately 20% (1 in 5) of PODs supply recharge basins and the remainder supply Flood-MAR systems.
- **Diversion Infrastructure**
    - Bypass Diversion – All diversions from the Bypass were assumed to be pumped using permanent or semi-permanent pumps. Pump stations include fish screens.
    - MID/CWD Canal Diversion – Diversions from the MID/CWD canals were assumed to be made under gravity flow with a standard District turnout design being used to regulate flow. Standard turnouts are typically a concrete structure with a canal gate.
- **Flow Measurement** – All diversions would include flow measurement at the point of diversion to enable regulation and management. Magnetic flow meters were assumed for all PODs.

- **Recharge Area –** Exact locations were not identified as part of these preliminary cost estimates, but rather general regions or groupings of parcels. Future design phases will identify the specific project areas.
    - Dedicated Recharge Basins – All dedicated recharge basins were assumed to be 30-40 acres and have an operating depth of approximately 6 feet.
    - Flood-MAR - The Prop. 68 project was designed to serve an area sized so that only 25% to 50% of the total area is required to recharge the water diverted. This assumed that some land will not be available in some years due to cropping, farming practices, landowner preference, or other constraints. The specific multiplier used for each project concept included in this preliminary design phase was based on professional judgement.
- **Pipeline Sizing** – All pipelines were assumed to be 27” PVC PIP.
- **Pipeline Length**
    - Dedicated Recharge Basin PODs – Approximately 300 linear feet of pipe was assumed for each POD serving a dedicated recharge basin based upon the 10% Designs for the Prop. 68 grant projects. This assumes that the dedicated recharge basin will be located directly adjacent to the Bypass or canal.
    - Flood-MAR PODs – For diversions from the Bypass, the total pipeline length assumed required was estimated based upon the total Recharge Area (with multiplier) and assuming that approximately 9-15 linear feet of pipe was required per acre to serve the area. Approximately 15 linear feet per acre was required for the Prop. 68 grant design and therefore it was assumed that future projects would be similar in arrangement (field size, density, orientation, grower cooperation) with certain projects using less pipe based on professional judgement.
- **Pipeline Turnouts** – Grower turnouts were assumed to be included for pipelines in Flood-MAR projects. One turnout was assumed required for every 120 acres served by the pipeline. All turnouts would have an above-ground flow control valve and flow meter. To the extent possible, turnouts would be sited and designed for connection to existing landowner-installed irrigation systems or water conveyance facilitates such that these private facilitates can be used to distribute water for Flood-MAR purposes.

2. Unit Costs

Appendix B includes the 10% Design cost estimate developed for the Proposition 68 grant application.

Annual operations and maintenance costs (O&M) was estimated at 1.5% of the total capital cost (excluding land costs) based upon an itemized estimate prepared for the Proposition 68 project where O&M was estimated for each line item. For this exercise, O&M for mechanical pump and screening systems was estimated at 3% of the capital cost and all other items estimated at 1% of capital cost. On a project level, annual O&M costs totaled approximately 1.5% of total capital costs. In practice, average annual O&M may be lower than estimated due to non-operation during dry or water-short years. Operations and maintenance activities are anticipated to be generally completed by specialty service providers subcontracted by the County and/or underlying landowner(s).

Costs associated with management and administration of the recharge program include 1 full-time equivalent (FTE) Water Resource Specialist III staff for the duration of the Recharge Program implementation, including coordination, data collection, monitoring and reporting. Costs of subcontracted technical support services necessary for administration of the Recharge Program was assumed at 500 hours per year at an average rate of $150 per hour for technical analysis and performance-monitoring support, legal support, contractual and labor compliance support during construction. Total annual Recharge Program administration costs are estimated to be approximately $225,000 (Table 3). Administration of engineering contracts, construction contracts, and management of grant funding agreements was included as approximately 10% of the estimated capital construction costs for each project and was not included as a Recharge Program cost.

Table 3. Summarized estimate of annual costs to administer the Recharge Program by County staff and external support services. Costs associated with implementation of individual projects are included in the project cost estimates.

	Fiscal Year Costs (Typical)
Water Resources Specialist III (1 FTE)	*$122,044.00*
Management (0.1 FTE)	*$27,900.00*
External Technical Staff	*$75,000.00*
Total	**$224,944.00**

Program Administration costs are presented in this TM as a constant annual cost for the duration, but costs may be lower in earlier years and increase as the Recharge Program scales. O&M and Administration Costs may also be greater in wet years when water is available for diversion and recharge. O&M and Program Administration costs would be expected to continue beyond 2030 for each year of project operation.

Water supply and acquisition costs were estimated for projects slated to use USBR Section 215 for recharge water (Chowchilla Project 5 and Madera Project 1) and account for USBR's Conveyance, Marketing, Restoration, and Friant Surcharge rates based on the 2020 CVP Rate Setting Manual. An estimate of potential MID District wheeling costs were also included.

5.0 - Summary of Recharge Potential and Costs by Subbasin

A series of PODs were packaged together to create five (5) Projects, including Project 1 which was submitted for funding through the 2021 Proposition 68 opportunity. Project implementation was anticipated to be phased over time to facilitate design and construction between 2022 and 2026. Total volumes estimated to be recharged by each project and the estimated water was estimated and is summarized in Table 4 for the Chowchilla Subbasin.

Table 4. Recharge Potential and Water Source for Proposed Projects in the Chowchilla Subbasin.

	Total Annual Recharge Volume in Wet Years (35%)		Recharge Volume by Source and Water Rights Applicant, AF (2)		
			Chowchilla/Eastside Bypass		
Projects	**Volume Provided by Concept Projects**	**Recharge Project Area, Acres (1)**	**TTWD (3)**	**Madera Co.**	**USBR Contract for Section 215 water**
Project 1— 2021 Prop 68 Grant	*8,294*	*1,250*	*8,294*	*0*	*0*
Project 2	*14,244*	*2,267*	*14,244*	*0*	*0*
Project 3	*16,048*	*1,493*	*16,048*	*0*	*0*
Project 4	*21,998*	*2,999*	*0*	*21,998*	*0*
Project 5	*19,449*	*1,285*	*0*	*10,097*	*9,352*
TOTALS	**80,033**	**9,294**	**38,586**	**32,095**	**9,352**

1 Includes the total Flood-MAR area available for recharge.
2 Water right applications are currently pending or will be applied for by Madera County or other agencies.
3 Diversion volumes shown are net of diversions to TTWD GSA.

The proposed infrastructure components for Projects 1-5 for the Chowchilla Subbasin and the associated capital and O&M costs are shown in Table 5. Private landowners were assumed to provide the land for dedicated recharge basins and associated construction at no cost to the County. For the purposes of this TM, no grant funding was assumed for Projects 2-5[2] due to the uncertainty in the availability of funding opportunities and recognizing that all grant opportunities are competitive and cannot be guaranteed.

Table 5. Project component and cost summary for the Chowchilla Subbasin. Total Project Cost include planning, engineering and design, grant/project administration, monitoring and reporting, and construction management.

	Preliminary Infrastructure Counts				Estimated Project Cost by Potential Funding Source (millions)			Estimated Annual O&M	
Project	**PODs**	**Basins**	**Pipeline (LF)**	**Estimated Total Project Cost (millions)**	**Grants**	**Madera County GSA**	**Landowner Funding**	**Infrastructure**	**Water Supply/ Acquisition**
1	*4*	*2*	*18,750*	*$6.90*	*$4.20*	*$0.86*	*$1.85*	*$35,900*	*$0.00*
2	*7*	*2*	*34,005*	*$17.30*	*$0*	*$15.21*	*$2.09*	*$93,100*	*$0.00*
3	*8*	*1*	*22,395*	*$14.09*	*$0*	*$12.75*	*$1.34*	*$95,100*	*$0.00*
4	*11*	*1*	*44,985*	*$22.93*	*$0*	*$21.45*	*$1.48*	*$147,200*	*$0.00*
5	*5*	*1*	*19,275*	*$14.26*	*$0*	*$12.94*	*$1.32*	*$64,000*	*$645,000*
TOTALS	**35**	**7**	**139,410**	**$75.48**	**$4.20**	**$63.21**	**$8.07**	**$435,300**	**$645,000**

Similar to the Chowchilla Subbasin above, Table 6 provides the phased Project implementation plan with associated recharge volumes and sources for the Madera Subbasin.

Table 6. Recharge Potential and Water Source for Proposed Projects in the Madera Subbasin.

	Total Annual Recharge Volume in Wet Years (35%)		Recharge Volume by Source and Water Rights Applicant, AF (2)		
			Chowchilla/Eastside Bypass		
Projects	**Volume Provided by Concept Projects**	**Recharge Project Area, Acres (1)**	**TTWD (3)**	**Madera Co.**	**USBR Contract for Section 215 water**
Project 1— 2021 Prop 68 Grant	11,150	*1,200*	*0*	*0*	*11,150*
Project 2	28,129	*4,830*	*2,975*	*25,154*	*0*
Project 3	26,145	*3,910*	*0*	*26,145*	*0*
Project 4	24,162	*3,521*	*0*	*24,162*	*0*
Project 5	25,965	*3,386*	*0*	*25,965*	*0*
TOTALS	115,550	**16,847**	**2,975**	**101425**	**11,150**

1 Includes the total Flood-MAR area available for recharge. Only 25%-50% of this area would be flooded at any one time during diversion.
2 Water right applications are currently pending or will be applied for by Madera County or other water agencies.
3 Diversion volumes shown are net of diversions to TTWD GSA.

[2] As of the date of this TM, Project 1 for both the Chowchilla and Madera subbasins have been awarded for funding through DWR's 2021 Proposition 68 SGM Grant Program Implementation and final funding agreements have been finalized.

Table 7 summarizes Project components and costs for the Madera Subbasin.

Table 7. Project component and cost summary for the Madera Subbasin. Total Project Cost include planning, engineering and design, grant/project administration, monitoring and reporting, and construction management.

	Preliminary Infrastructure Counts				Estimated Project Cost by Potential Funding Source (millions)			Estimated Annual O&M	
Project	**PODs**	**Basins**	**Pipeline (LF)**	**Estimated Total Project Cost (millions)**	**Grants**	**Madera County GSA**	**Landowner Funding**	**Infrastructure**	**Water Supply/ Acquisition**
1	*4*	*2*	*6,000*	*$6.57*	*$4.20*	*$0.71*	*$1.67*	*$43,300*	*$768,300*
2	*11*	*2*	*44,967*	*$26.55*	*$0.00*	*$24.38*	*$2.17*	*$187,500*	*$0*
3	*11*	*2*	*46,920*	*$26.58*	*$0.00*	*$24.41*	*$2.17*	*$175,100*	*$0*
4	*12*	*2*	*42,252*	*$25.62*	*$0.00*	*$23.48*	*$2.14*	*$159,600*	*$0*
5	*12*	*1*	*40,632*	*$24.91*	*$0.00*	*$23.46*	*$1.45*	*$170,900*	*$0*
TOTALS	**50**	**9**	**180,771**	*$110.23*	*$4.20*	*$96.43*	*$9.60*	*$736,400*	*$768,300*

6.0 - Project Implementation Schedule and Phasing

Due to the scope of the Recharge Program, Projects 1-5 for each subbasin are planned to be implemented over time and in phases to strategically align with assumed schedules for planning, design, water rights acquisition, and project financing. The proposed implementation schedule (Table 8) prioritizes recharge projects in the Chowchilla Subbasin Western Management Area to address subsidence more expediently in this area and further capitalize on existing water rights from the Bypass and project development that has already taken place.

Table 8. Proposed Project Phasing Plan for Chowchilla and Madera Subbasins. Color shading indicates projects that would occur simultaneously.

	Chowchilla Subbasin				Madera Subbasin			
	Planning/Design		Construction		Planning/Design		Construction	
PROJECT	Start Date	End Date	Start Date	End Date	Start Date	End Date	Start Date	End Date
Project 1	10/1/2021	12/1/2022	1/1/2023	12/1/2023	10/1/2021	12/1/2022	1/1/2023	12/1/2023
Project 2	9/1/2023	12/1/2024	1/1/2025	12/1/2025	1/1/2027	4/1/2028	5/1/2028	4/1/2029
Project 3	9/1/2023	12/1/2024	1/1/2025	12/1/2025	9/1/2027	12/1/2028	1/1/2029	12/1/2029
Project 4	1/1/2027	4/1/2028	5/1/2028	4/1/2029	5/28/2028	8/30/2029	9/1/2029	8/1/2030
Project 5	9/1/2027	12/1/2028	1/1/2029	12/1/2029	5/28/2028	8/30/2029	9/1/2029	8/1/2030

The following assumptions were made in developing the phasing schedule.

1. The TTWD/CWD water right permit will be approved by August 31, 2023, and recorded in 2025.
2. A Madera County water right permit will be submitted in early 2022 and approved five years later in 2027.
3. Madera County's petition to the USBR for a change to a place-of-use change for the Hidden Lakes Estates supply contract will be approved by August 31, 2022.

APPENDIX A

Project Overview Figures

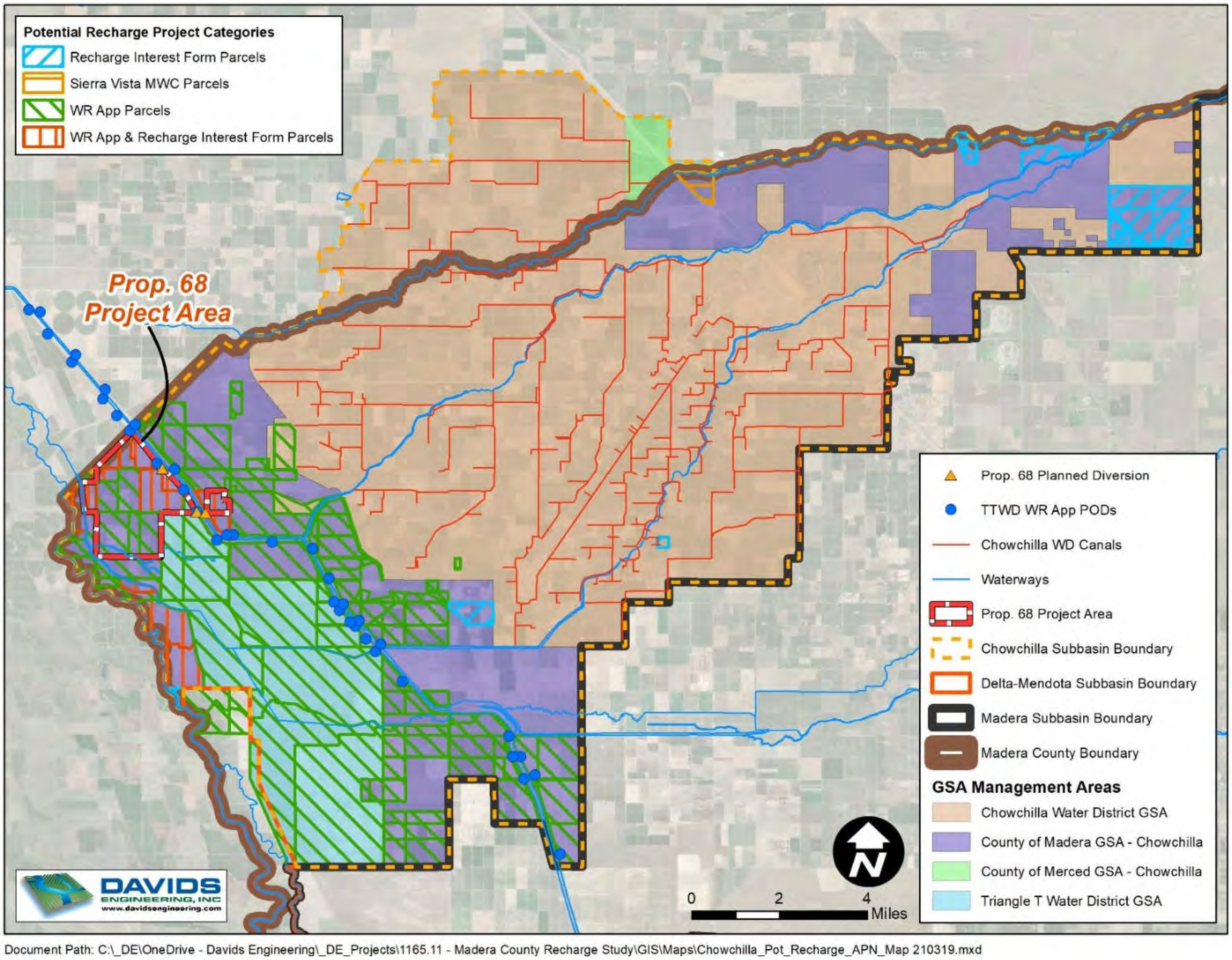

Figure 1. Chowchilla Subbasin map with GSAs, regional hydrology, CWD conveyances, and proposed project areas, including parcels identified in the Recharge Interest Forms and parcels in the TTWD WR application.

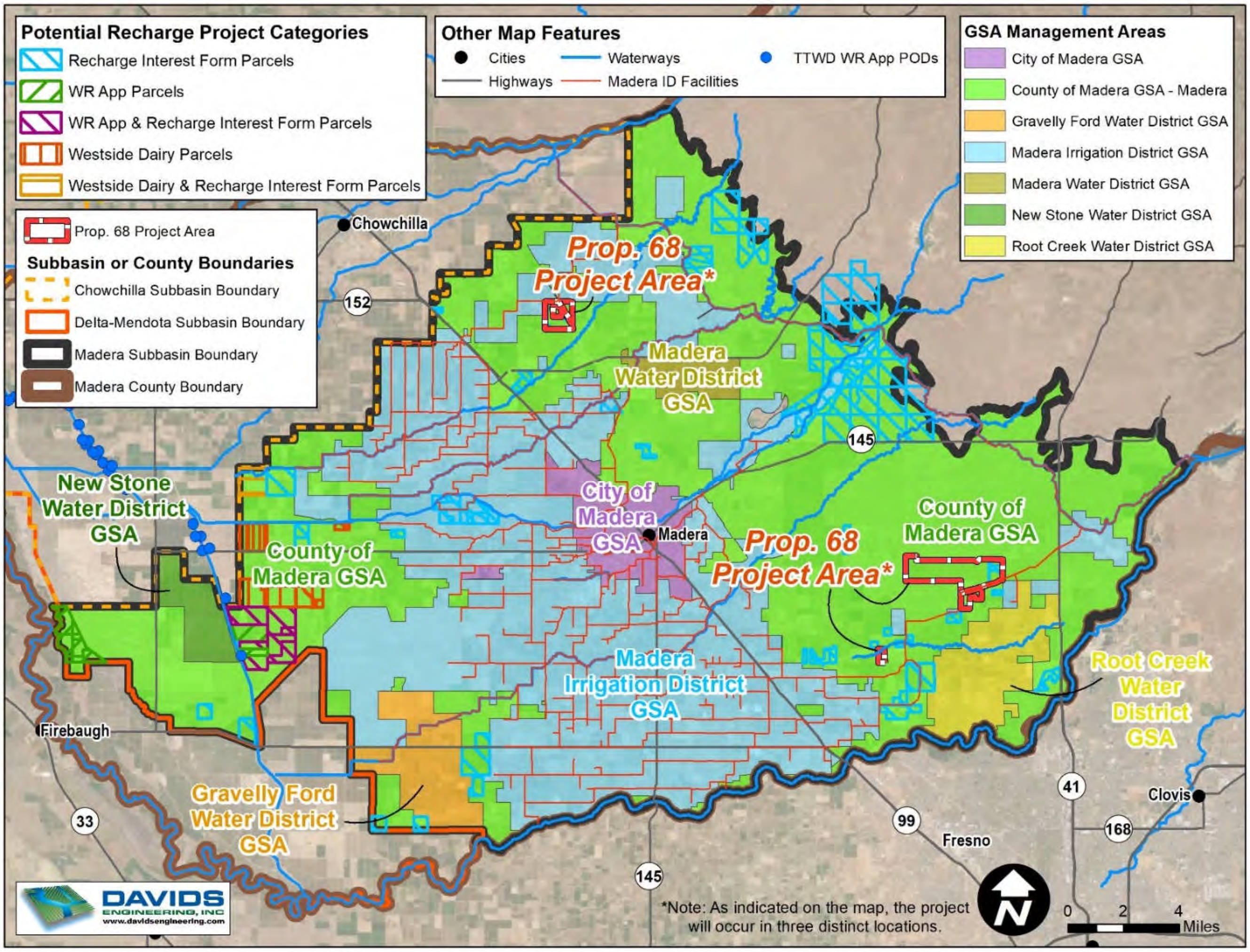

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Figure 2. Madera Subbasin map with GSAs, regional hydrology, MID conveyances, and proposed project areas, including parcels identified in the Recharge Interest Forms and parcels in the TTWD WR application.

APPENDIX B

Cost References

10% Design Cost Estimates prepared for the 2021 Proposition 68 Grant Opportunity

APPENDIX A

To

Attachment 4 of Grant Proposal for the Eastside Bypass Recharge for Subsidence and Flood Risk Reduction Project Phase 1

Cost Documentation

Applicant: Madera County Groundwater Sustainability Agency

Chowchilla Subbasin

CONTENTS:

Madera County GSA - Round I DWR Proposition 68 Implementation Grant

CHOWCHILLA SUBBASIN PROJECT COST
January 7, 2021
Unit Costs provided by Provost and Pritchard, Water and Land Solutions, Luhdorff & Scalmanini
All totals rounded to the nearest one-thousand dollars

10% Design Preliminary

Budget Category Assignment	Item No.	Item Description	QTY	Unit	Unit Price	Amount	Requested Grant Amount	Local Cost Share: Non-State Fund Source	Total Cost	% Local Cost Share
	A . POD #25 and #27 Pipeline									
	Item No.	**Item Description**	**QTY**	**Unit**	**Unit Price**	**Amount**				
c	1	Clear and Grub	1	LS	$ 5,000	$ 5,000	$ 5,000	$ -	$ 5,000	0%
c	2	F&I 20 CFS Fish Screen	2	EA	$ 80,000	$ 160,000	$ 160,000	$ -	$ 160,000	0%
c	3	F&I 20 CFS Pumps and Electrical [1]	2	EA	$ 250,000	$ 500,000	$ -	$ 500,000	$ 500,000	100%
c	4	F&I 27" PVC PIP SDR 51	18,800	LF	$ 80	$ 1,504,000	$ 1,504,000	$ -	$ 1,504,000	0%
c	5	Shoring, Sheeting, and Bracing	1	EA	$ 12,000	$ 12,000	$ 12,000	$ -	$ 12,000	0%
c	6	F&I 24" Magnetic Flow Meter	2	EA	$ 15,000	$ 30,000	$ 30,000	$ -	$ 30,000	0%
c	7	F&I 12" Grower Turnouts and Appurtenances	10	EA	$ 15,000	$ 150,000	$ 150,000	$ -	$ 150,000	0%
c	8	F&I 12" Magnetic Flow Meters	10	EA	$ 8,000	$ 80,000	$ 80,000	$ -	$ 80,000	0%
					Total	**$ 2,441,000**	**$ 1,941,000**	**$ 500,000**	**$ 2,441,000**	**20%**
	B. POD #22 Pipeline and Recharge Basin - Haynes Parcel									
	Item No.	**Item Description**	**QTY**	**Unit**	**Unit Price**	**Amount**				
c	1	Clear and Grub	1	LS	$ 5,000	$ 5,000	$ 5,000	$ -	$ 5,000	0%
c	2	F&I 20 CFS Pump and Electrical [1]	1	EA	$ 250,000	$ 250,000	$ -	$ 250,000	$ 250,000	100%
c	3	Inlet Structure	1	EA	$ 36,000	$ 36,000	$ 36,000	$ -	$ 36,000	0%
c	4	Fish Screen	1	LS	$ 80,000	$ 80,000	$ 80,000	$ -	$ 80,000	0%
c	5	F&I 27" PVC PIP SDR 51	1,600	LF	$ 80	$ 128,000	$ 128,000	$ -	$ 128,000	0%
c	6	F&I 24" Magnetic Flow Meter	1	EA	$ 15,000	$ 15,000	$ 15,000	$ -	$ 15,000	0%
c	7	Earthwork (Approximately 30 acre basin)	42,000	CY	$ 6.5	$ 273,000	$ 273,000	$ -	$ 273,000	0%
c	8	Shoring, Sheeting, and Bracing	1	EA	$ 12,000	$ 12,000	$ 12,000	$ -	$ 12,000	0%
					Total	**$ 799,000**	**$ 549,000**	**$ 250,000**	**$ 799,000**	**31%**
	C. POD #24 Recharge Basin - Vlot Parcel									
	Item No.	**Item Description**	**QTY**	**Unit**	**Unit Price**	**Amount**				
c	1	Clear and Grub	1	LS	$ 5,000	$ 5,000	$ 5,000	$ -	$ 5,000	0%
c	2	F&I 20 CFS Pump and Electrical [1]	1	EA	$ 250,000	$ 250,000	$ -	$ 250,000	$ 250,000	100%
c	3	Inlet Structure	1	EA	$ 36,000	$ 36,000	$ 36,000	$ -	$ 36,000	0%
c	4	Fish Screen	1	LS	$ 80,000	$ 80,000	$ 80,000	$ -	$ 80,000	0%
c	5	F&I 27" PVC PIP SDR 51	300	LF	$ 80	$ 24,000	$ 24,000	$ -	$ 24,000	0%
c	6	F&I 24" Magnetic Flow Meter	1	EA	$ 15,000	$ 15,000	$ 15,000	$ -	$ 15,000	0%
c	7	Earthwork (Approximately 32 acre basin)	44,000	CY	$ 6.5	$ 286,000	$ 286,000	$ -	$ 286,000	0%
					Total	**$ 696,000**	**$ 446,000**	**$ 250,000**	**$ 696,000**	**36%**
	D. Groundwater Level Monitoring									
	Item No.	**Item Description**	**QTY**	**Unit**	**Unit Price**	**Amount**				
d	1	Single Shallow Completion, Single Sites	0	LS	$ 44,960	$ -	$ -	$ -	$ -	
d	2	Single Shallow Completion, Three Sites	0	LS	$ 129,355	$ -	$ -	$ -	$ -	
d	3	Deep Dual Completion, Single Site	1	LS	$ 69,820	$ 70,000	$ 70,000	$ -	$ 70,000	0%
d	4	Deep Dual Completion, Three Sites	0	LS	$ 209,680	$ -	$ -	$ -	$ -	
					Total	**$ 70,000**	**$ 70,000**	**$ -**	**$ 70,000**	**0%**
					Subtotal of Elements	**$ 4,006,000**	**$ 3,006,000**	**$ 1,000,000**	**$ 4,006,000**	**25%**
	INDIRECT									
c	1	Mobilization/Demobilization, Bonds, Insurance, permits[2]			3.5%	$ 105,210	$ 105,210	$ -	$ 105,210	0%
c	2	Worker and Public Protection [2]			1.00%	$ 30,060	$ 30,060	$ -	$ 30,060	0%
					Contract Cost	**$ 4,141,270**	**$ 3,141,270**	**$ 1,000,000**	**$ 4,141,270**	**24%**
c	3	Construction Contingencies [2]			10%	$ 314,127	$ 314,127	$ -	$ 314,127	0%
					Field Cost	**$ 4,455,397**	**$ 3,455,397**	**$ 1,000,000**	**$ 4,455,397**	**22%**
b	4	Planning/Design/Environmental[3]			15.0%	$ 668,310	$ 603,310	$ 65,000	$ 668,310	10%
		Task 1. Data Gathering					0%	15%	*$ 9,750*	
		Task 2. Evaluation Criteria Development and Recharge Area Screening					0%	20%	*$ 13,000*	
		Task 3. Project Concept and Design Criteria Development					0%	10%	*$ 6,500*	
		Task 4. Permitting and Consultation Requirements					0%	5%	*$ 3,250*	
		Task 5. Initial Envirnomental Fatal Flaws Analysis					0%	10%	*$ 6,500*	
		Task 6. 10% Design and Financial Analysis					0%	40%	*$ 26,000*	
		Task 7. 30% Design					10%	0%	*$ 60,331*	
		Task 8. 60% Designs					30%	0%	*$ 180,993*	
		Task 9. Environmental Compliance and Permitting					*50%*	0%	*$ 301,655*	
		Task 10. Final Design					10%	0%	*$ 60,331*	
c	5	Construction Management [3]			10%	$ 445,540	$ 445,540	$ -	$ 445,540	0%
		Task 1. Bid/Award					10%	0%	*$ 44,554*	
		Task 2. Pre-Construction					5%	0%	*$ 22,277*	
		Task 3. Construction					75%	0%	*$ 334,155*	
		Task 4, Construction Contract Close-out					10%	0%	*$ 44,554*	
d	6	Monitoring and Assessment [3]			1.0%	$ 44,553.97	$ 44,554	$ -	$ 44,554	0%
		Task 1. Performance Monitoring					75%	0%	*$ 33,415*	
		Task 2. Final Report					25%	0%	*$ 11,138*	
e	7	Stakeholder Outreach/Education [3]			0.5%	$ 22,277	$ 22,277	$ -	$ 22,277	0%
		Task 1. Stakeholder Design Review Workshop					80%	0%	*$ 17,822*	
		Task 2. Public Education					20%	0%	*$ 4,455*	
					Subtotal	**$ 1,180,680**	**$ 1,115,680**	**$ 65,000**	**$ 1,180,680**	**6%**
a	8	Grant Administration[4]			9.2%	$ 420,539	$ 420,539	$ -	$ 420,539	0%
c	9	Land/Easement Acquisition and Access Agreem	71	AC	$ 12,000.00	$ 847,581	$ -	$ 847,581	$ 847,581	100%
					Project Cost	**$ 6,904,197.58**	**$ 4,991,616**	**$ 1,912,581**	**$ 6,904,198**	**28%**

Notes

1 Landowners, water district, or others to supply pumping equipment as local cost share
2 Calculated as a percentage of total requested grant amount for Items A-D
3 Calculated as a percentage of total Project Field Cost.
4 Calculated as a percentage of the Requested Grant Funds for Field Cost and Indirect Items 4-7

Prepared by Davids Engineering
T. Ostrowski, PE
1/7/2021

PROVOST & PRITCHARD CONSULTING GROUP — An Employee Owned Company

12/16/2020

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

Draft

CLAYTON WATER DISTRICT
BLECH DIVERSION

Item No.	Item Description	Quantity	Unit	Unit Price	Amount
	General				
1	Mobilization/Demobilization, Bonds and Insurance and Permits[4] (3%)	1	LS	$ 72,000	$ 72,000
2	Worker and Public Protection[5] (1%)	1	LS	$ 24,000	$ 24,000
3	SWPPP and DCP[5] (1%)	1	LS	$ 24,000	$ 24,000
				Subtotal	**$ 120,000**
	Blech Diversion - Pump station & Pipeline				
4	F&I 20 CFS Fish Screen	2	EA	$ 80,000	$ 160,000
5	F&I 20 CFS Temporary Pumps (To be Supplied by Land Owner)	2	EA	$ 60,000	$ -
6	F&I 27" PVC PIP SDR 51 (80 PSI)	21,400	LF	$ ~~88~~	$ 1,892,000
7	F&I 24" Magnetic Flow Meter	2	EA	$ 15,000	$ 30,000
				Subtotal	**$ 2,082,000**
	Turnout				
8	F&I 12" Grower Turnouts and Appurtenances	15	EA	$ 15,000	$ 225,000
9	F&I 12" Magnetic Flow Meter	15	EA	$ ~~7,000~~	$ 105,000
				Subtotal	**$ 330,000**
				CONSTRUCTION SUBTOTAL	**$ 2,532,000**
	NON-CONSTRUCTION				
10	Survey, Engineering, and Design	1	LS	$ 177,240	$ 177,240
11	Construction Supervision	1	LS	$ 177,240	$ 177,240
12	Direct Permitting Costs	1	LS	$ 100,000	$ 100,000
13	Environmental Documentation	1	LS	$ 250,000	$ 250,000
				NON-CONSTRUCTION SUBTOTAL	**$ 704,480**
				TOTAL	**$ 3,236,480**

Revised to $80/LF

Revised to $8000 per revised supplier quote

Notes:
1. This estimate represents the opinion of probable cost based on the engineer's experience with prior projects, Caltrans Bids and cost sources such as RS Means.
2. Totals rounded to the nearest one-thousand dollars.
3. The cost for the temporary pumps is noted as a potential cost share for the project.
4. Valued at approximately 3% of construction cost items.
5. Valued at approximately 1% of construction cost items.

Clayton WD - Blech Pipeline									
Item	Qty	Unit	List Price	Taxes	Labor	Markup	Contingency	Unit Price	Amount
20 cfs Fish Screen	2	EA	$ 43,000.00	10%	40%	15%	20%	**$ 80,000**	**$ 160,000**
27" SDR41 PVC PIP	18,800	LF	$ 44.09	10%	36%	15%	20%	**$ 80**	**$ 1,504,000**
24" Ultra Mag Flow Meter	1	EA	$ 9,637.00	10%	10%	15%	20%	**$ 15,000**	**$ 15,000**
12" Ultra Mag Flow Meter	1	EA	$ 4,920.00	10%	10%	15%	20%	**$ 8,000**	**$ 8,000**
27" Saddle Connection for Turnout	1	EA	$ 740.00	10%	20%	15%	20%	-	**$ 2,000**
12" x 4" saddle for Air Vent	1	EA	$ 156.00	10%	20%	15%	20%	-	**$ 1,000**
12" Steel Pipe	40	LF	$ 34.95	10%	20%	15%	20%	-	**$ 3,000**
4" Air vent-Continuous Acting	2	EA	$ 308.00	10%	20%	15%	20%	-	**$ 2,000**
12" Butterfly Valve w/extension	1	EA	$ 979.00	10%	20%	15%	20%	-	**$ 2,000**
12" Butterfly Valve	1	EA	$ 712.00	10%	20%	15%	20%	-	**$ 2,000**
12" Pipe Support	2	EA	$ 315.16	10%	20%	15%	20%	-	**$ 2,000**
12" Blind Flange	1	EA	$ 462.63	10%	10%	15%	20%	-	**$ 1,000**
									$ 15,000

Grower Turnout and appurtenances

Notes

1.) All cost were rounded up to the nearest $1,000.

2.) The fish Screen cost was interpolated from a similar project that had a 35 cfs fish screen.

Intake Screens, Inc.
(916) 665-2727
8417 RIVER ROAD
SACRAMENTO, CA 95832

1. PRICING

The following lump sum price includes all system equipment and project services outlined below and drawn in accompanying renderings. Quote excludes sales tax, any bonding requirements, and general contractor services

SYSTEM EQUIPMENT:

ITEM	DESCRIPTION	QTY
1	C168-48 CONE SCREEN UNIT: Refurbished 14-foot diameter at base cone screen unit with hydraulic or electric drive system for automatic brush cleaning. Screen unit fabricated entirely from type 304 stainless steel with exception of 6-12 nylon brushes and drive assembly. Screen material fabricated from #69V wedgewire with 1.75 mm (0.069-inch) slots for 50% open area.	1
2	CUSTOM CONE SCREEN BASE & INTALKE PIPE: Epoxy coated carbon steel screen base designed to seal to and support the 14-foot cone screen unit. Base to include an 18" inlet pipe (maximum of 10-feet) with an 18-inch flange connection to flexible intake pipe. Base to be designed to set on the bed of the river channel and be equipped with lifting provisions for delivery and installation.	1
3	CONTROLS: control panel to be designed for both automatic and manual control of screen cleaning operation. Power source for control panel and screen unit drive assembly to be determined.	1
	LUMP SUM PRICE:	$75,000.00

Cost reduced for 20 cfs turnout, (20cfs/ 35cfs), then rounded up.

PROJECT SERVICES:

In addition to providing the above noted equipment, the following project services are included.

- PROJECT SERVICES: design consultation, engineering analysis, submittals, factory acceptance testing, and Owner's Operation & Maintenance Manual.
- DELIVERY: Transport of all system components from ISI's manufacturing facility in Sacramento, CA to the site for offloading by the Owner or Contractor.
- INSTALLATION ASSISTANCE: ISI to play an advisory role to Contractor during installation to ensure that the system is installed and operated to our satisfaction. This excludes any heavy onsite lifting of equipment. ISI to be available to make all adjustments necessary once the system is installed.
- SYSTEM COMMISIONING AND TRAINING: ISI to conduct system startup, testing, and training for Owner's personnel to operate screen system.
- WARRANTY: ISI to provide a one year warranty beginning on system commissioning date or beginning three years after system delivery, whichever comes first.

2. FEATURES

C168-48 CONE SCREEN UNIT:

- Complies with regulatory criteria
- Powerful automatic and manual brush cleaning capability.
- Conical design provides large screen surface area in shallow water applications.
- Internal flow baffle evenly distributes flow of water across wedgewire surface.

(916) 665-2727
8417 RIVER ROAD
SACRAMENTO, CA 95832

- Minimal power required; system can operate on standard line voltage or solar power.
- Robust stainless steel fabrication.

CONE SCREEN BASE AND INTAKE PIPE:

- Low profile intake plenum to reduce overall height.
- Base designed to set on riverbed for ease of installation for a temporary screening system.

3. COMPARABLE PROJECT

GG Farms, QTY 1 C144-41HA Cone Screen Unit

GG Farms, QTY 1 C144-41HA Cone Screen Unit

Item No. 3

FERGUSON WATERWORKS

FERGUSON #3303 (FRESNO)
2812 S ORANGE AVE
FRESNO, CA 93725-1922

Phone: 559-442-3333
Fax: 559-266-0858

Deliver To:
From: **Faustin Medina**
Comments:

15:20:07 OCT 14 2020

FERGUSON WATERWORKS #1423
Price Quotation
Phone: 559-442-3333
Fax: 559-266-0858

Bid No: B406540
Bid Date: 10/14/20
Quoted By: FFM

Cust Phone: 559-442-3333
Terms: CASH ON DEMAND

Customer: CASH SALES #3303
2812 S ORANGE AVE
FRESNO, CA 93725-1922

Ship To: CUSTOMER PICK-UP

Cust PO#: 27" SDR41

Job Name: PP ENGINEERING

Item	Description	Quantity	Net Price	UM	Total
PT-PVCPIPETERMS	PVC PIPE PRICE IS VALID FOR 30/30. 30 DAYS FROM BID DATE AND 30 DAYS UPON RECEPTION OF ORDER. PRICING IS SUBJECT TO CHANGE BASED ON AVAILABILITY AT TIME OF DELIVERY ORDERED ON: ---- PT-PVCPIPETERMS	1		EA	0.00
SP-SDR41IP2720	27X20 SDR41 100# PVC GJ PIP PIPE	1300	44.088	FT	57314.40

List Price

Net Total:	$57314.40
Tax:	$4570.82
Freight:	$0.00
Total:	$61885.22

Quoted prices are based upon receipt of the total quantity for immediate shipment (48 hours). SHIPMENTS BEYOND 48 HOURS SHALL BE AT THE PRICE IN EFFECT AT TIME OF SHIPMENT UNLESS NOTED OTHERWISE. QUOTES FOR PRODUCTS SHIPPED FOR RESALE ARE NOT FIRM UNLESS NOTED OTHERWISE.

CONTACT YOUR SALES REPRESENTATIVE IMMEDIATELY FOR ASSISTANCE WITH DBE/MBE/WBE/SMALL BUSINESS REQUIREMENTS.

Seller not responsible for delays, lack of product or increase of pricing due to causes beyond our control, and/or based upon Local, State and Federal laws governing type of products that can be sold or put into commerce. This Quote is offered contingent upon the Buyer's acceptance of Seller's terms and conditions, which are incorporated by reference and found either following this document, or on the web at https://www.ferguson.com/content/website-info/terms-of-sale
Govt Buyers: All items are open market unless noted otherwise.

LEAD LAW WARNING: It is illegal to install products that are not "lead free" in accordance with US Federal or other applicable law in potable water systems anticipated for human consumption. Products with *NP in the description are NOT lead free and can only be installed in non-potable applications. Buyer is solely responsible for product selection.
WATER FLOW RATE NOTICE: Lavatory Faucets with flow rates over 0.5 GPM are not allowed for 'public use' in California.

HOW ARE WE DOING? WE WANT YOUR FEEDBACK!
Scan the QR code or use the link below to
complete a survey about your bids:
https://survey.medallia.com/?bidsorder&fc=3303&on=425103

Item No. 4

Line #:	Item Number:	Description:	Qty:	UM:	List Price:	Disc:	Net Price:	Ext. Price:
6.000	UM06-24	24" ULTRA MAG, 150# AC or DC Powered converter Dual 4-20mA Outputs Four programmable digital outputs 25' Remote Mount cable, or directly-mounted converter (Additional cable is $3.28/ft up to 500') SS316 Electrodes SS Body Carbon Steel Class D Flanges (2) SS Grounding Rings See specification sheet for detailed information Manufacturing lead time is up to 30 working days once ordered.	1	EA	$9,637.00			

Item No. 6

Please note that freight costs are not included in this quote.

Line #:	Item Number:	Description:	Qty:	UM:	List Price:	Disc:	Net Price:	Ext. Price:
1.000	UM06-12	12" ULTRA MAG, 150#	1	EA	$4,920.00			

AC or DC Powered converter
Dual 4-20mA Outputs
Four programmable digital outputs
25' Remote Mount cable, or directly-mounted converter (Additional cable is $3.28/ft up to 500')
SS316 Electrodes
SS Body
Carbon Steel Class D Flanges
(2) SS Grounding Rings
See specification sheet for detailed information
Manufacturing lead time is up to 10 working days once ordered.

Item No. 5

Miguel Jimenez

From:	Ed Morrill <ed@morrill-industries.net>
Sent:	Tuesday, November 24, 2020 2:10 PM
To:	Miguel Jimenez
Subject:	RE: Budgetary Cost for Clamp on Saddles

Use $740.00

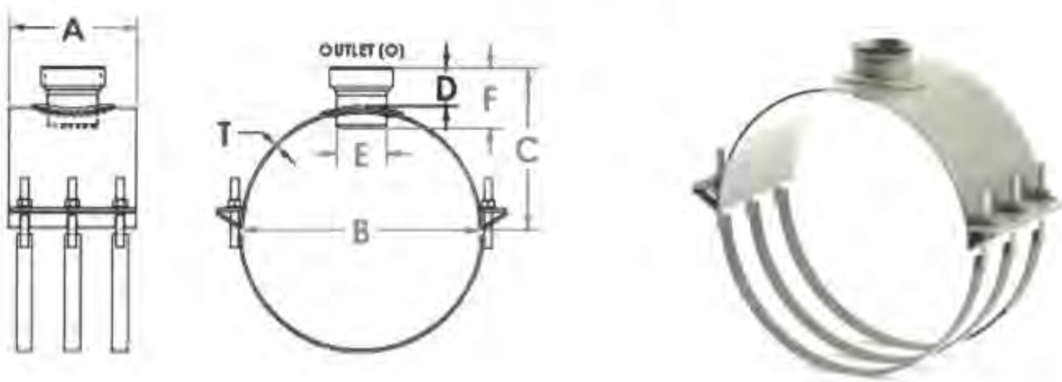
comparable cost for 27" x 12" saddle

From: Miguel Jimenez <MJimenez@ppeng.com>
Sent: Tuesday, November 24, 2020 1:55 PM
To: Ed Morrill <ed@morrill-industries.net>
Subject: Budgetary Cost for Clamp on Saddles

Hi Ed,
Any chance I could get a budgetary cost for a clamp on saddle? I'm looking for a 27" x 10" Flange , **Product Number 1096-279-10F.** If you have a product catalog with list pricing that you could provide that would be great.

Morrill Industries, Inc.

1096 Clamp On Saddles



Item No. 5

Epoxy Fittings

Saddles (Set Saddle x FT)

Bolts to Steel, PVC, IPS, PIP and OD sizes. Epoxy or Galvanized coating. Female or Male outlets. Includes gasket and hardware.

Saddle	Female Thread	Type	Part Number	Price
6"	3"	Epoxy	P1311-82	120.00
8"	3"	Epoxy	P1312-82	126.00
10"	3"	Epoxy	P1313-82	150.00
12"	3"	Epoxy	P1314-82	159.00
6"	4"	Epoxy	P1311-83	122.00
8"	4"	Epoxy	P1312-83	150.00
10"	4"	Epoxy	P1313-83	155.00
12"	4"	Epoxy	P1314-83	164.00
6"	3"	Galvanized	P1311-92	106.00
8"	3"	Galvanized	P1312-92	116.00
10"	3"	Galvanized	P1313-92	122.00
12"	3"	Galvanized	P1314-92	136.00
6"	4"	Galvanized	P1311-93	124.00
8"	4"	Galvanized	P1312-93	135.00
10"	4"	Galvanized	P1313-93	144.00
12"	4"	Galvanized	P1314-93	156.00

List Price

Saddle Risers (Set Saddle Riser x RV)

Bolts to Steel, PVC, IPS, PIP and OD sizes. Provides V-stub for valve opener connections. Epoxy or Galvanized coating. Includes gasket and hardware.

Saddle	Ringlock Valve	Type	Part Number	Price
6"	4"	Epoxy	P1320-85	192.00
8"	4"	Epoxy	P1323-85	210.00
10"	4"	Epoxy	P1326-85	226.00
12"	4"	Epoxy	P1329-85	250.00
6"	4"	Galvanized	P3586-85	210.00
8"	4"	Galvanized	P3672-85	214.00
10"	4"	Galvanized	P3670-85	218.00
12"	4"	Galvanized	P3671-85	224.00

Note: Standard riser height is 36", call for optional sizes.

Saddle Gasket

Type	Part Number	Price
4" Outlet	P2121-04	5.00
6" Outlet	P2121-05	7.00

Abbreviations
IF – Female Thread RV – Ringlock Valve Stub

PIERCE™ FITTINGS

Item No. 5

Re: C900 pipe

Valdez, Eddie <eddie@signatureirrigation.com>
To Miguel Jimenez

You replied to this message on 11/24/2020 1:19 PM.

34.95 ← List Price for 12" Steel Pipe

On Tue, Nov 24, 2020 at 11:29 AM Miguel Jimenez <MJimenez@ppeng.com> wrote:

> No worries Eddie, can you give me a cost on 12" Steel pipe instead.
>
> Thank you and happy thanks giving.
>
> Miguel

Item No. 5

Series 3500 *Model 35 Continuous Acting Air & Vacuum Relief*

The Series 3500 Continuous Acting Air Vent exhausts large volumes of trapped air from pipelines during line filling and continuously releases smaller amounts of entrapped air during system operation. Installed near pumps, on pressure boxes and near check valves, as well as high points and at the ends of lines.

Size	Part Number	Price
2"	F035-20000	218.00
3"	F035-30000	246.00
4"	F035-40000	308.00

List Price

Valve Parts

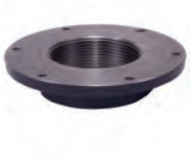
Aluminum Body

Size	Part Number	Price
2"	F035-30105	116.00
3"	F035-30105	116.00
4"	F035-40105	148.00

Shaft

Size	Part Number	Price
2"	F035-3050	5.80
3"	F035-3050	5.80
4"	F035-4050	5.80

Cast Iron Base

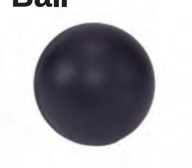


Size	Part Number	Price
2"	F035-20225	53.10
3"	F035-30225	68.10
4"	F035-40225	89.80

Ball Knob

Size	Part Number	Price
2"	F035-3035	4.10
3"	F035-3035	4.10
4"	F035-3035	4.10

Ball



Size	Part Number	Price
2"	F035-30128	74.80
3"	F035-30128	74.80
4"	F035-30128	74.80

Base Gasket

Size	Part Number	Price
2"	F035-3028	5.30
3"	F035-3028	5.30
4"	F035-4028	6.00

Ball Retainer

Size	Part Number	Price
2"	F035-3020	8.70
3"	F035-3020	8.70
4"	F035-4020	10.50

Studs & Nuts (Set)

Size	Part Number	Price
2"	F035-20155	10.50
3"	F035-20155	10.50
4"	F035-20155	10.50

Seal Disc

Size	Part Number	Price
2"	F035-30114	33.50
3"	F035-30114	33.50
4"	F035-40114	36.60

Item No. 5

Series 8500 *Grayline Butterfly Valves*

The Series 8500 Fresno Butterfly Valves are general purpose, in-line water control valves. Series 8500 Valves are effective for agricultural, industrial and specialty applications. Featuring Stainless Steel disc and Buna N liner, standard.

Valve Size	Lever Operated	Gear Operated w/ Handwheel	Gear Operated w/ 2" Sq Nut
2"	98.00 F085-020-05	163.00 F085-020-10	163.00 F085-020-12
2-1/2"	105.00 F085-025-05	165.00 F085-025-10	165.00 F085-025-12
3"	130.00 F085-030-05	194.00 F085-030-10	194.00 F085-030-12
4"	158.00 F085-040-05	219.00 F085-040-10	219.00 F085-040-12
5"	188.00 F085-050-05	264.00 F085-050-10	264.00 F085-050-12
6"	212.00 F085-060-05	289.00 F085-060-10	289.00 F085-060-12
8"	310.00 F085-080-05	398.00 F085-080-10	398.00 F085-080-12
10"	425.00 F085-100-05	514.00 F085-100-10	514.00 F085-100-12
12"	604.00 F085-120-05	712.00 F085-120-10	712.00 F085-120-12
14"	-	1,032.00 F085-140-10	1,032.00 F085-140-12
16"	-	1,384.00 F085-160-10	1,384.00 F085-160-12
18"	-	2,065.00 F085-180-10	2,065.00 F085-180-12
20"	-	2,835.00 F085-200-10	2,835.00 F085-200-12
24"	-	4,370.00 F085-240-10	4,370.00 F085-240-12
30"	-	6,288.00 F085-300-10*	6,288.00 F085-300-12*
36"	-	10,985.00 F085-360-10*	10,985.00 F085-360-12*

List Price for 12" B-Fly Valve

*Discs for 30" and 36" gear operated butterfly valves are nickel plated ductile iron.

$15 added for assembly of valves to extensions (2” – 12”).
$45 added for assembly of valves to extensions (14” and larger).

added cost for B/G Isolation Valve

Butterfly Stem Extensions

Valve Size	Extension Size 24"	36"	48"	60"	72"
2"- 6"	152.00 F084-E020-024	168.00 F084-E020-036	180.00 F084-E020-048	195.00 F084-E020-060	210.00 F084-E020-072
8"- 12"	185.00 F084-E080-024	200.00 F084-E080-036	216.00 F084-E080-048	234.00 F084-E080-060	252.00 F084-E080-072
14"- 16"	435.00 F084-E140-024	458.00 F084-E140-036	482.00 F084-E140-048	504.00 F084-E140-060	529.00 F084-E140-072
18"	589.00 F085-E180-024	598.00 F085-E180-036	624.00 F085-E180-048	688.00 F085-E180-060	728.00 F085-E180-072
20" - 24"	764.00 F085-E200-024	816.00 F085-E200-036	858.00 F085-E200-048	896.00 F085-E200-060	972.00 F085-E200-072

Note: Stem extensions for 30” & 36” butterfly valves are available upon request

Appendix A - Page 13

Item No. 5

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Pipe Fittings | Pipe Nipples | Flanges | Pipe | Tube Fittings | Sanitary | Valves | Supplies | Clearance | OEMs

Home - Supplies -

16" Adjustable Saddle Support Kit Hot Dip Galvanized

Empire Industries

$315.16

(No reviews yet) Write a Review

List Price

SKU:
012-428KTHDG1600

Weight:
47.50 LBS

Quantity:

1

ADD TO CART | ADD TO WISH LIST

Description

16" Adjustable Saddle Support Kit Hot Dip Galvanized

Empire Figure #428KTHDG

Related Products | Customers Also Viewed

2" Adjustable Saddle Support Kit Hot Dip Galvanized
$84.56
ADD TO CART

3" Adjustable Saddle Support Kit Hot Dip Galvanized
$88.99
ADD TO CART

4" Adjustable Saddle Support Kit Hot Dip Galvanized
$108.76
ADD TO CART

12" Adjustable Saddle Support Kit Hot Dip Galvanized
$148.30
ADD TO CART

16" Adjustable Saddle Support w/ U-Bolt Kit Hot Dip Galvanized
$341.56
ADD TO CART

Item No. 5

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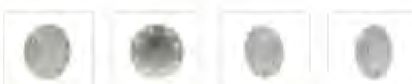
Home > Flanges > 150# Flanges – Stainless Steel > 12" Blind Flange 150# Raised Face (RF) 316/316L SS A/SA182



12" Blind Flange 150# Raised Face (RF) 316/316L SS A/SA182

$462.63

List Price

(No reviews yet) Write a Review

SKU:
60BL6L120

UPC:
671404050504

Availability:
Usually ships in 24 hours

Weight:
110.00 LBS

Quantity:
1

ADD TO CART | ADD TO WISH LIST

Description

12" Blind Flange 150# Raised Face (RF) Stainless Steel 316/316L A/SA182

Bolt Circle: 17"
Number of Bolt Holes: 12
Diameter of Bolts: 7/8"

Product Dimensions & Weights can be found on our Downloads page.

Related Products | Customers Also Viewed

Costs prepared by Water and Land Solutions, LLC

Dirk Vlot Recharge Pond (TTWD)
Preliminary Cost Estimate

Item	Quantity	Unit	Description	Unit Price	Amount
			Planning and Design		
1	1	LS	Environmental (5%)	$ 51,825	$ 51,825
2	1	LS	Legal (2%)	$ 20,730	$ 20,730
3	1	LS	Design (7%)	$ 72,555	$ 72,555
4	1	LS	Field Survey (1.5%)	$ 15,548	$ 15,548
5				Sub-total	$ 160,658
			Construction		
6	1	LS	Mobilization	$ 5,000	$ 5,000
7	1	LS	Clear and Grub	$ 5,000	$ 5,000
8	1	LS	Slant Pump (20 CFS)	$ 160,000	$ 160,000
9	1	LS	Inlet Structure	$ 36,000	$ 36,000
10	1	LS	Fish Screen	$ 75,000	$ 75,000
11	109,000	CY	Earthwork	$ 6.50	$ 708,500
12	1	LS	Shoring, Sheeting & Bracing	$ 12,000	$ 12,000
13	1	LS	PG&E	$ 35,000	$ 35,000
				Sub-total	$ 1,036,500
				TOTAL	**$ 1,197,158**

Unit costs used

Single Shallow Completion MW - Single Site					
Drilling Contractor Cost					
Item	Task	Units	Estimated Quantities	Unit Price	Total
1A	Mobilization	Lump Sum	1	$7,500	$7,500
2	Test Hole Drilling	Linear Foot	200	$25	$5,000
3	Geophysical Logging	Each	1	$2,070	$2,070
4	Borehole Reaming	Linear Foot	0	$15	$0
5A	Blank Monitoring Well Casing 2-inch Sch 40 PVC	Linear Foot	145	$7	$1,015
5B	Well Screen 2-inch Sch 40 PVC w/030' Slots	Linear Foot	50	$8	$400
6	Gravel Envelope and Intermediate Seals	Linear Foot	150	$25	$3,750
7	Annular Surface Seal	Linear Foot	50	$25	$1,250
8	Well Development	Each	1	$850	$850
9	Surface Completion - Above Ground	Each	1	$1,200	$1,200
10	Standby Time	Hour	0	$375	$0
11	Fluid/Cuttings Containment and Disposal	Each	1	$9,000	$9,000
12	Borehole Abandonment	Linear Foot	0	$9	$0
				Total Contractor Cost	**$32,035**

LSCE Cost	
Labor	$14,575
WQ	$2,000
Transducers	$1,000
Surveying	$1,950
Expenses	$900
Total LSCE Cost	**$20,425**
Grand Total	**$52,460**

Deep Dual Completion MW - Single Site					
Drilling Contractor Cost					
Item	Task	Units	Estimated Quantities	Unit Price	Total
1A	Mobilization	Lump Sum	1	$7,500	$7,500
2	Test Hole Drilling	Linear Foot	400	$25	$10,000
3	Geophysical Logging	Each	1	$2,070	$2,070
4	Borehole Reaming	Linear Foot	400	$15	$6,000
5A	Blank Monitoring Well Casing 2-inch Sch 40 PVC	Linear Foot	345	$7	$2,415
5B	Well Screen 2-inch Sch 40 PVC w/030' Slots	Linear Foot	100	$8	$800
6	Gravel Envelope and Intermediate Seals	Linear Foot	350	$25	$8,750
7	Annular Surface Seal	Linear Foot	50	$25	$1,250
8	Well Development	Each	2	$850	$1,700
9	Surface Completion - Above Ground	Each	1	$1,200	$1,200
10	Standby Time	Hour	0	$375	$0
11	Fluid/Cuttings Containment and Disposal	Each	1	$9,000	$9,000
12	Borehole Abandonment	Linear Foot	0	$9	$0
				Total Contractor Cost	**$50,685**

LSCE Cost	
Labor	$14,685
WQ	$6,000
Transducers	$3,000
Surveying	$1,950
Expenses	$1,000
Total LSCE Cost	**$26,635**
Grand Total	**$77,320**

Luhdorff & Scalmanini
Consulting Engineers

Single Shallow Completion MW - Three Sites					
Drilling Contractor Cost					
Item	Task	Units	Estimated Quantities	Unit Price	Total
1A	Mobilization	Lump Sum	1	$7,500	$7,500
1B	Site to Site Mobilization	Each	2	$4,500	$9,000
2	Test Hole Drilling	Linear Foot	600	$25	$15,000
3	Geophysical Logging	Each	3	$2,070	$6,210
4	Borehole Reaming	Linear Foot	0	$15	$0
5A	Blank Monitoring Well Casing 2-inch Sch 40 PVC	Linear Foot	435	$7	$3,045
5B	Well Screen 2-inch Sch 40 PVC w/030' Slots	Linear Foot	150	$8	$1,200
6	Gravel Envelope and Intermediate Seals	Linear Foot	450	$25	$11,250
7	Annular Surface Seal	Linear Foot	150	$25	$3,750
8	Well Development	Each	3	$850	$2,550
9	Surface Completion - Above Ground	Each	3	$1,200	$3,600
10	Standby Time	Hour	0	$375	$0
11	Fluid/Cuttings Containment and Disposal	Each	3	$9,000	$27,000
12	Borehole Abandonment	Linear Foot	0	$9	$0
				Total Contractor Cost	**$90,105**

LSCE Cost	
Labor	$29,700
WQ	$6,000
Transducers	$3,000
Surveying	$5,800
Expenses	$2,250
Total LSCE Cost	**$46,750**
Grand Total	**$136,855**

Deep Dual Completion MW - Three Sites					
Drilling Contractor Cost					
Item	Task	Units	Estimated Quantities	Unit Price	Total
1A	Mobilization	Lump Sum	1	$7,500	$7,500
1B	Site to Site Mobilization	Each	2	$4,500	$9,000
2	Test Hole Drilling	Linear Foot	1,200	$25	$30,000
3	Geophysical Logging	Each	3	$2,070	$6,210
4	Borehole Reaming	Linear Foot	1,200	$15	$18,000
5A	Blank Monitoring Well Casing 2-inch Sch 40 PVC	Linear Foot	1,475	$7	$10,325
5B	Well Screen 2-inch Sch 40 PVC w/030' Slots	Linear Foot	300	$8	$2,400
6	Gravel Envelope and Intermediate Seals	Linear Foot	1,050	$25	$26,250
7	Annular Surface Seal	Linear Foot	150	$25	$3,750
8	Well Development	Each	6	$850	$5,100
9	Surface Completion - Above Ground	Each	3	$1,200	$3,600
10	Standby Time	Hour	0	$375	$0
11	Fluid/Cuttings Containment and Disposal	Each	3	$9,000	$27,000
12	Borehole Abandonment	Linear Foot	0	$9	$0
				Total Contractor Cost	**$149,135**

LSCE Cost	
Labor	$32,945
WQ	$18,000
Transducers	$9,000
Surveying	$5,800
Expenses	$2,300
Total LSCE Cost	**$68,045**
Grand Total	**$217,180**

Technical Memorandum:

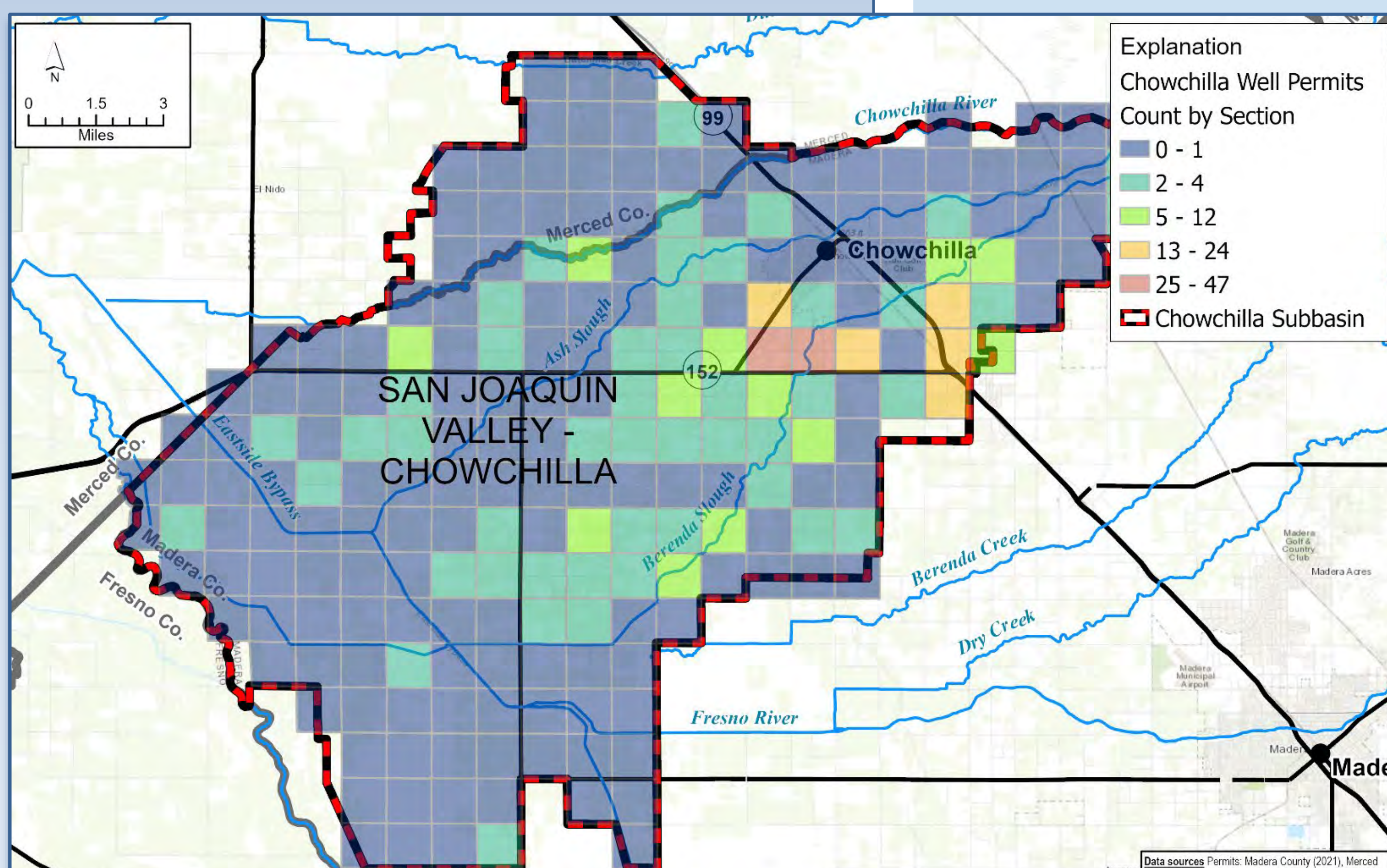
Domestic Well Inventory for the Chowchilla Subbasin

Prepared for Madera County and the
Chowchilla Subbasin Groundwater Sustainability Agencies

April 2022

Prepared by

Luhdorff & Scalmanini Consulting Engineers



Technical Memorandum:

Domestic Well Inventory for the Chowchilla Subbasin

This memorandum was prepared for Madera County and the Chowchilla Subbasin Groundwater Sustainability Agencies to support implementation of the Chowchilla Subbasin Groundwater Sustainability Plan.

Luhdorff and Scalmanini Consulting Engineers conducted the Domestic Well Inventory project for the Chowchilla Subbasin and prepared this technical memorandum with assistance from ERA Economics.

Madera County and the Chowchilla Subbasin Groundwater Sustainability Agencies appreciate and acknowledge funding received from the California Department of Water Resources under the Sustainable Groundwater Planning Grant Program, authorized by the California Drought, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68). This grant funding supported the completion of the Chowchilla Subbasin Domestic Well Inventory project.

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LIST OF ABBREVIATIONS & ACRONYMS

Acronym	Meaning
APN	Assessor Parcel Number
CDP	Census-Designated Place
CDWR	California Department of Water Resources
CEHTP	California Environmental Health Tracking Program
DAC	Disadvantaged Communities
DDW	Division of Drinking Water
DTW	depth to water
GPS	Global Positioning Satellite
GSP	Groundwater Sustainability Plan
LSCE	Luhdorff & Scalmanini, Consulting Engineers
LSWS	Local Small Water System
MCSIM	groundwater model
MD	Maintenance District
MHI	median household income
OSWCR	Online System for WCRs
PLSS	Public Land Survey System
PWS	Public Water System
SDAC	Severely Disadvantaged Communities
SDWIS	Safe Drinking Water Information System
SGMA	Sustainable Groundwater Management Act
SHE	Self-Help Enterprises
SSWS	State Small Water System
SSWS	State Small Water System
SWRCB	State Water Resources Control Board
TM	Technical Memorandum
WCR	Well Completion Report

1 INTRODUCTION

The Chowchilla Subbasin Groundwater Sustainability Plan (GSP) includes maps, figures, analysis, and discussion of domestic wells and potential impacts from continued decline in regional groundwater levels during the GSP Implementation Period (2020 through 2040) while the Subbasin works to achieve sustainability. The GSP provided the background and data analyses to illustrate the need for a Domestic Well Mitigation Program in Chowchilla Subbasin and described how it is the most economically viable way to transition from current overdraft conditions to sustainable conditions in 2040. However, there was insufficient time during GSP development to conduct the more thorough inventory of domestic wells and the potential range of impacts to domestic wells under various scenarios of future groundwater conditions. This study supplements domestic well information provided in the GSP and provides an updated analysis that includes anticipated impacts to domestic wells during the GSP Implementation Period.

Madera County was successful in applying for a DWR grant under Prop 68 to conduct a more detailed well inventory, which is documented in this Technical Memorandum (TM). In addition, the grant funding provides for drilling and installation of nested monitoring wells at three sites in proximity to clusters of domestic wells to provide monitoring of current and future groundwater levels and quality. This TM includes recommendations for locations of these three nested well sites.

To prepare this domestic well inventory, approximations of the number, depths, and locations of domestic wells were developed from multiple available data sources. The total number of domestic wells indicated to be present according to different data sources were reviewed and compared. Domestic well depths were then compared to historical, current, and predicted future local groundwater depths based on observed and modeled data from the groundwater model (MCSIM) developed for and described in the 2020 Chowchilla Subbasin GSP. Due to the uncertainty in future climatic conditions for the GSP Implementation Period; two primary future condition scenarios were evaluated to bracket the range of domestic wells that are estimated to go dry during the GSP Implementation Period. Estimates of costs to replace domestic wells are included in this TM.

This TM documents the available data sources for estimating numbers and locations of domestic wells, domestic well construction details, and occurrence of domestic wells inside and outside of public and small community water systems, analyses to estimate the number of domestic wells that may go dry through 2040 based on two different climatic sequences, and sensitivity analyses to evaluate how various assumptions impact estimates of the number of dry wells. Using the results from the domestic well inventory and analysis, an updated economic analysis was also conducted comparing the tradeoffs of implementing a Domestic Well Mitigation Program during the Implementation Period versus immediately implementing demand reduction in the Subbasin to avoid significant and unreasonable adverse impacts on domestic well users. This economic analysis is included as **Attachment 1** (Domestic Well Replacement Economic Analysis) and provides an update to Appendix 3.C of the Chowchilla Subbasin GSP. **Attachment 1** incorporates the latest results from the domestic well inventory relative to the total number of domestic wells estimated to go dry during the GSP Implementation Period. The economic analysis evaluated the difference in costs for implementing a Domestic Well Mitigation

Program concurrent with gradual reductions in groundwater pumping over the twenty-year Implementation Period compared to not having a Domestic Well Mitigation Program and immediately implementing demand management and other PMAs to eliminate the overdraft in the Subbasin.

2 DOMESTIC WELL INVENTORY DATA SOURCES AND COMPILATION

Data from a variety of public agencies were assembled for consideration in the project. Compiled datasets included the following.

- Well Completion Report (WCR) Database from California Department of Water Resources (CDWR) Online System for WCRs (OSWCR)
- Madera County well permit database (records since 1990)
- Madera County Assessor's Parcel data
- Merced County well permit database (records since 1999)
- Merced County Assessor's Parcel data
- Public Water System (PWS) service area boundaries and PWS well locations from State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW)
- State Small Water System (SSWS) service area boundaries from Madera County
- Census block-level household counts from the US Census Bureau
- Disadvantaged Community boundaries from DWR

With the exception of the Madera and Merced County well permit databases, all of the above-listed datasets were available in geospatial (e.g., GIS) formats. The well permit databases were provided as tabular data, which were converted to geospatial information as described below.

2.1 DWR WCR Database

The primary source for well construction data in the Subbasin is the CDWR OSWCR database (CDWR, 2020). Well drillers are required to submit a WCR to DWR for all wells drilled and constructed in the State of California. DWR has tabulated information from WCRs for the State, including data from WCRs dating as far back as the early 1900s. The tabulated WCR information include well type and construction characteristics such as the intended use of the well, well depths, and screened intervals along with location, construction date, permit information, and other details included on the WCR. Although completed WCRs commonly include additional notes on borehole lithology and a variety of other types of information; however, lithology and some other well information included on WCRs is not entered or maintained in the OSWCR database. It is notable that many well attributes in the WCR database are blank or incomplete because of missing or illegible information provided on the WCRs. Additionally, well locations in the WCR database are commonly only provided to the center of the Public Land Survey System (PLSS) section in which it is located, which translates to a locational accuracy of approximately +/- 0.5 mile.

2.1.1 Domestic Well WCRs

As part of the project, initial quality checks were conducted on the WCR database to identify obvious inconsistencies in well data, including conflicting well locations (e.g., latitude, longitude, PLSS coordinates) and construction (e.g., well depths, top and bottom of screens). Such questionable information and records were flagged for additional consideration during subsequent analyses. For the purpose of this domestic well inventory project, only WCRs indicated to be domestic water supply wells were included in the analysis. To limit potential double counting of domestic wells, only WCRs for new well construction (i.e., not well repairs/modifications or destruction) were included in the domestic well inventory.

The number of well records within the Chowchilla Subbasin in the WCR database exhibit a notable increase starting in about 1970 as indicated by domestic WCR counts by decade presented in **Table 1**. This shift may be partly due to changes in the Water Code relating to well data collection methods and reporting requirements that were instituted in 1969. The number of WCRs for domestic wells in the Chowchilla Subbasin increased by a factor of two around 1970, from 46 WCRs in the 1960s to 76 in the 1970s.

2.1.2 WCR Dates

The typical lifespan of a small water well is estimated to be 30 to 50 years based on the durability and longevity of typical domestic well materials, which are commonly constructed of steel or polyvinyl chloride (PVC) casing. Wells drilled prior to 1970 are also less likely to still be in operation because of long-term trends in groundwater levels in the Subbasin.

For these reasons, only WCRs for wells with dates on or after 1970, were included in the domestic well inventory and associated analyses. The OSWCR database includes 62 domestic well new construction WCRs located in the Chowchilla Subbasin that do not have any recorded installation or permit dates. For this well inventory and analysis, these 62 wells were included in the analysis even though some fraction of them may have been constructed prior to 1970. A total of 500 domestic wells constructed since 1970 were considered in the project based on WCR records.

2.1.3 WCR Locations

Wells with WCRs marked as domestic were selected and mapped based on one of four geolocation methods, depending on what information was available in the tabulated data. Only wells with installations in 1970 or later were considered, or those with no available date of installation. The geolocation methods, in order of priority, are as follows:

1. Assessor Parcel Number (APN) – 236 wells
2. Address – 95 wells
3. Public Land Survey System (PLSS) – 169 wells

A total of 500 domestic well were located within the Chowchilla Subbasin using these methods (**Figure 1a**). Wells located by PLSS are typically placed at the center of the section in which they are located, and thus may be out of position by as much as about 0.5 mile (half the typical width of a section). Other sources of location error include changes in APNs over time; poorly matched addresses; and incorrect WCR entries for PLSS values, GPS coordinates, APNs, or addresses. Since many of the location dots for domestic wells plot on top of each other in **Figure 1a**, the locations of domestic wells in the Subbasin by Township/Range/Section are displayed in **Figure 1b**. Of the 500 domestic well WCRs, only 17 are located in Merced County, and the rest are located in Madera County.

2.2 Well Permit Records

Madera and Merced Counties require a well permit be obtained prior to drilling and constructing a domestic well. Records of well permits were provided by Madera and Merced Counties as tabular datasets (Madera County Environmental Health, 2020; Merced County Environmental Health, 2020); no GIS data were initially available for the well permits. The period of record for the well permits begins in 1990 for Madera County and 1998 for Merced County. Limited information on individual wells is available in the well permit dataset, although most well permits include Assessor Parcel Numbers (APNs) or well addresses that can be used for locating wells. Well uses in the permit dataset were inconsistently entered and required considerable review and assessment to standardize well uses for identifying likely domestic well permits.

2.2.1 Domestic Well Permits

2.2.1.1 Madera County Domestic Well Permits and Locations

A subset of 7,505 permits for all of Madera County was identified as likely domestic wells based on the indicated well use. The well uses retained as representative of likely domestic wells include the following:

1. Domestic (7300 permits),
2. Domestic Replacement (25 permits),
3. Shared (54 permits),
4. Dairy (36 permits),
5. No Use listed (90 permits).

"Shared" wells are typically domestic wells that are also used for irrigation. "Dairy" wells are typically used for semi-industrial, and irrigation uses on a dairy, but in some cases can also be used for domestic water supply. Wells without a listed use were included in an effort to be conservative in the domestic well inventory.

Of the 7,505 domestic well permits (7,362 with APNs) for all of Madera County, the portion applicable to Chowchilla Subbasin were identified based on locations derived from APNs and addresses. Multiple permits refer to the same APN in some cases with only 6,498 unique APNs listed as having domestic well permits in the database. Domestic well permits in the County well permit database were located by matching the listed APN with the county parcel data when possible. Following this approach, 426 permits were matched to 378 unique parcel locations within Chowchilla Subbasin. For the 143 Madera County well permits without APNs, 8 permits were expected to be located within the Subbasin based on the fraction of permits with APNs that were determined to be within the Subbasin.

In addition to APNs, the Madera well permit database includes site addresses for most (7,323) of the wells. Through geocoding of addresses in the well permit database, 6 more well permits were located within the Subbasin.

Through locating of well permits based on APNs and site addresses, approximate locations for 6,709 of the 7,505 Madera County domestic well permits were determined. Using these locations, the total number of domestic well permits in the Madera County portion of the Chowchilla Subbasin was determined to be 432 permits (at 384 unique locations) out of 7,505 domestic well permits in the data base. Madera County well permit information is summarized in **Table 2 and Figures 2a and 2b**.

2.2.1.2 Merced County Domestic Well Permits and Locations

Two datasets of well permit records were provided by Merced County. The first well permit dataset includes 2,034 domestic wells drilled since 1996, with depths and locations (as latitude and longitude) provided for all wells. Locations for these wells were determined using the coordinates included in the dataset. None of these wells are located in the Chowchilla Subbasin. The second dataset of well permit information available from Merced County includes 291 domestic wells that were installed in 1998 and later. These permit locations were determined based on addresses provided in the dataset for all wells. Most of these wells (all but 12) also have depth information. Seven of these 291 domestic wells with permits are located within the Chowchilla Subbasin. Merced County well permit information is summarized in **Table 2 and Figures 2a and 2b**.

2.3 County Assessor Parcel Data

County Assessor parcel GIS data were provided by Madera and Merced Counties (Madera County Assessor's Office, 2020; Merced County Assessor's Office, 2020), including land use and other characteristics for each APN indicating the presence of a dwelling. The Madera County parcels dataset includes 7,033 unique APNs within the Chowchilla Subbasin. Of those, 4,494 are listed as having dwellings associated with them. The Merced County parcels dataset includes 160 unique APNs within the Subbasin. Of those, four are listed as having dwellings associated with them, for a total of 4,498 in the Subbasin (**Figure 3)**. Although the County parcel datasets do not include records related to the presence of domestic wells on parcels, the presence of a dwelling on a parcel is interpreted to suggest the presence of a drinking water supply, including in some areas the potential for a domestic well to exist. This includes parcels that are located within a public water system service area.

2.4 Water System Data

Public Water System (PWS), State Small Water System (SSWS), and Local Small Water System (LSWS) service area boundaries from State and local data sources were used to map and evaluate where and how many inferred well locations occur inside of a water system service area and therefore may not be supplied by a domestic well. Water system boundaries are a key dataset for comparing with potential domestic well locations identified through analysis of WCRs, parcels, and permits. The service area boundaries for water systems identified in the Subbasin are presented on **Figure 4** based on the evaluation of PWS, SSWS, and LSWS boundaries as described below

2.4.1 State Regulated Systems

The PWS boundaries are part of an archived dataset developed by the California Environmental Health Tracking Program (CEHTP) and now maintained by the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) (SWRCB, 2021). This dataset is a publicly available GIS feature class of system boundaries provided voluntarily by water system operators over the period from 2012 to 2019. Previous assessments of this dataset suggest it includes approximately 85 percent of community water systems, although this can vary by region within the state. Of the state regulated community PWS boundaries, two were identified to have service areas within Chowchilla Subbasin.

2.4.2 County Regulated Systems

The PWS service area dataset from DDW is not intended to include county-regulated systems. Madera County Public Works provided additional service area boundary data for county-regulated water systems (Madera County Environmental Health, 2021), but none of these County water system boundaries are within the Chowchilla Subbasin. Merced County Environmental Health was asked to provide locations of county-regulated systems in the Chowchilla Subbasin and indicated that none exist in that area.

2.4.3 Public Water System Wells

PWS well locations were downloaded from the SWRCB GAMA website (SWRCB, 2021) and used to check for any water system wells in areas not covered by the water systems service area boundaries data. All PWS wells were located within previously delineated water system service area boundaries.

2.5 Community Data

2.5.1 Census

United States Census data (US Census, 2016) were used for cross-checking and comparison with domestic well WCRs, domestic well permits, and parcels with dwellings in the Subbasin. The Census data include counts of households by Census area (e.g., block, tract, designated place). The Census data were evaluated to assess whether they could inform the count and locations of domestic wells in the Subbasin. To approximate the number of households that might have a domestic well, Census block area were converted to randomly located points within each block equal in number to the count of households per block. The resulting 2,739 points represent an estimate of the total number of households within the Subbasin that might have a domestic well (**Figure 5**). This includes households that are included within a public water system service area.

2.5.2 Disadvantaged Communities

DWR defines Disadvantaged Communities (DACs) as communities with an annual median household income (MHI) less than 80 percent of the Statewide annual MHI (PRC Section 75005(g)), and SDACs as communities with an annual MHI less than 60 percent of the Statewide annual MHI. The statewide median household income (MHI) for the Census American Community Survey (ACS): 2014-2018 dataset is $71,228. Therefore, a community where the MHI is less than $56,982 meets the DAC threshold and a community where the MHI is less than $42,737 meets the SDAC threshold.

DWR provides a standardized GIS layer of Disadvantaged Communities and Severely Disadvantaged Communities (DACs, SDACs) (DWR, 2021). These data are available as Census Designated Places, Census Tracts, or Census Blockgroups. The Tract-level data are simply aggregated from the Blockgroup-level data and were not used in the current analysis. Place-level data are not congruent with Blockgroups or Tracts, typically following established neighborhood boundaries. Place-level data provide a more focused description of the regions that qualify as DAC or SDAC; however, the Place-level data is only available in Census-Designated Places (CDPs), and these do not capture more diffuse residential neighborhoods. DACs and SDACs are found in both urban and rural areas in Chowchilla Subbasin. **Figure 6** shows the locations of the Census Designated Places and Census Blockgroups identified as DACs or SDACs by the definition above.

3 ANALYSIS AND RESULTS

Estimates of domestic wells were developed through analysis and comparison of the data sources discussed above. Evaluation of the number and locations of domestic wells in Chowchilla Subbasin were made using four different sources of data and approaches: from WCRs, well permits, parcels with dwellings, and Census households. Domestic well WCRs and well permits provide a more direct indication of the existence (past or present) of a domestic well, whereas the parcel data and Census data provide a basis for inferring the existence of domestic wells. The County well permit databases are believed to provide the most accurate estimate of the numbers and locations of domestic wells constructed during the available data record (since 1990 in Madera County and from 1998 in Merced County).

The completeness of the well records in County well permit data are expected to be greater than the WCR database because although regulations state that WCRs are required to be submitted to DWR for all constructed wells, there has historically been little or no verification at the County or State level that a well driller submits a WCR to DWR after a well is completed. In cases where a WCR is submitted, the time elapsed between when a well is drilled and when a WCR is submitted to DWR can be highly variable and information provided on WCRs may not be complete. There are also additional steps involved in entering WCRs into DWR's database after receiving a WCR, which may also introduce timing delays or data entry errors. In contrast, although there is generally no information about a given well's design provided in the County well permit database, there is a fee to obtain a well permit and permits are typically obtained by the driller immediately prior to starting work on a project. Therefore, it is believed that most permitted wells are constructed even if a corresponding WCR is never submitted to DWR by the well driller.

The locational accuracy of well permit records are also believed to be better because most well permit records include data on the parcel where the well is permitted. Many of the WCR records only indicate location by the PLSS section in which the well is located.

Although the well permit data are believed to be more complete and provide better locational accuracy of wells, only the WCR data have information on well depths and other well construction details (**Figure 7a**, **Figure 7b**). Additionally, while WCRs and well permits generally have a date associated with each record indicating the approximate date of well construction, the parcel and Census datasets do not.

However, estimates of well counts based on parcel and Census data do provide a sense for the maximum possible number of domestic wells, and also a comparative check on the relative spatial density of domestic wells in the Subbasin.

Water system service area boundaries were used to refine domestic well estimates derived from parcel and Census household counts, with the expectation that all parcels and households within a water system boundary are served water from the water system and therefore do not rely on a domestic well. The locations and count of permits and WCRs were assumed to be correct, regardless of their location relative to a PWS service area.

With this information, estimated locations and counts of domestic wells in the Subbasin were developed and well depths were compared to historical groundwater levels and model-simulated future groundwater levels (based on the modeling conducted during GSP development) to evaluate potential impacts to domestic wells from changing groundwater levels in the Subbasin. The methods and results from these analyses are described below.

3.1 Analysis of Domestic Well Locations and Counts

3.1.1 Domestic Well WCRs

The domestic well WCRs since 1970 were compared with water system boundaries. Because the WCRs are records of actual wells that were constructed, those located within a water system service area are assumed to be correctly located. It is possible that wells that pre-existed the establishment of a water system in an area may remain in use after the water system is operational; however, the frequency of this occurring is not known.

Of the 500 domestic wells represented by WCRs in the Subbasin, 12 are located within the known water system boundaries (**Figure 8**). This represents 2.4 percent of the domestic well WCRs in the Subbasin. Some of these domestic well WCRs may be associated with wells that no longer actively supply domestic drinking water. Nevertheless, WCRs within a water service area boundary were still considered in the domestic well inventory and analysis described below, which is a conservative assumption relative to likely domestic well counts.

3.1.2 Domestic Well Permits

Similar to the WCR estimate, permits are expected to accurately identify well locations, but domestic well permits may exist for wells drilled and constructed prior to the operation of a water system in an area. The use of such wells may have been discontinued when a residence was hooked up to a water system, although this may not always be the case and some domestic wells within water system service areas may still be operational.

In contrast to the WCR dataset, which relies on submittal and entry of a WCR in DWR's database, the County well permit datasets are expected to be a more comprehensive representation of the wells drilled in the County for the period it covers (1990 to present for Madera, 1998 to present for Merced). Although the comparisons across different datasets described below highlight differences between data sources and the estimates of domestic wells derived from each, this study did not attempt to assess the accuracy of the well permit database in relation to actual domestic wells.

Of the 439 domestic well permits in the Subbasin, two are located within known water system boundaries, which represents about 0.5 percent of the domestic well permits in the Subbasin. These two permits within a water service area boundary were still considered in the domestic well inventory and analysis described below.

3.1.3 Parcels with Dwellings

For the purpose of assessing the maximum possible number of domestic wells in the Subbasin, all parcels with a dwelling but not within a water system service area were counted. In this approach, a parcel is considered within a water system service area if its centroid is within the service area.

Based on these criteria, within the Chowchilla Subbasin there are a total of 4,498 parcels with dwellings, 967 (963 in Madera County, four in Merced County) of which are outside of water system service area boundaries. These 967 parcels representing potential domestic well locations are presented on **Figure 9**. There are several areas within the Chowchilla Subbasin with a relatively high density of parcels with dwellings that are not covered by a water system boundary.

3.1.4 Census households

Due to the irregular shape of Census blocks and the inconsistent alignment of blocks with other important boundaries in the Subbasin (e.g., Subbasin, water service areas) the Census data provided have limited utility to inventory domestic wells, although they do provide an approximate check on the maximum overall number of potential domestic wells in the Subbasin. Conversion of the Census household counts to points and comparing to water system service areas provides as estimate of 1,294 potential households outside of water system service areas. Within that set of 1,294 potential wells, 1,241 are in Madera County, and 53 are in Merced County. Although the total number of parcels with dwellings is almost twice as large as the total number of households within the Subbasin, the number of households estimated to be outside of the water system service areas is about 33% higher than the number of parcels outside of the water system service areas.

3.1.5 Comparisons of Domestic Well Location Information Sources

3.1.5.1 Domestic Wells Within PWS Service Areas

While most residences within a PWS service area are supplied with drinking water by that PWS, it is not unusual for wells drilled prior to the creation of the PWS would be retained and used for part or all of a residence's use, including for drinking water or landscape irrigation.

Of the 500 WCRs since 1970 located in the Chowchilla Subbasin, 12 are located within a water system service area. Of the 436 permits (since 1990) located within the Madera County portion of the Chowchilla Subbasin, two were located within a water system service area. None of the seven permits (since 1998) located within the Merced County portion of the Chowchilla Subbasin were located within a water system service area. Overall, less than 0.5 percent of domestic well permits are located within a water system service area.

Of the 4,498 parcels with dwellings noted in the two county APN datasets, 3,531 are within a water system boundary. Of the 2,739 households in the Subbasin indicated by the 2010 Census data, 1,445 are within a water system service area.

The count of known locations of permits and WCRs within water systems, when compared to the number of residences within those systems based on parcel and Census data, represent between zero and three percent of the number of residences within those service areas. This suggests that the number of domestic well permits and WCRs located within water system boundaries is a very small fraction of the number of likely residences within those water system areas. Accordingly, this comparison suggests that neither the WCR nor well permit data identify a large number of domestic wells within water system boundaries. Although this does not speak to the accuracy of the WCR and well permit data in locating wells in other areas of the Subbasin, they do not appear to identify an unreasonable number of domestic wells within areas covered by water systems.

3.1.5.2 Comparing WCR Locations to Well Permits

The Madera County well permits dataset is believed to be more complete in representing wells drilled in the County, but it only extends back to 1990. To provide an appropriate comparison between the WCR dataset and the well permit dataset, a subset of the WCRs since 1990 (those dated after 1989), were considered. In the Madera County portion of Chowchilla Subbasin, 304 domestic well WCRs have construction dates after 1989. An additional 58 domestic well WCRs have no installation date recorded. For this analysis, WCR records without dates are assumed to be drilled in 1990.

The subset of domestic wells with WCRs since 1990 has many similar characteristics as the dataset for WCRs since 1970, with several noteworthy differences. As shown in **Table 3**, proportionally, the WCR dataset since 1990 has fewer WCR records located in water system service areas. This is reasonable, as it is consistent with the understanding that many of the domestic well WCRs located within water system service areas are for wells drilled prior to the creation or expansion of those water systems.

There is no direct linkage between WCRs and well permits on record (i.e., WCRs commonly do not indicate well permit numbers) for majority of the wells, and the available method for geolocating records for a given well present in both datasets may differ. However, it was determined that 166 of the parcels associated with permit locations coincided with WCR locations for domestic wells for Madera County (and another two wells for Merced County), and the spatial distribution of Madera and Merced County domestic well permits and WCRs are similar within the Subbasin (**Figure 10**).

This relatively low rate of coincidence is most likely a function of poor accuracy of the WCR locations. The permit location error is generally related to the area of the parcel within which they are located and is commonly less than half the distance of the maximum parcel dimension. As parcel size decreases, the accuracy of the locating of well permits tends to increase. Many WCR locations have much higher error, especially those that rely on locations from the PLSS section centroid. In addition, the subset of domestic well WCRs since 1990 in the Madera County portion of the Chowchilla Subbasin has a similar spatial distribution to the dataset of WCRs since 1970. Therefore, the WCRs since 1970 likely reasonably represent the distribution of permits since 1970 similar to the way WCRs from 1990 and later represent permits from 1990 and later.

The Merced County well permits dataset only has records for 1998 and later, so a comparison with the WCRs for the Merced County portion of the Chowchilla Subbasin can only be made with WCRs from 1998 and later. Of the 17 WCRs for wells in the Merced County portion of the Chowchilla Subbasin, eight were installed after 1998. Four more WCRs in the area had no installation date.

Two of the seven permits for wells in the Merced County portion of the Chowchilla Subbasin are on the same parcel as WCRs for the area. Of those two, one also shares an address with the WCR that overlies it. Another permit shares an address with a WCR, but is not located on the same parcel, based on the APN location of the WCR. This may be due to an error on the WCR, or to changes in the APN since the well was installed. The APN identified on the permit matches the APN identified on a WCR for four of the wells.

3.1.5.3 Comparing Domestic Well Permits with Parcel Characteristics

Of the 439 domestic well permit locations identified within the Chowchilla Subbasin, 350 (80 percent) are located on parcels with dwellings, as indicated in the parcel datasets for Madera and Merced Counties, suggesting that a residence is present on the parcel associated with the well permit (**Figures 11a and 11b**).

3.1.5.4 Comparisons of Parcels with Dwellings and WCRs

Of the 967 parcels listed as having dwellings in the Chowchilla Subbasin, and not within a water system boundary, 202 coincide with the location of domestic well WCRs located as described above. All 202 of these were in Madera County. Only one parcel listed (in Madera County) with a dwelling was located within a water system and also coincided with a WCR location (**Figure 12**). As discussed above, WCRs are poorly located due to lack of APN, GPS, or address data.

3.1.6 Final Domestic Well Count and Location Estimates

The Madera County permit database includes 432 domestic (or considered domestic for this analysis) wells installed since 1990. For providing a direct comparison of the domestic wells counts from the WCR database, the count of WCRs was limited to WCRs with dates since 1990 (362 domestic well WCRs) to allow for direct comparison to available County permits. This comparison yields a ratio of 1.19 between the domestic well permit count and the domestic well WCR count. Well permits are believed to provide a more complete representation of wells constructed in the Subbasin, but these permit records do not contain information on well perforations and depths and only date back to 1990. As a result, the ration of well permits to WCRs for the period since 1990 provides a useful scaling metric of results derived during the evaluation of potential impacts on domestic wells from changing water levels, an analysis which relies heavily on well construction information available only on WCRs. The domestic well impacts analysis is described below.

3.2 Evaluation of Potential Domestic Well Impacts

A key consideration in the implementation of the GSP for the Chowchilla Subbasin is the potential occurrence of impacts to domestic well users due to declining water levels. As part of implementing the GSP, the Subbasin is in the process of evaluating and designing a Domestic Well Mitigation Program targeting domestic wells that may be impacted by future declines in groundwater levels. To support this effort, the effects of historical and future groundwater levels on domestic wells in the Subbasin were evaluated.

This analysis involved comparing domestic well perforation and depth information to historical groundwater levels and potential future groundwater levels, as simulated by the groundwater model (MCSim) utilized during the GSP development. Simulated groundwater level conditions from MCSim were used to estimate the number of domestic wells that may go dry during the GSP implementation period from 2020 through 2040, the period during which the Subbasin will be working towards achieving sustainability as required by SGMA. WCR records for domestic wells (and the well construction information provided on WCRs) were used to estimate well depth information for evaluating impacts. The ratio of well permits to WCRs (1.19) was used to upscale the results derived from these analyses conducted using WCR data.

3.2.1 WCR Domestic Well Construction Information

Of the 500 domestic well WCRs in the Chowchilla Subbasin, 479 included some information on bottom of perforated interval (top and bottom of perforations) or total depth. As mentioned earlier, several inconsistencies in construction information were noted in the initial WCR dataset (e.g., total well depth less than depth to top of perforations, depth to bottom of perforations less than top of perforations), so multiple levels of quality checks were conducted on the well construction data in the WCR database to assess the reliability of the information. Only WCR records determined to have sufficiently reliable well construction information (i.e., lack of obviously conflicting information on the well construction) were included in the summary and analyses relating to domestic well construction in the Subbasin. In analyses using well perforations (screens), where data for bottom of perforations was not available, the reported total well depth was used. A total of 454 WCRs included top of screened interval information. For wells lacking information for either bottom of perforations or top of perforations, the average values for wells in the same section were used. Where a section had fewer than three wells with reported depth or top of screen data, the average values from wells in the same section and the eight surrounding sections were used. This resulted in estimates of top and bottom of perforated Intervals for all 500 domestic well WCRs in the Subbasin. **Figure 7a** and **Figure 7b** show the depth of domestic wells in the Subbasin based on these estimates.

3.2.2 Domestic Well Impacts Analysis Methods

Simulated groundwater levels output from the MCSim model developed by Luhdorff & Scalmanini Consulting Engineers (LSCE) and described in the 2020 GSP for Chowchilla Subbasin were queried to produce depth to water (DTW) datasets for the Subbasin for the period from 1989 through 2070. MCSim is a multi-layered model and based on review of the well data and consideration of the hydrogeologic conceptual model and groundwater conditions described in the GSP, model layers 3 and 4 were determined to most appropriately correspond with the production zones for most domestic wells in the Subbasin. The simulated DTW datasets for model Layers 3 and 4 were used to extract DTW values for different time periods at all WCR locations; DTW values at each domestic well WCR location were compared with the top and bottom of perforations (screens) values for each WCR. Based on this comparison, the wells were assigned DTW values for either model Layer 3 or 4. If a well was screened at least 50 percent in Layer 4 or deeper, the well was assigned DTW values for Layer 4. If more than 50 percent of the screened interval was above Layer 4 (in Layer 3 or shallower) then Layer 3 DTW values were assigned to the well.

Simulated depth to water model output for Layers 3 and 4 for the years from 1989 to 2039 were then compared to the screened intervals for each domestic well (WCR) to assess if each well was wet or dry during each year. For each year, the fall simulated DTW (on October 31st) in Layers 3 and 4 of the model were assessed for each well location.

The analysis was performed using different analysis periods and methods. Generally, the analysis was conducted using five-year analysis periods, with the first analysis period starting in 1989 and extending to 2014 or 2015 followed by shorter five-year intervals thereafter. Analyses included comparisons based on snapshots of DTW conditions at the end of each analysis interval (generally five-year analysis periods) and separate comparisons based on the maximum depth to water found during each analysis period. Variations of analyses were also performed using simulated model output from the projected model run used in the GSP, and also separately for a model run utilizing a projected future hydrology that included drier conditions during the early years of the GSP Implementation Period, conditions that are more consistent with the recent hydrology experienced in the area. In all analyses, if the simulated DTW in the assigned model layer at a well location falls below the required minimum level of saturation in relation to the depth of the well, either at the end of each analysis period (or in the year within each five-year period that generally had the lowest water levels for the maximum DTW scenario), the well was considered to have gone dry during the analysis period. Once a well was concluded to have gone dry in an analysis scenario, it was removed from the pool of potential wells that could go dry in subsequent years. The sensitivity of model results to different assumptions, analysis periods, and WCR data restrictions were tested and evaluated.

The parameters used in the analysis are defined as follows:

P = the base year for the analysis periods. This defines the end of the initial historical analysis period (after 1989) during which wells were evaluated for historically having gone dry. This is generally Fall 2019, indicating a historical analysis period of 1989-2019, but 2018 was also used as the ending year for the historical period during sensitivity analyses (because groundwater levels in 2018 were generally lower than in 2019).

S = minimum saturation threshold above the well total depth for a well to remain wetted. This is assumed to be 10 feet in the baseline analysis, but the sensitivity of analysis results to varying this value was conducted to evaluate the influence of this parameter on analysis results.

E = the earliest year of installation for the WCRs considered. This reflects the cutoff year for the construction date on WCRs intended to reflect wells that may have been active at the time of the base year considered based on typical domestic well life expectancy.

Appropriate scaling of the results of these impacts analyses based on WCR was also considered based on the ratio (1.19) of domestic well permits to domestic well WCRs determined previously. The ratio is developed from a direct comparison of domestic well permits and WCRs with dates since 1990. The scaling ratio is applied for the entire Subbasin (including the Merced County portion) and is assumed to have limited spatial or temporal bias across the Subbasin or across the period since 1990. The potential for bias in the ratio has not been evaluated.

The baseline analysis scenario of potential domestic well impacts involved the parameters listed below.

- Snapshots of DTW at the end of each analysis period
- The ending year for historical analysis is 2019, with historical analysis period 1989-2019 (P = 2019). Corresponding analysis periods as follows:
    - 1989-2019
    - 2020-2024
    - 2025-2029
    - 2030-2034
    - 2035-2039

  The analysis periods were selected to correspond with the dates of the Interim Milestones and preparation of Five-Year Update Reports.

- Minimum well saturation threshold of 10 feet (S = 10).
- Using projected model run from GSP (without early sequence of dry years).
- Wells analyzed based on the WCR count of wells installed since 1970 (E = 1970).

Because the early years of the projected model period, including during the early GSP implementation period, have been dry, an alternative analysis scenario evaluated potential domestic well impacts based on simulated groundwater levels from a model run that starts with a drier sequence of years. This analysis involved the same parameters as the baseline analysis (described above) but used simulated groundwater levels from a different projected model run with an early dry period.

3.2.3 Results of Domestic Well Impacts Analyses for Baseline GSP Climate Scenario

In the baseline analysis scenario described above, a total of 95 of the 500 domestic wells (from WCRs) analyzed are indicated to have gone dry during years prior to 2020. A total of 83 wells are projected to go dry between 2020 and 2039 (**Table 4a**). The analysis suggests 40 of the total of 83 domestic wells are estimated to become dry between 2020 and 2024. **Table 5a** includes the results for this analysis when scaled up by a multiplier of 1.19, the ratio of well permits to WCRs.

3.2.3.1 Spatial Distribution of Dry Wells

Figures 13a to **13e** show the distribution of dry wells (and remaining wetted wells) in each of the analysis years for the baseline analysis. The predicted dry wells are generally north of Highway 152 and south of the Chowchilla River.

Most of the domestic wells that are predicted to go dry over the 20-Year GSP Implementation Period in the Base Case occur in the 2020-2024 and 2030-2034 five-year intervals (**Tables 4a and 5a**). Groundwater levels stabilize and begin to recover after 2035 and no additional wells are predicted to go dry in the Base Case after 2035. The timing of domestic wells going dry is closely related to the assumed sequence of average, dry, and wet years applied for the Base Case, which is based on a historical sequence of years that represent overall average conditions for the 20-year Period.

3.2.3.2 Impacts on Disadvantaged Communities

Some dry domestic wells are predicted to occur in DAC and SDAC areas, but these areas are not disproportionately impacted by groundwater level declines. The analysis suggests that the percent of domestic wells in DAC/SDAC areas estimated to go dry is similar to the Subbasin as a whole although it is slightly lower than for areas outside of DACs or SDACs..

Some DACs and SDACs in the Chowchilla Subbasin are located near urban centers, and thus near existing water system service areas. Opportunities for annexation or consolidation of DACs and SDACs in close proximity to existing (or creating new) State- or County-regulated systems may provide a better solution than replacement of existing wells in these areas.

3.2.3.3 Scaling Estimates

The previous analyses are all based on WCR counts of wells drilled since 1970 or 1990. A more accurate number of wells, however, is more likely the number of Permits in the permit database provided by Madera County.

Figure 14 shows that the spatial distributions of the two datasets are similar. As shown in that figure, the agreement between WCR and permit data is relatively good in most of Madera County; however, interspersed throughout the region there are sections with some differences between the numbers of permits and WCRs. The largest portion of the Subbasin is represented by ratios (permits to WCRs) near 1.0 (from 0.5 to 1.5). One section near the town of Chowchilla had notably higher numbers of permits compared to WCRs, but this is likely due to the denser population and presence of municipal water systems in that area of the Subbasin. The relatively similar distributions of permits and WCRs indicates that simply scaling the count of wells up for each period should be adequate. The number of Permits for wells installed since 1990 is 119% of the number of WCRs for wells in the same period, averaged over the Subbasin (**Table 2**).

Scaling the results up to match the expected number of wells based on the Permits-to-WCRs ratio of 1.19:1 yields 99 domestic wells going dry between 2020 and 2040 (**Table 5a**).

3.2.4 Results of Domestic Well Impacts Analyses for Alternative Dry-Start Climate Scenario

The same analysis was conducted as described above for the GSP Climate Scenario, but instead using an alternative climate sequence for the GSP Implementation Period with more dry years at the beginning of the 20-year climate sequence. In the alternative analysis scenario, a total of 100 of the 500 domestic wells (from WCRs) analyzed are indicated to have gone dry during years prior to 2020. A total of 147 wells are projected to go dry between 2020 and 2039 (**Table 4b**); the analysis suggests 85 dry wells of the total of 147 occurring during the period 2020-2024. **Table 5b** includes the results for this analysis when scaled up by a multiplier of 1.19 based on the ratio of well permits to WCRs.

3.2.5 Sensitivity Analyses on Potential Domestic Well Impacts

To understand influences from different analysis assumptions and parameters, sensitivity analyses were conducted on a number of aspects of the analysis. These sensitivity analyses evaluated different approaches to evaluating the DTW at well locations over each analysis period (e.g., DTW at end of period vs maximum DTW during analysis period), the required minimum saturation threshold for concluding a well is dry, and different cutoff dates for WCRs included in the analysis.

3.2.5.1 Snapshot of Depth at End of Reporting Period vs. Maximum Depth During Reporting Period

The baseline analysis described above compares domestic well depths to groundwater levels at the end of each Five-Year Update reporting period using the years 2019, 2024, 2029, 2034 and 2039. As noted previously, these baseline analysis periods were selected because the final year of each period aligns with the IM and Five-Year Update reporting periods. However, if the lowest groundwater levels do not align with the end of each analysis period, this method may not capture the full extent of potential impacts on domestic wells.

By choosing analysis period ending years as 2023, 2028, 2033, and 2038, the lowest groundwater levels in each five-year period will typically be captured along with the lowest pre-2020 groundwater levels (generally occurring in 2015 or 2018). Therefore, a separate analysis was performed using the maximum DTW in each five-year period. This analysis results in a slight decrease (2 wells) in the total number of wells (81) expected to go dry between 2020 and 2040 compared to the Base Case (**Table 6**). The reason for the decrease of dry well occurrence between 2020 and 2040 is this analysis has more wells going dry prior to the start of the GSP implementation period in 2020 due to the lowest pre-2020 groundwater levels occurring prior to Fall 2019, (which is the year used in the Base Case to determine well going dry prior to 2020). Therefore, the base case with a greater number of wells going dry between 2020 and 2040 is used for further sensitivity analyses described below because it is a more conservative estimate of dry wells.

3.2.5.2 Minimum Saturation Threshold

The baseline analysis comparing DTW, and total well depths included a minimum well saturation threshold that a well is considered dry when the groundwater levels fall below a level less than 10 feet above the bottom of the well. This baseline assumption was based on the expectation that the required saturation in a domestic well is not great because of the generally low pumping rates required for domestic wells. The sensitivity of analysis results for this minimum saturation assumption were evaluated using alternative minimum well saturation levels. Sensitivity to the minimum saturation threshold was tested by varying the parameter (S) and observing the change in the count of wells going dry in each analysis period (**Table 7**).

The number of wells going dry over the period from 2020 to 2039 increases as the minimum saturation threshold is increased from 0 feet to 30 feet and then decreases with greater minimum saturation thresholds (**Figure 15**). The reason for this pattern is that at minimum saturation thresholds exceeding 30 feet, more wells are considered to be going dry before 2020 relative to after 2020 for those greater thresholds (i.e., the threshold applies both before and after 2020). The number of dry wells at the saturation threshold of 10 feet is 83 wells, it increases to 100 wells at 30 feet, and at 50 feet it declines to 84 wells. This analysis suggests that the number of wells expected to go dry is sensitive to the saturation threshold applied, but the relationship between saturation threshold and number of dry wells predicted after 2019 varies depending on how many wells go dry before 2020. Considering the results of this sensitivity analysis and the previous discussion regarding saturation needed to support typical domestic well pumping rates, the application of a minimum saturation threshold of 10 feet is interpreted to be a reasonable threshold for estimating the potential number of domestic wells that may go dry during the GSP implementation period.

3.2.5.3 WCR Cutoff Dates

The influence on results from varying the earliest year of WCR records used in the dry well analysis was also evaluated. As expected, the average well depths for older wells tend to be shallower than younger wells, likely because of the declining water levels that have occurred in the area and the resulting need to drill to greater depths to ensure reliable water supply. This trend towards deeper wells is illustrated in a comparison of the average total well depths for WCRs since 1970 and those since 1990 and 1998, as presented in **Table 3.**

The changes in the numbers of total wells analyzed and the resulting numbers of dry wells drop as the cutoff date for WCRs is increased. The change from a WCR cutoff year of 1970 to 1975 has minimal (less than 10 percent) impact on all counts, but as this cutoff date in increased further the dry well count drops faster than the total well count (**Table 8**). The implication of this trend is that as the WCR cutoff date is moved forward in time from 1970, older wells that would be counted as going dry are not included in the analysis, resulting in a smaller number of wells predicted to go dry. Although many wells constructed since 1970 likely are no longer in existence or active use, the 1970 WCR cutoff date provides an appropriately conservative estimate of wells predicted to go dry during the implementation period.

3.2.6 Potential Replacement Costs for Wells Impacted

The potential costs for addressing domestic well issues were evaluated in some detail. These costs were largely based on discussions with drillers who install domestic wells and replace pumps on a regular basis. These costs are summarized in **Table 9**, and include lowering a domestic well pump ($1,000 to $2,000), replacing a domestic well pump ($5,000 to $7,000), and drilling/installing a new domestic well to replace an existing well ($25,000 to $35,000). Estimates of total costs for a Domestic Well Mitigation Program were based on estimates of total number of dry wells expected to occur between 2020 to 2039, with WCRs scaled to the number of County well permits and considering both the GSP climate scenario and the alternative dry-start climate scenario for the GSP Implementation Period.

3.2.7 Updated Economic Analysis

As described in the Introduction, **Attachment 1** (Domestic Well Replacement Economic Analysis) incorporates updated estimates provided in this TM for the number of dry domestic wells into an economic analysis intended to replace Appendix 3.C of the Chowchilla Subbasin GSP with newer information. The economic analysis evaluated the difference in costs for implementing a Domestic Well Mitigation Program concurrent with gradual reductions in groundwater pumping over a twenty-year period vs. not having a Domestic Well Mitigation Program and immediately implementing demand management and other PMAs to eliminate the overdraft in the subbasin to avoid significant and unreasonable adverse impacts on domestic well users. The overall conclusion remains consistent with the GSP: the cost of implementing a Domestic Well Mitigation Program is significantly less than the alternative.

3.3 Public Water System Wells

PWS wells data are maintained by the State Water Resources Control Board Division of Drinking Water in the Safe Drinking Water Information System (SDWIS); however, these data are incomplete at this time. In the Chowchilla Subbasin, only 8 PWS wells (7 for Chowchilla City Water Department, and one for Valeta Municipal Services District 85) are listed in SDWIS. Therefore, the WCR database was queried for PWS wells. There were 18 PWS wells drilled in the Subbasin and tagged as “Municipal” or “Public” on the WCR. This discrepancy may be due, in part, to the fact that WCRs do not typically distinguish between Public Water Systems and other residential water systems serving more than one household. When a well driller fills out the WCR, the “Municipal” box is checked if the well is to be used for any purpose other than irrigation, industrial processes, or domestic single-household use. These can include PWS wells but can also include Local Small and State Small Water System wells (LSWS and SSWS, respectively), and wells used for drinking water at facilities such as rest stops, churches, schools, and other locations that sometimes are not supplied by a local PWS. The wells identified here are shown in **Figure 16**.

Depth to the bottom of perforated interval ranged from 174 to 980 feet below ground surface in these wells. Of the 18 PWS wells, three were drilled prior to 1970 and are not considered here. The remaining 15 wells were compared to the snapshots of groundwater DTW results for the model years 2019, 2024, 2029, 2034, and 2039, with the GSP climate scenario. **Table 10** shows the results of this analysis.

Based on the comparison with the modeled groundwater levels at the 5-year intervals, one PWS well is expected to have gone dry by 2020, and another one over the implementation period. Further analysis with data provided by individual well-operators would be required to identify specific water systems that are vulnerable.

3.4 Comparison of Estimated Domestic Well Impacts to Online Databases

The estimated numbers and locations of dry wells described in this TM (modeled dry wells) were compared to two available datasets related to reported domestic well supply issues: DWR’s Household Water Supply Shortage Reporting System, and Self-Help Enterprises (SHE) Tank Water Program participants (**Attachment 2**). While the assumptions underlying the estimates of modeled dry wells in this TM differ in some regards to the well issues included in these two datasets, the spatial patterns in modeled dry wells are very similar to the spatial patterns in the DWR and SHE datasets. Overall, the total numbers of modeled dry wells estimated in this TM are greater than the number of well issues included in the DWR and SHE datasets; however, it is likely that not all dry wells have been reported in these other two datasets. More details on the DWR Household Water Supply Shortage Reporting System dataset and the SHE Tank Water Program participants dataset and comparisons of these datasets to modeled dry wells presented in this TM are provided in **Attachment 2**.

4 PRIORITIZATION OF AREAS FOR ADDITIONAL MONITORING

Expansion of monitoring network is important for areas of the Subbasin with higher densities of domestic drinking water wells. In addition, the domestic well impacts analyses provide a guide to locating areas that should be more closely monitored. The monitoring network should consider the presence of vulnerable populations, such as those reliant on groundwater and DAC/SDAC areas. Another key variable was to consider the locations of existing nested monitoring wells installed recently at eight locations throughout the Chowchilla Subbasin.

The domestic well inventory analysis conducted for this study illustrates that domestic wells are most concentrated along the Highway 152 corridor, and that the occurrence of dry domestic wells are predicted to be most common along and just north of Highway 152. There are four existing nested monitoring wells relatively far to the north of Highway 152, and four existing nested monitoring wells relatively far to the south of Highway 152 in Chowchilla Subbasin. Two large and dense clusters of domestic wells occur just north of the junction of Highway 152 and Highway 99 and just northeast of the junction of Highway 152 and Highway 233 (Robertson Blvd.). These are considered primary areas for siting of new nested monitoring wells (**Figure 17**). A third primary area is located further west and south of Highway 152 between Robertson Blvd. and Berenda Slough. Two secondary areas for potential consideration of monitoring well siting are in areas of significant, but somewhat less dense, clusters of domestic wells; these locations would fill gaps between existing nested monitoring wells and improve overall spacing and density of dedicated nested well monitoring sites in the Chowchilla Subbasin.

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6 TABLES

Table 1. Summary of Domestic Well WCRs by Decade (no WCRs prior to 1950).

WCR Date Range	WCRs in Date Range	Cumulative WCRs
1950-1959	3	3
1960-1969	46	49
1970-1979	76	125
1980-1989	49	174
1990-1999	82	256
2000-2009	123	379
2010-2019	107	486
2020-Plus	1	487
Unknown	62	549

Table 2. Comparisons Between Different Domestic Well Count Estimation Methods.

	WCRs Chowchilla SB 1970+	WCRs Madera Co. Chowchilla SB 1990+	WCRs Merced Co. Chowchilla SB 1999+	Permits Madera Co. Chowchilla SB 1990+	Permits Merced Co. Chowchilla SB 1999+
Domestic Well Count	500	362	12	436	7
Domestic Well Count Outside of Water System Boundaries	488	350	12	434	7
Domestic Well Count Inside Water System Boundaries	12	12	0	2	0
Percent of WCR-Based Count (since Permit earliest date)	n/a	n/a	n/a	120%	58%
With Depth Recorded	500	362	12	0	7
Location Precision	Varies	Varies	Varies	Parcel	Parcel

Table 3. Relative Similarity Between Wells Recorded Since 1970 and Those Recorded Since 1990.

	Count of WCRs within the Chowchilla Subbasin		
	Since 1970	Since 1990	Since 1999
Total Count	500	375	303
Count within PWS	12	8	7
Count Outside of PWS	488	367	296
Average Total Depth (ft)	377	402	423

Table 4a. Summary of Dry Wells for Base Case. Wells drilled in 1970 or later, based on snapshot of depth to groundwater at end of period. Assumes 10 feet of well saturation above bottom of screen.

Year Range	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	6	405	**40**	365	40
2025 to 2029	0	365	**0**	365	40
2030 to 2034	0	365	**42**	323	82
2035 to 2039	0	323	**1**	322	83
During the period 1989 to 2019, prior to the implementation period, the model suggests 95 wells went dry.				Total	**83**

Table 4b. Summary of Dry Wells for Dry Start Case. Wells drilled in 1970 or later, based on snapshot of depth to groundwater at end of period. Assumes 10 feet of well saturation above bottom of screen.

Year Range	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	6	400	**85**	315	85
2025 to 2029	0	315	**61**	254	146
2030 to 2034	0	254	**1**	253	147
2035 to 2039	0	253	**0**	253	147
During the period 1989 to 2019, prior to the implementation period, the model suggests 100 wells went dry.				Total	147

Table 5a: Adjusted Estimates of Dry Wells for Base Case Based on WCRs Since 1970 Upscaled Using Ratio of Permits to WCRs (1.19).

Year Range (Oct 31st Minimums)	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	7	486	48	438	48
2025 to 2029	0	438	0	438	48
2030 to 2034	0	438	50	388	98
2035 to 2039	0	388	1	387	99
During the period 1989 to 2019, prior to the implementation period, the model suggests 114 wells went dry.				Total	99

Table 5b: Adjusted Estimates of Dry Wells for Dry Start Case Based on WCRs Since 1970 Upscaled Using Ratio of Permits to WCRs (1.19).

Year Range (Oct 31st Minimums)	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	7	480	102	378	102
2025 to 2029	0	378	73	305	175
2030 to 2034	0	305	1	304	176
2035 to 2039	0	304	0	304	176
During the period 1989 to 2019, prior to the implementation period, the model suggests 120 wells went dry.				Total	176

Table 6: Dry Well Summary Based on Snapshots of Groundwater Depth at End of Periods Ending in 2015, 2018, 2023, 2028, 2033, and 2038.

Year Range (Oct 31st Minimums)	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells Based on 5-Year Minimum
2019 to 2023	10	378	**30**	348	30
2024 to 2028	0	348	**1**	347	31
2029 to 2033	0	347	**50**	297	81
2034 to 2038	0	297	**0**	297	81
During the period 1989 to 2018, prior to the period described in this table, the model suggests 122 wells went dry.				Total	81

Table 7: Effect of Varying Saturation Requirement on Dry Well Counts.

Saturation Setting	Dry Wells Total After 2019
0	76
10	83
20	98
30	100
40	90
50	84
60	72
70	66
80	63
90	60
100	55

Table 8: Effect of Varying Minimum Installation Year on Counts of Wells and Dry Wells.

Well Counts	Earliest Installation Year						
	1970	1975	1980	1985	1990	1995	2000
Total Count of WCRs in Comparison	500	459	424	401	375	331	293
Fraction of 1970 (Total Count of Wells)	1.00	0.92	0.85	0.80	0.75	0.66	0.59
Total Count of Dry Wells	178	159	144	127	117	91	67
Fraction of 1970 (Dry Wells)	1.00	0.89	0.81	0.71	0.66	0.51	0.38
Count of Dry Wells Prior to 2020	95	85	77	66	59	41	30
Fraction of 1970 (Dry Prior to 2020)	1.00	0.89	0.81	0.69	0.62	0.43	0.32
Count of Dry Wells from 2020 to 2039	83	74	67	61	58	50	37
Fraction of 1970 (Dry Wells 2020 to 2039)	1.00	0.89	0.81	0.73	0.70	0.60	0.45

Table 9: Summary of Domestic Pump and Well Costs.

Issue	Type of Problem	Solution	Related to GSP	Typical Cost
Water level in well below pump setting depth	**Pump**	**Lower Pump**	**Yes/No**	**$1,000 to $2,000**
Pump not working (old age or pump-related issue)	**Pump**	**Replace Pump and Equipment**	**No**	**$5,000 to $7,000**
Well casing/screen failure (due to old age)	**Well**	**Replace Well**	**No**	**$25,000 to $35,000**
Water level below bottom of well	**Aquifer**	**Replace Well**	**Yes**	**$25,000 to $35,000**

Table 10: PWS and other Municipal Wells - Dry Well Summary Based on Snapshots of Groundwater Depth at End of Periods ending in 2024, 2029, 2034, and 2039, for the Base Case Climate Scenario.

Year Range (Oct 31st Minimums)	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	1	15	1	14	1
2025 to 2029	0	14	0	14	1
2030 to 2034	0	14	0	14	1
2035 to 2039	0	14	0	14	1
During the period 1989 to 2019, prior to the implementation period, the model suggests one well went dry.				Total	1

7 FIGURES

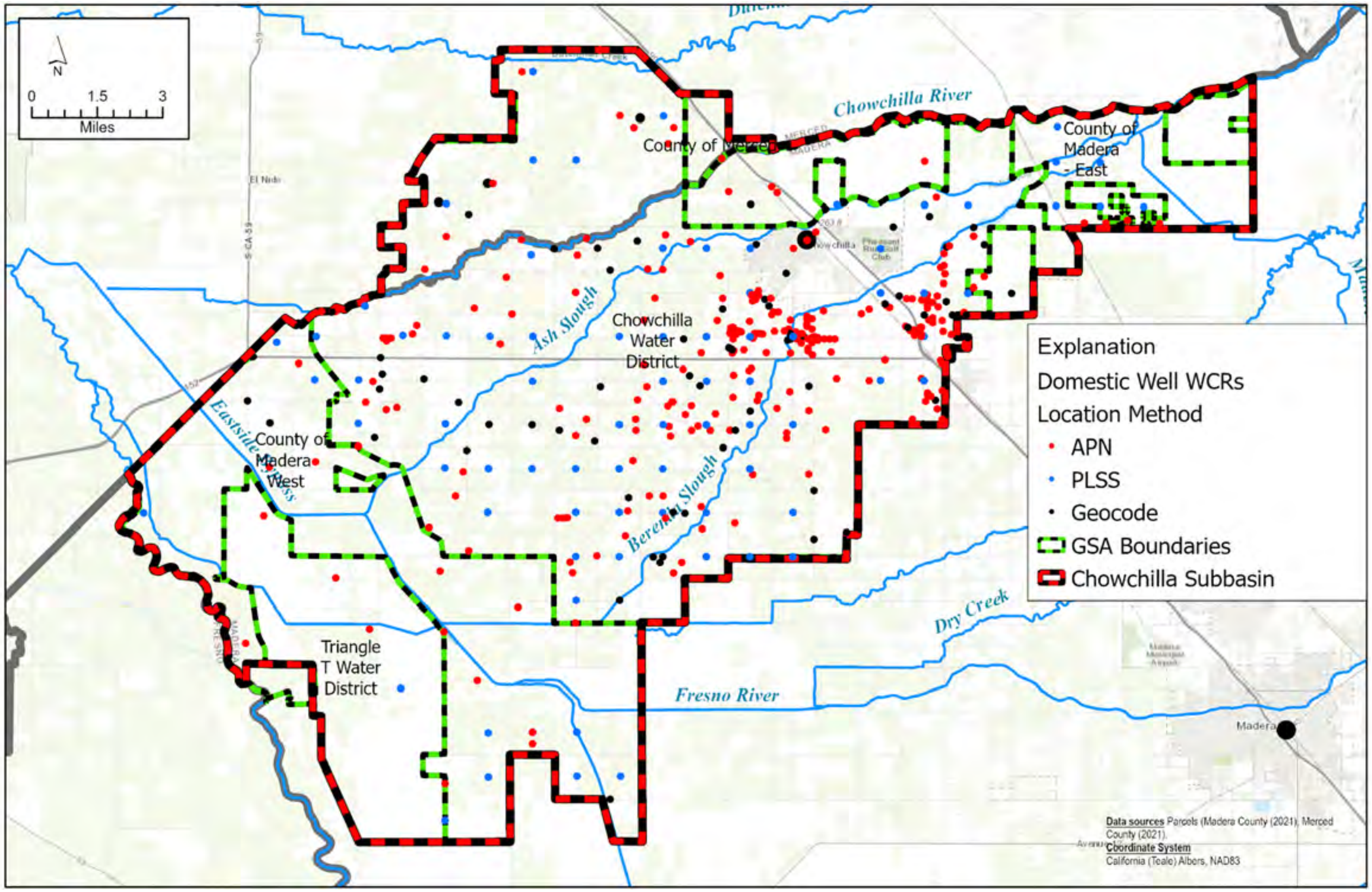

Figure 1a. Well Completion Report new construction domestic wells located by best available method.

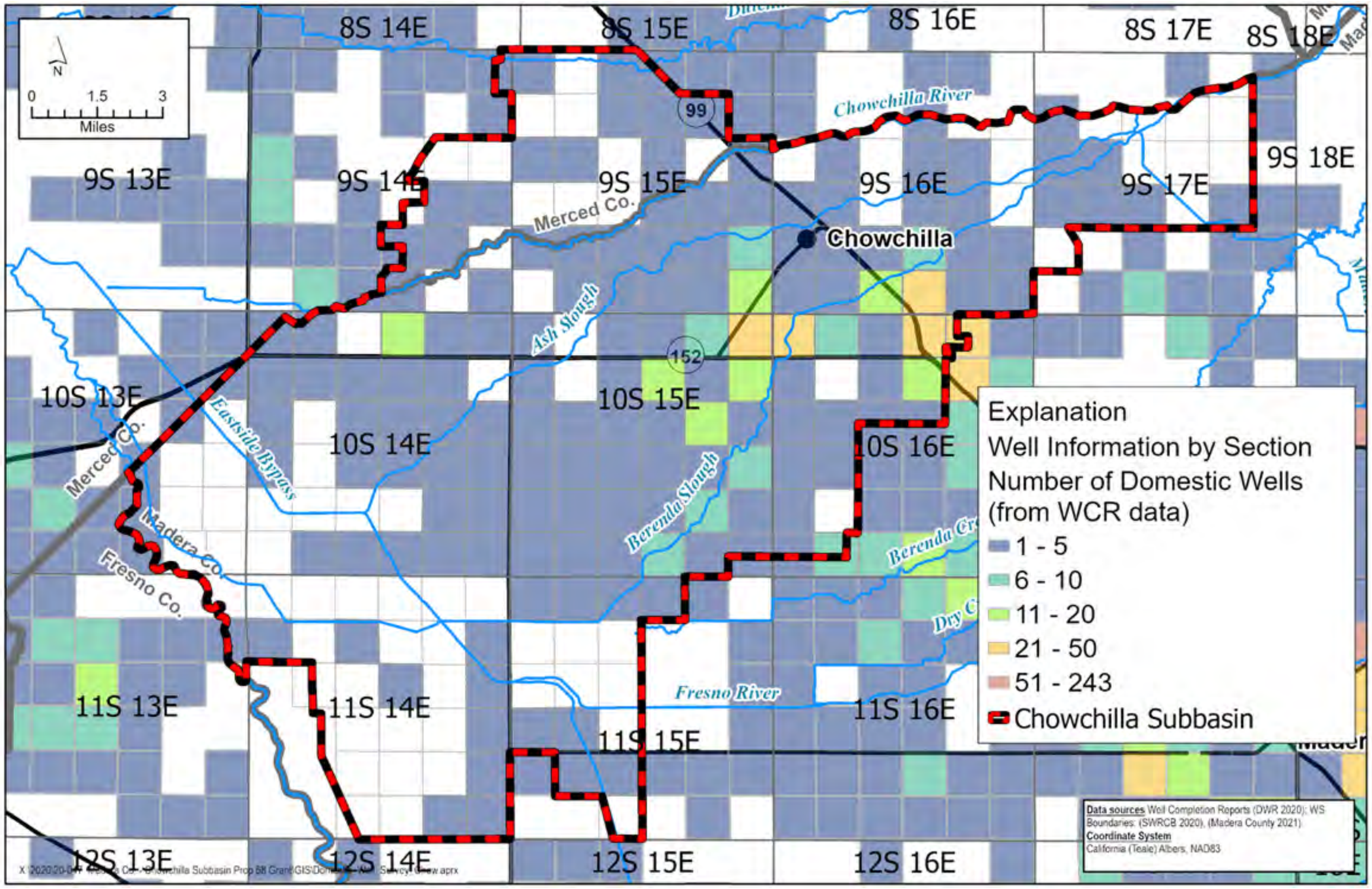

Figure 1b. Well Completion Report new construction domestic well counts by Section.

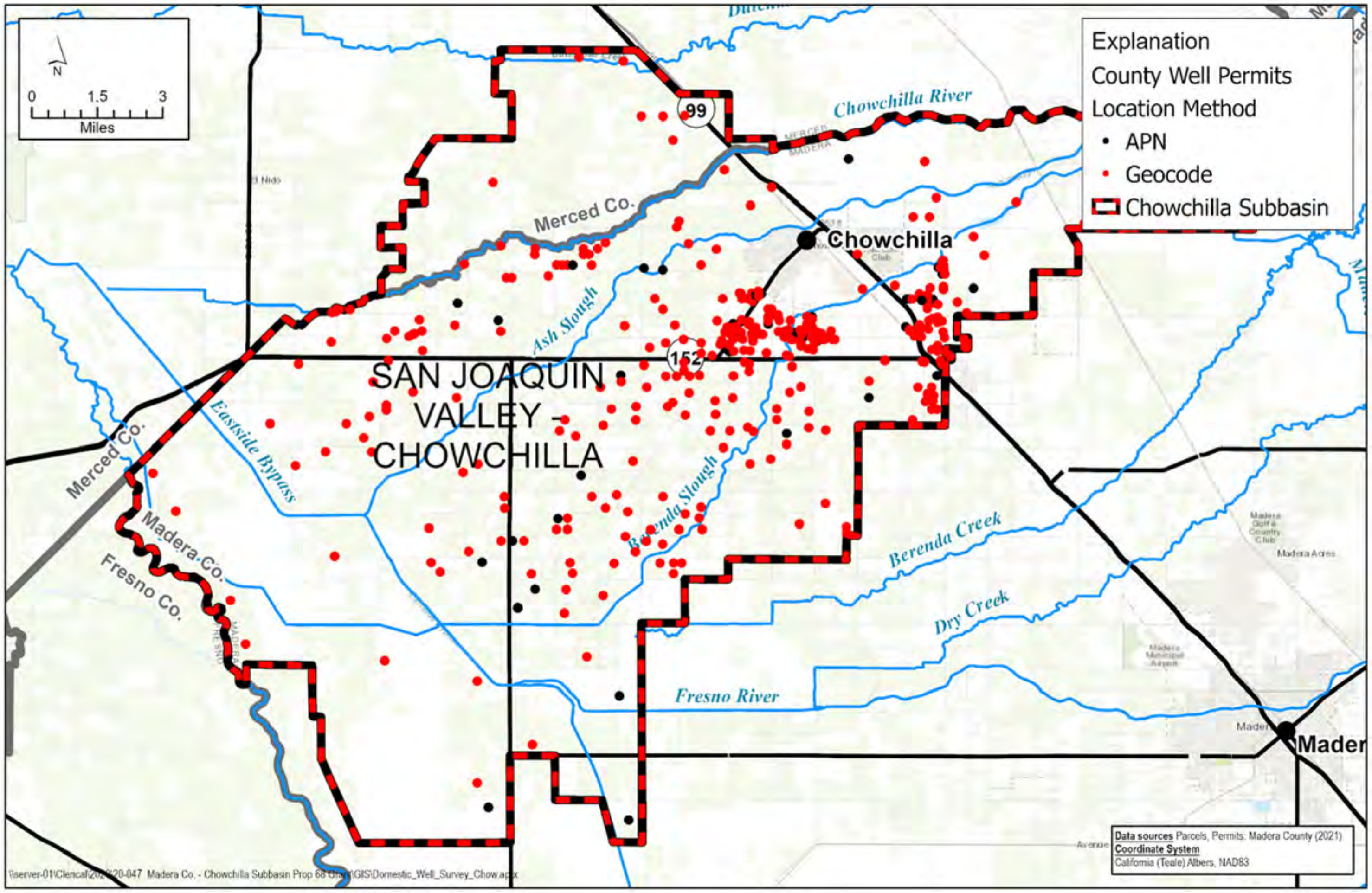

Figure 2a: Permit locations and geolocation method in Chowchilla Subbasin.

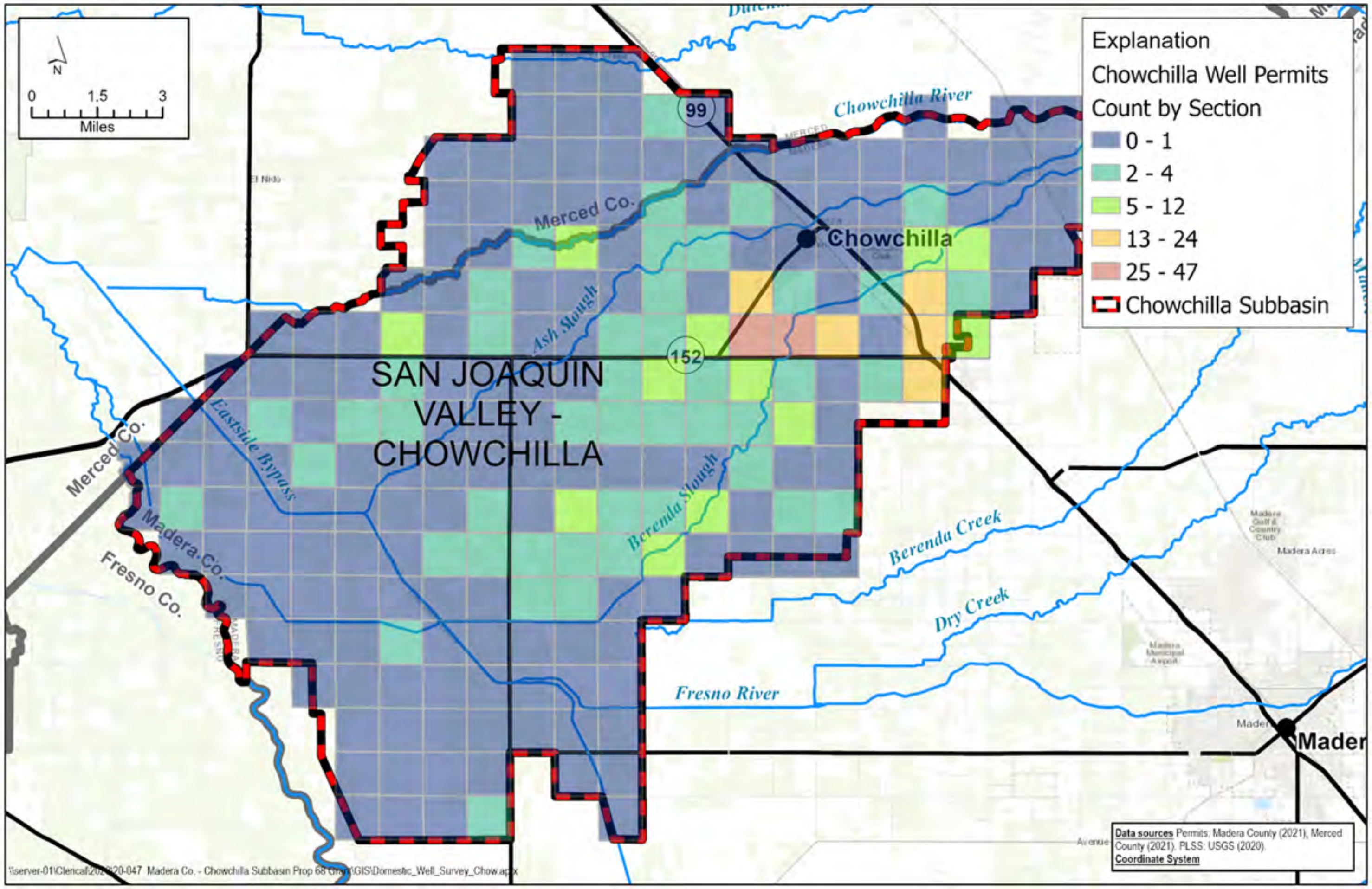

Figure 2b. Permit location counts by Township/Range/Section.

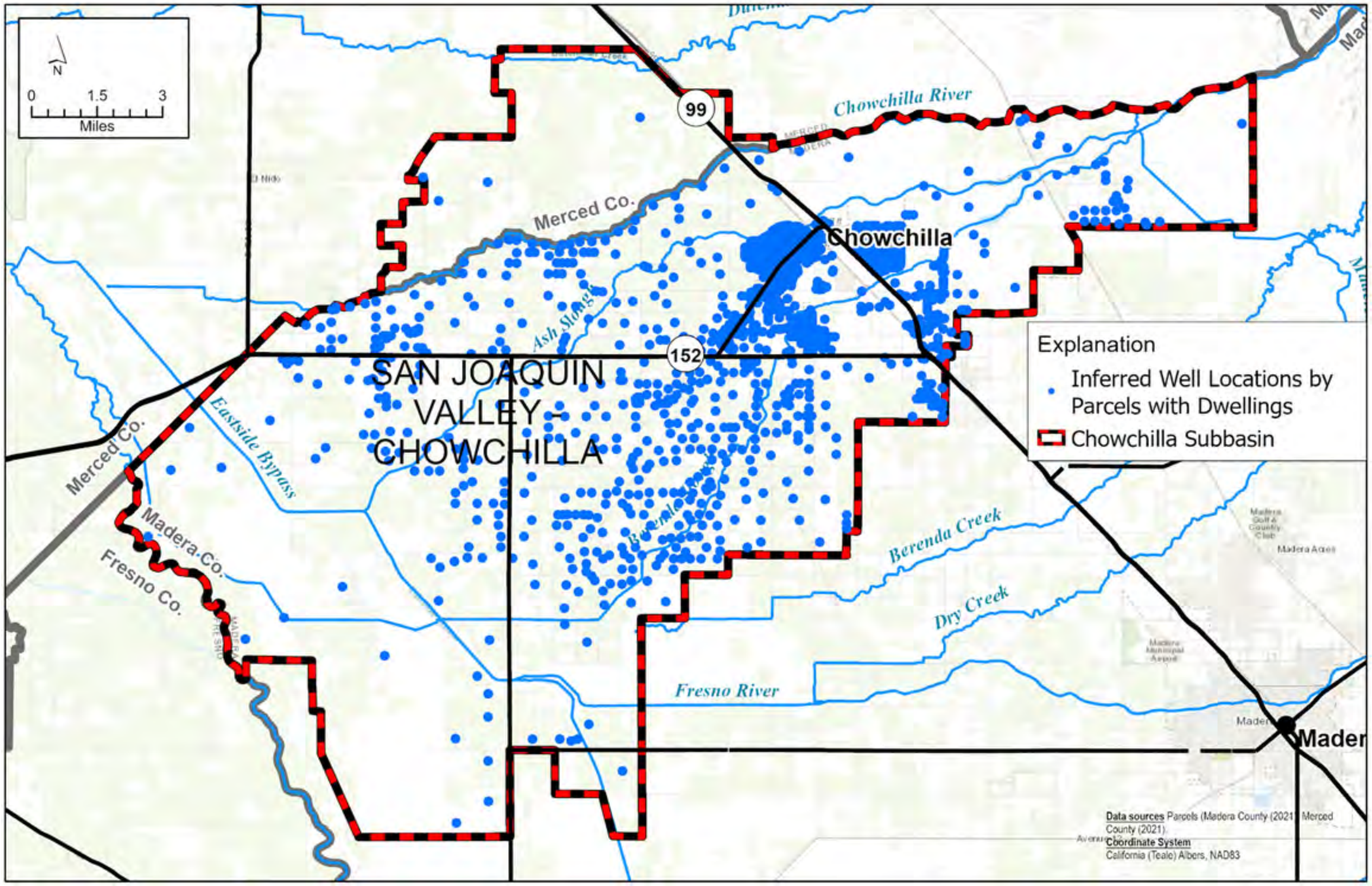

Figure 3: Inferred well locations based on Parcel Dwelling Status.

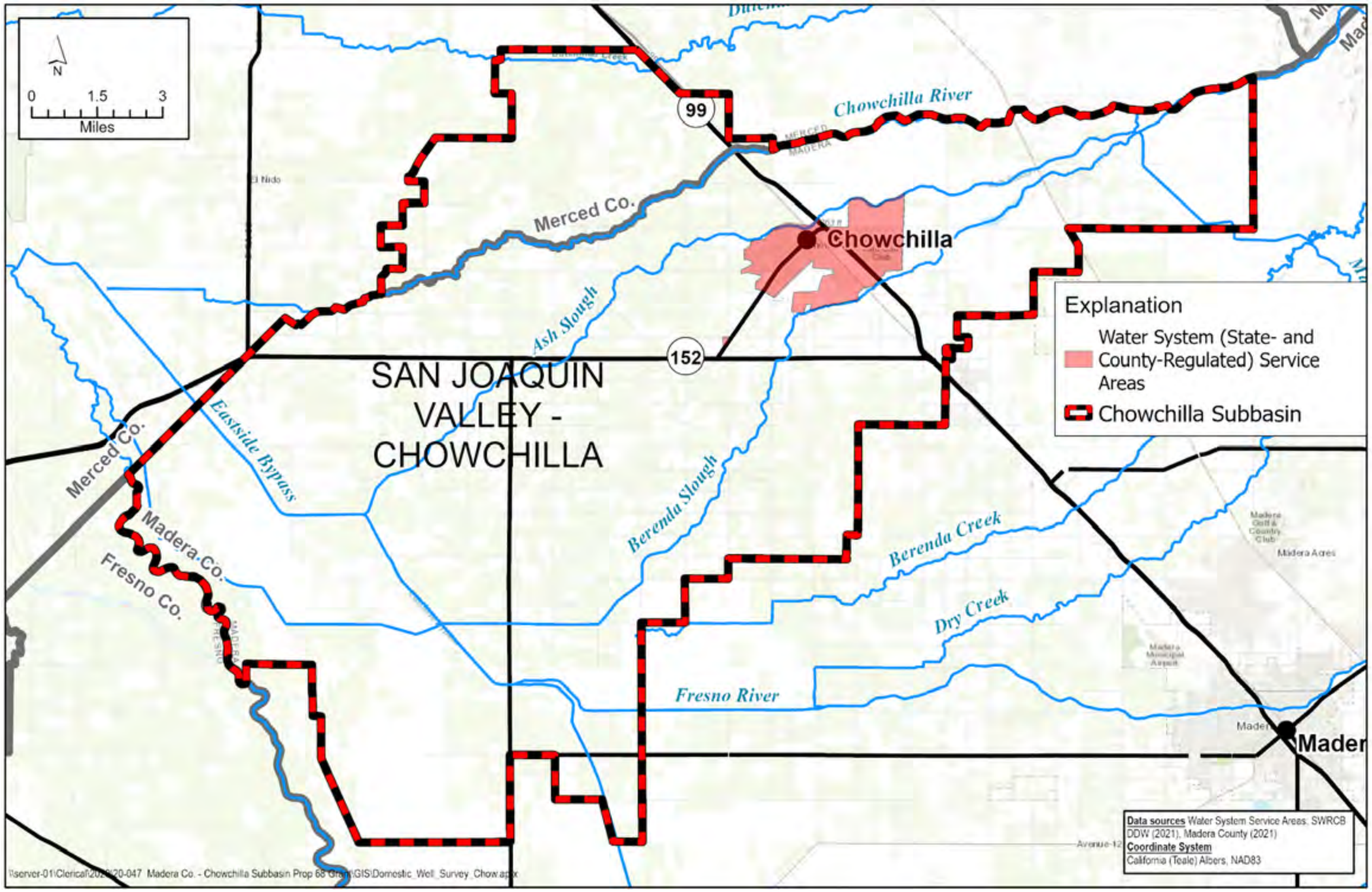

Figure 4: Water System Boundaries in Madera County.

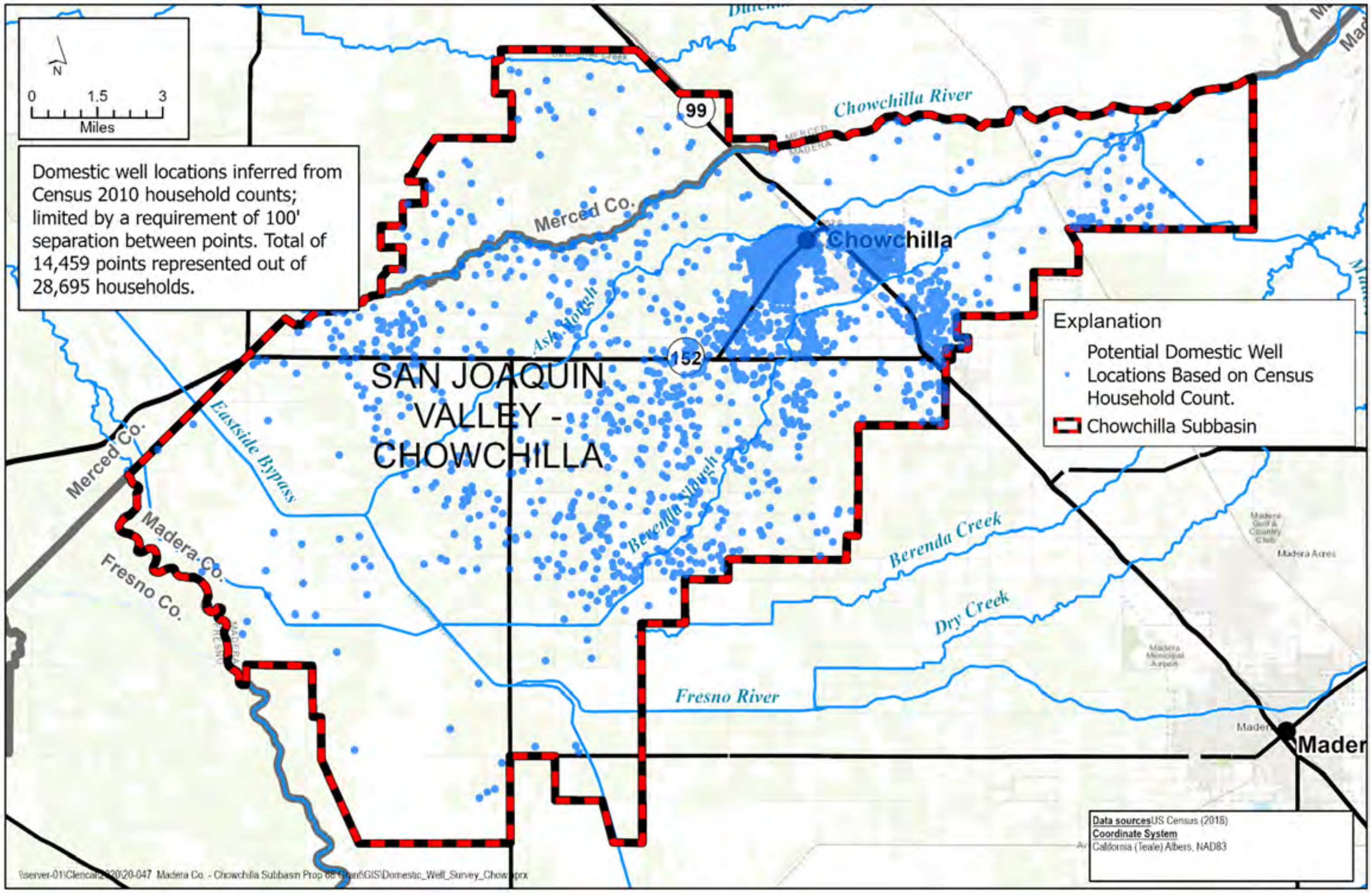

Figure 5: Inferred well locations based on 2010 Census Household counts.

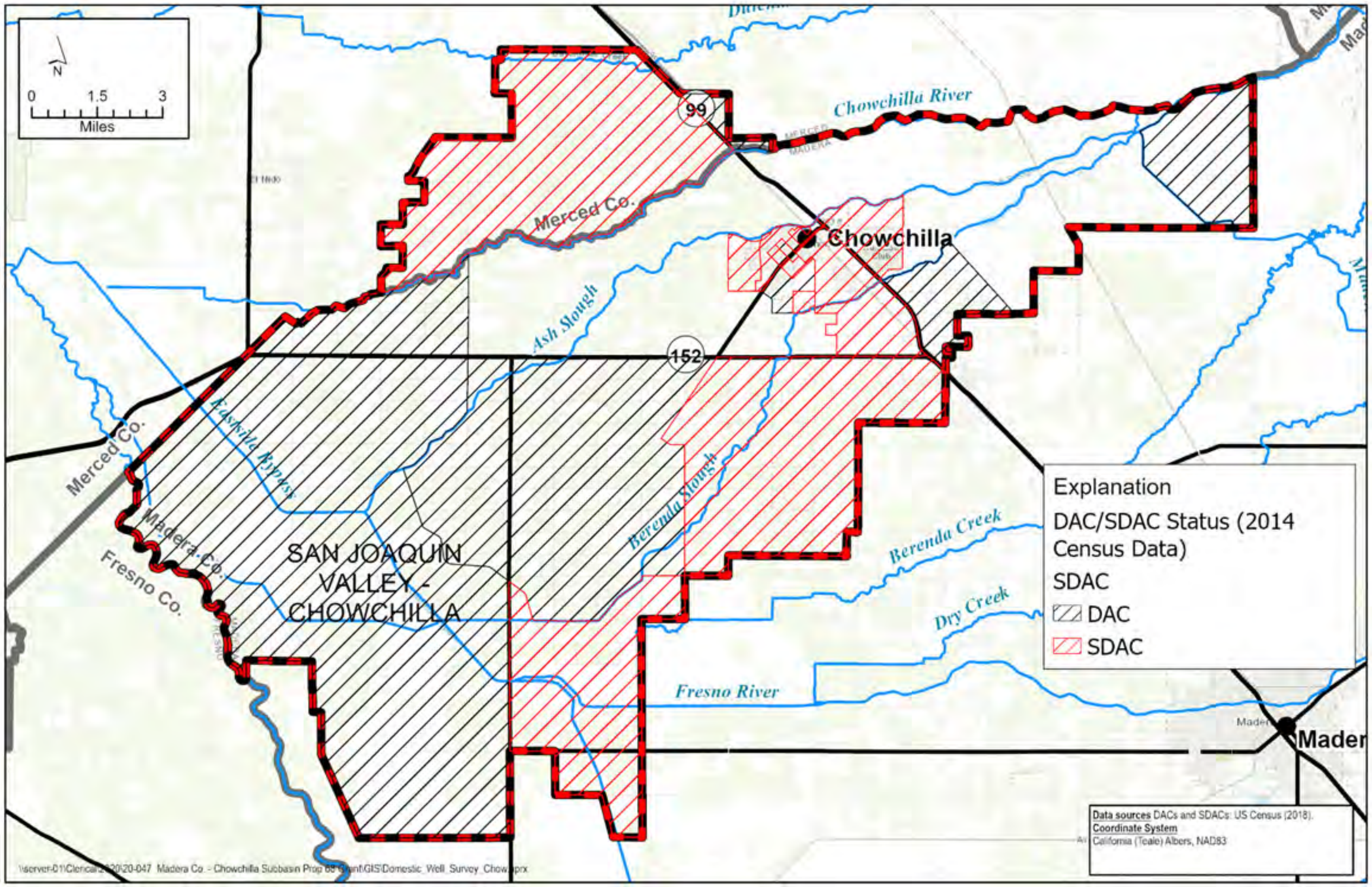

Figure 6: DACs and SDACs in the Chowchilla Subbasin.

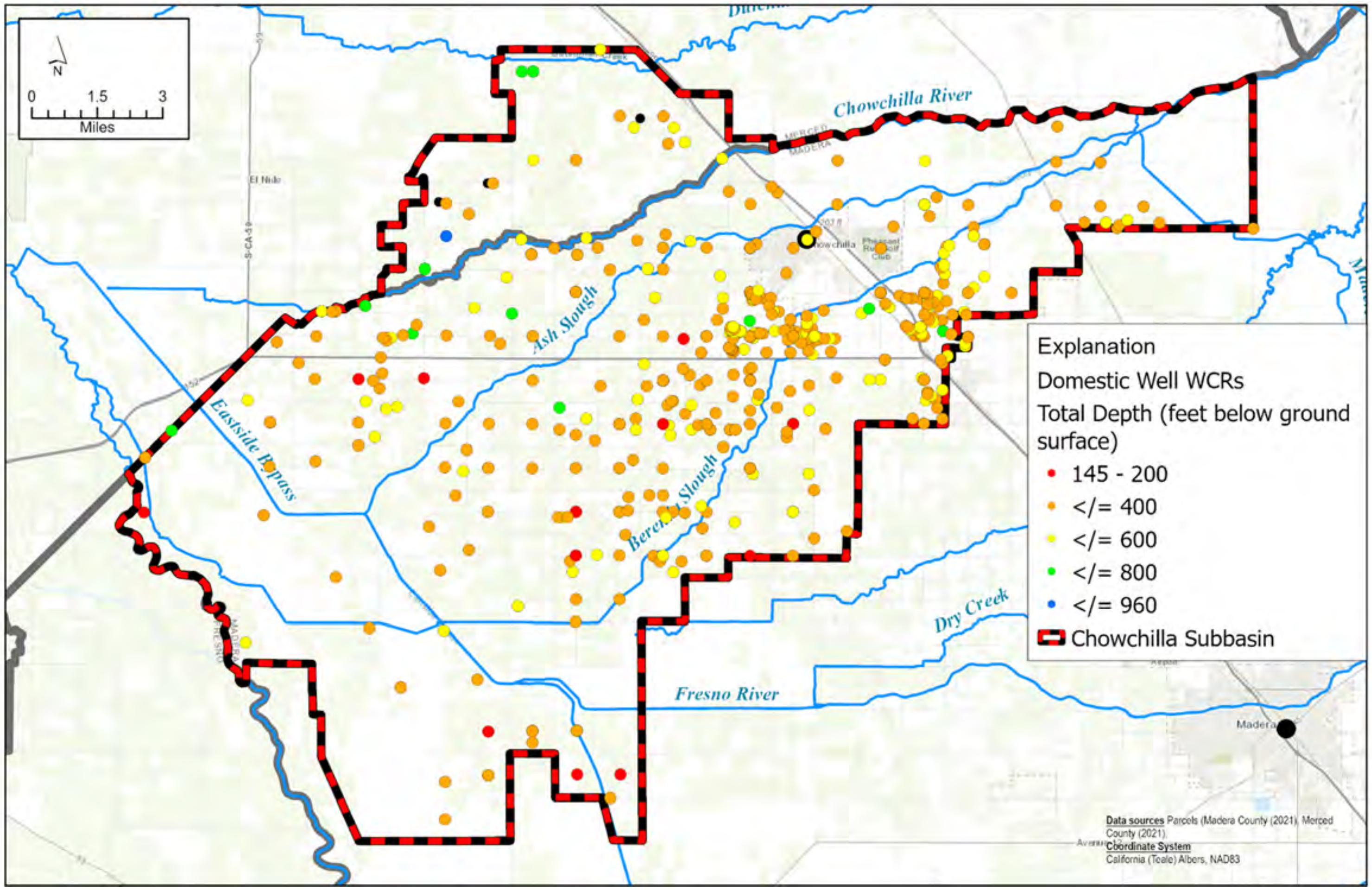

Figure 7a: Domestic wells in Chowchilla Subbasin with depth from WCR.

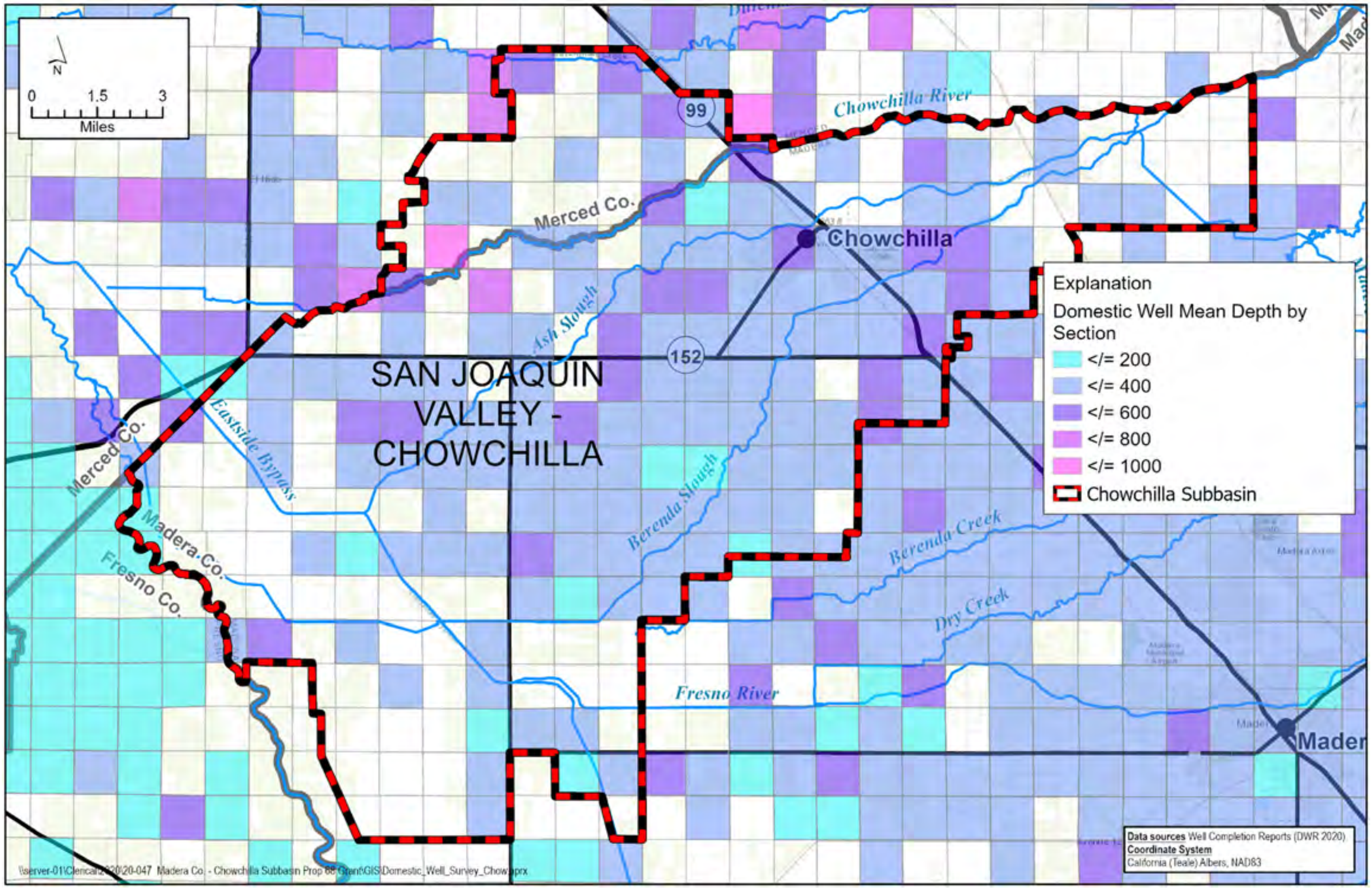

Figure 7b. Domestic Wells in Chowchilla Subbasin with Average Depth by Township/Range/Section from WCRs.

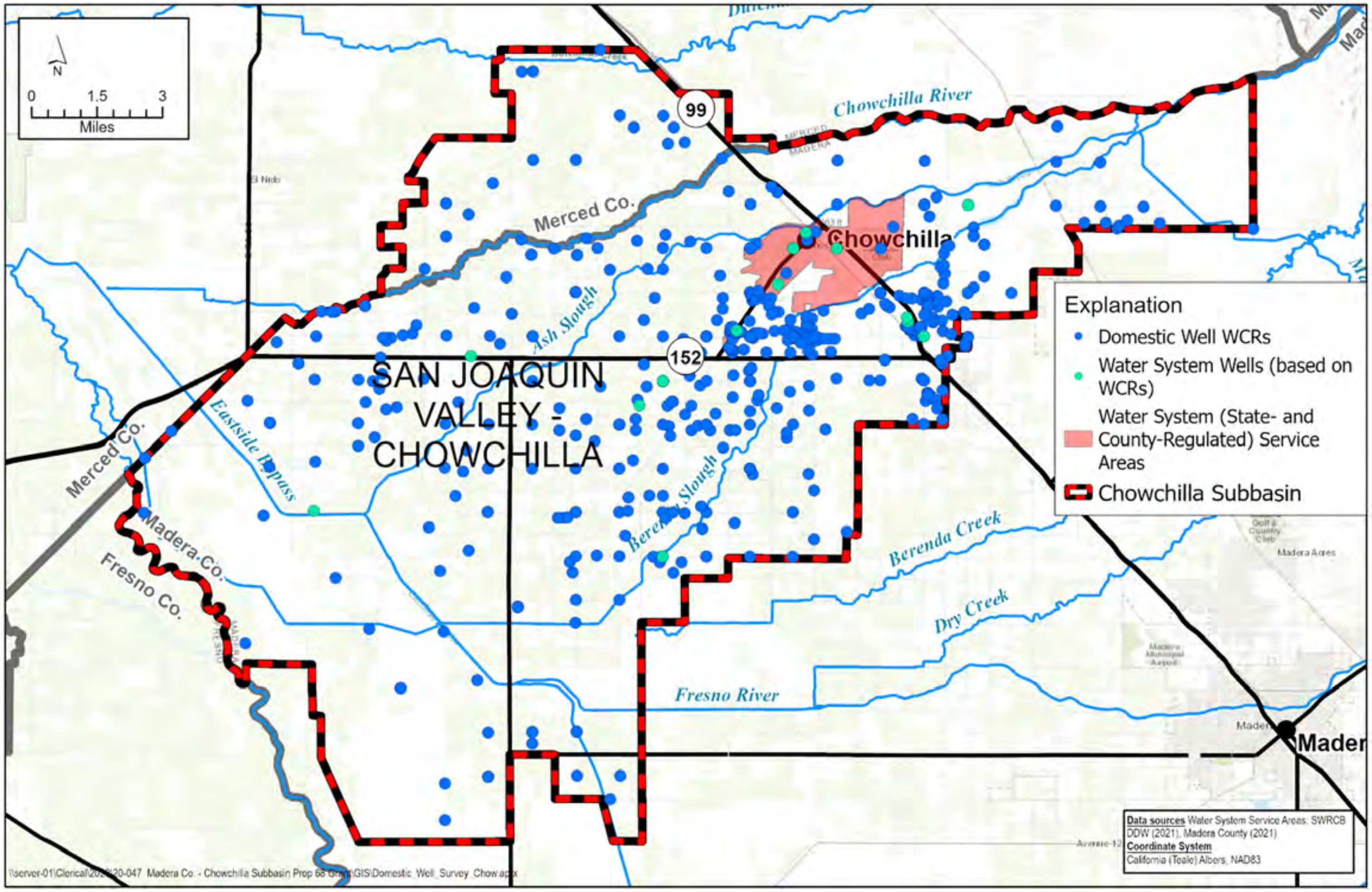

Figure 8: Domestic WCRs compared with Community PWS, County Maintenance Districts, and Community Service Areas.

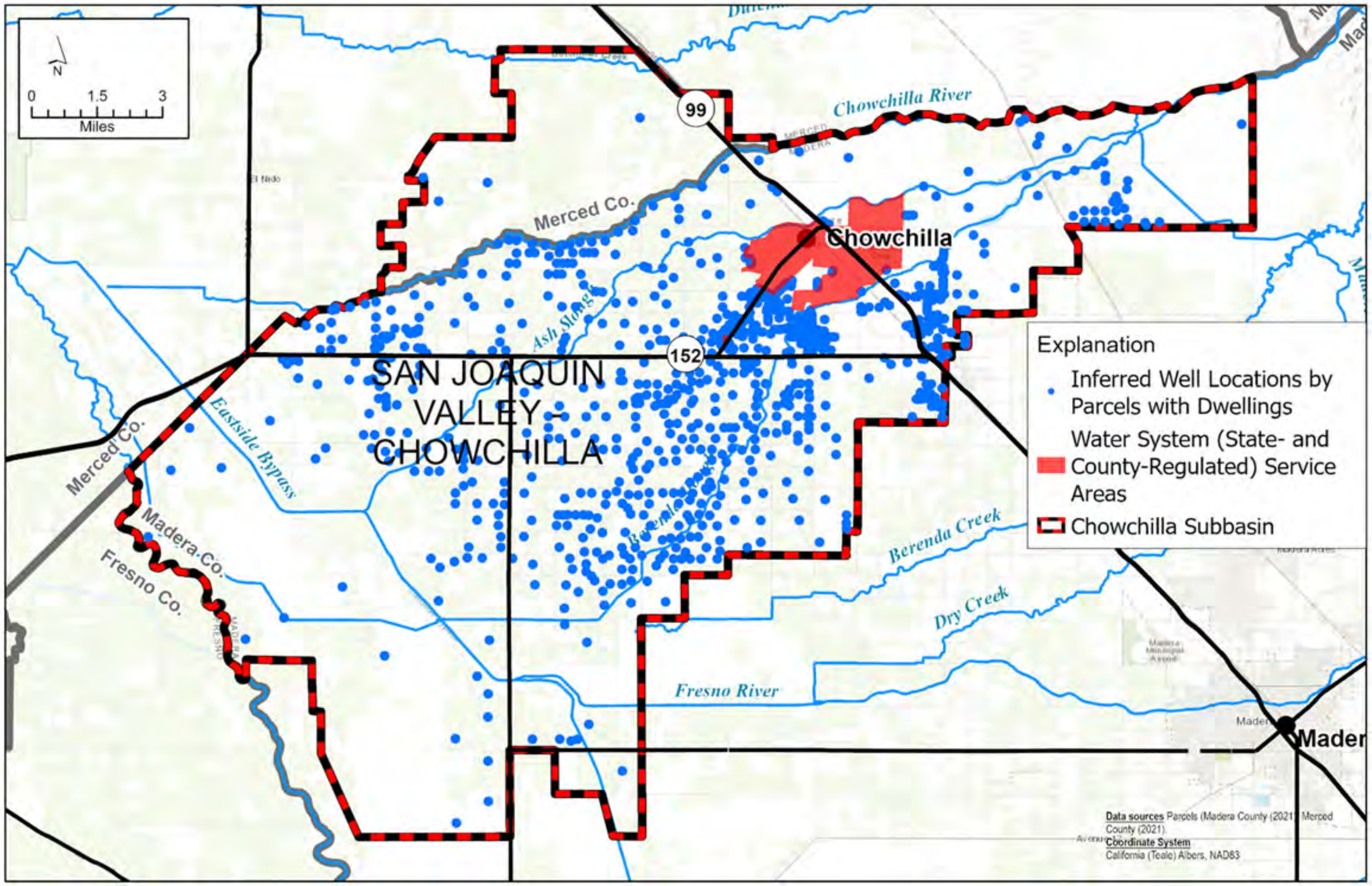

Figure 9: Parcels with Dwellings as Inferred Well Locations, outside of Community PWS, County Maintenance Districts, and Community Service Areas.

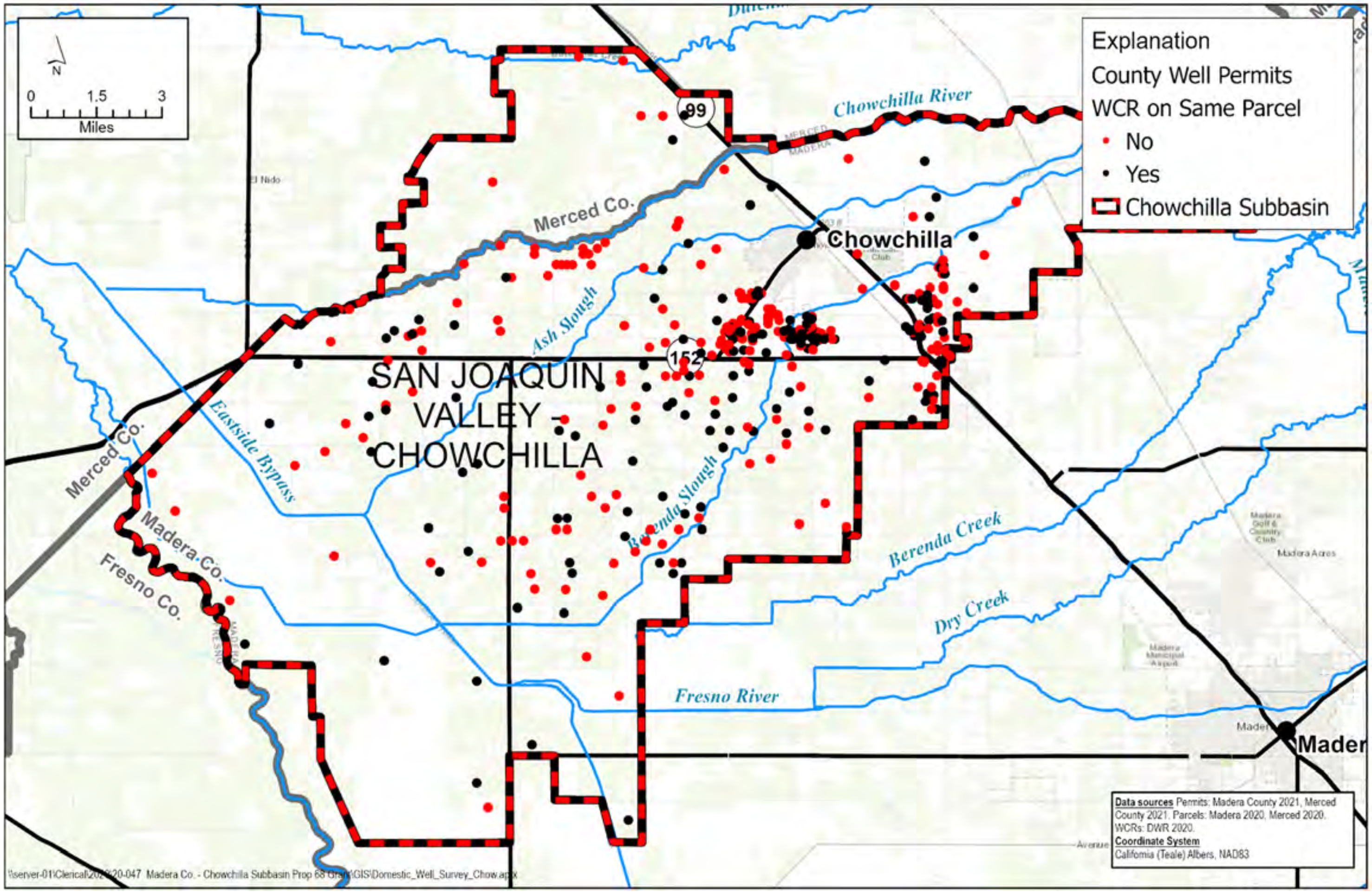

Figure 10: Parcels with Permits and WCRs.

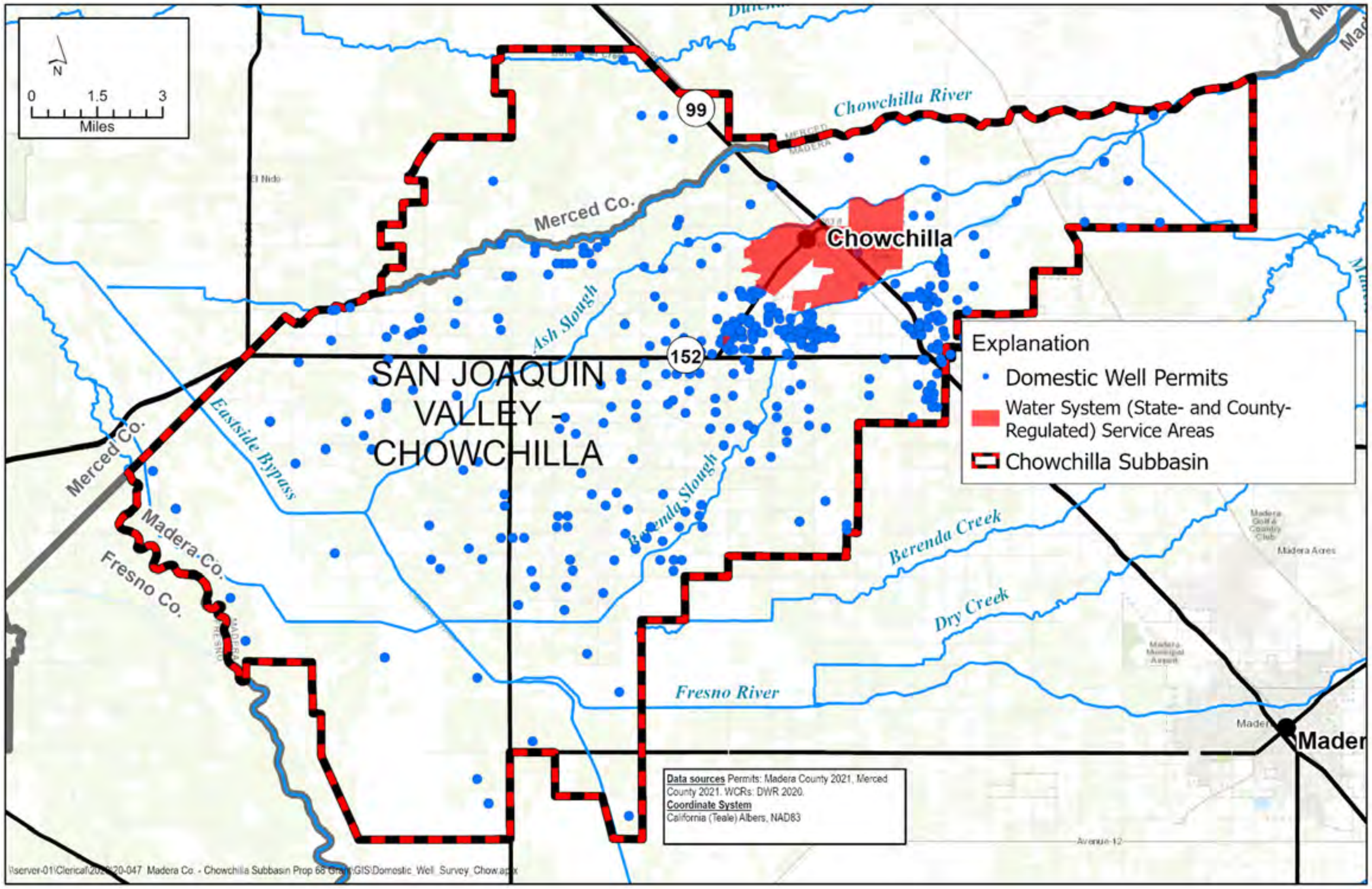

Figure 11a: Domestic Well Permits Compared with PWS, Community Service Districts and County Maintenance Districts.

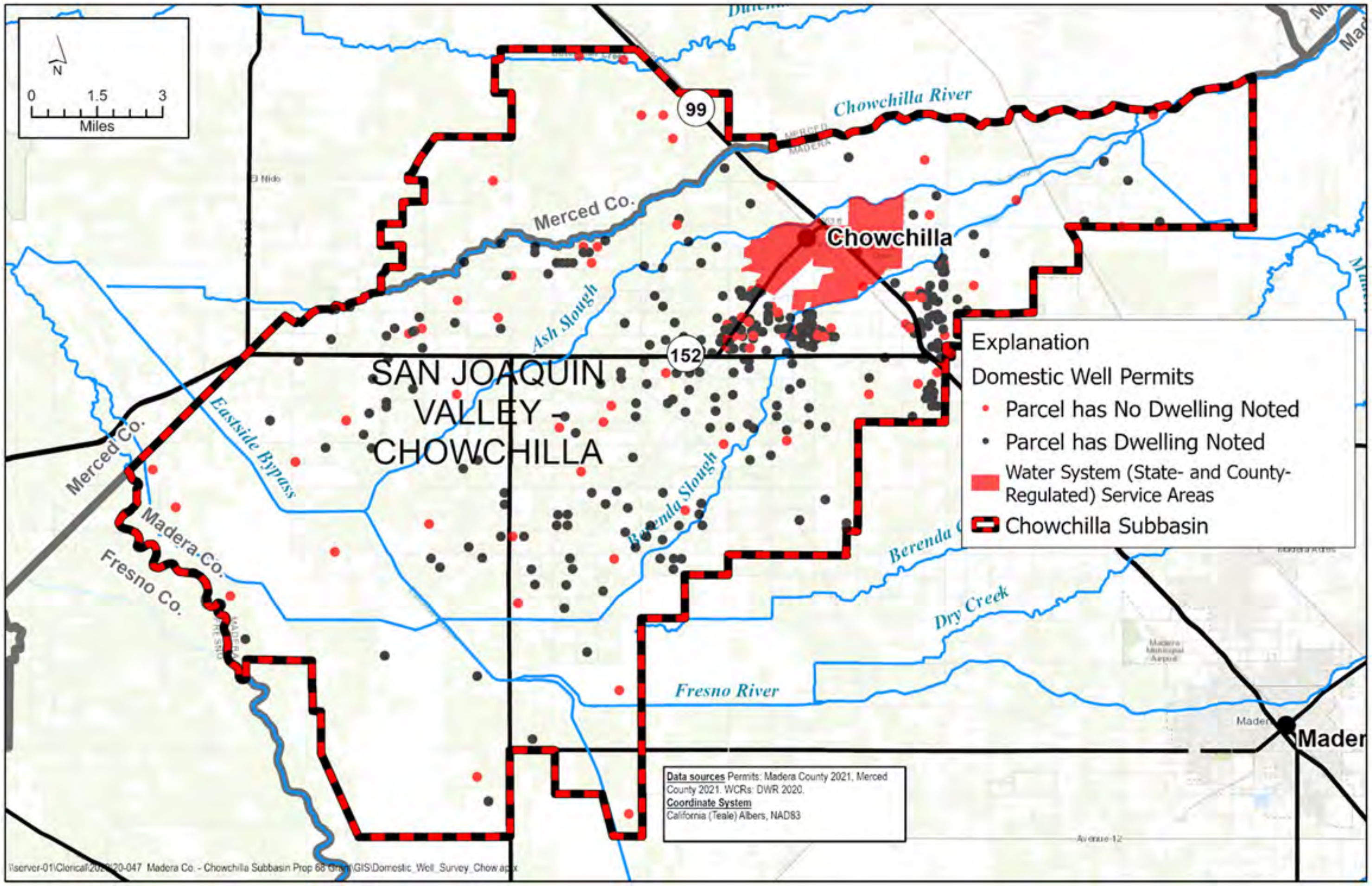

Figure 11b: Domestic Well Permits Compared with Parcel Characteristics.

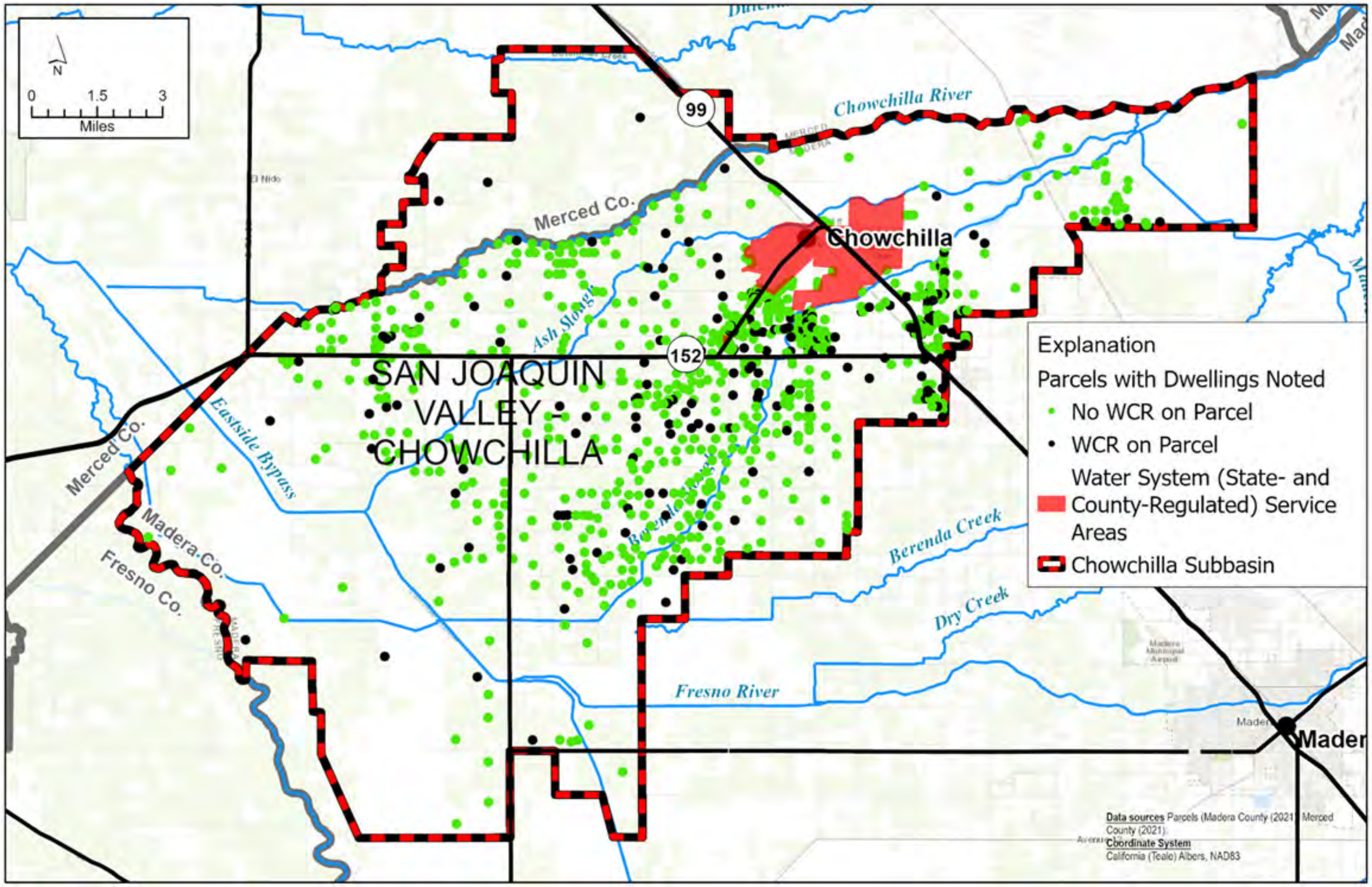

Figure 12: Inferred Domestic Well locations Based on Parcels with Dwellings, with Water Systems and Presence/Absence of WCRs on Parcel.

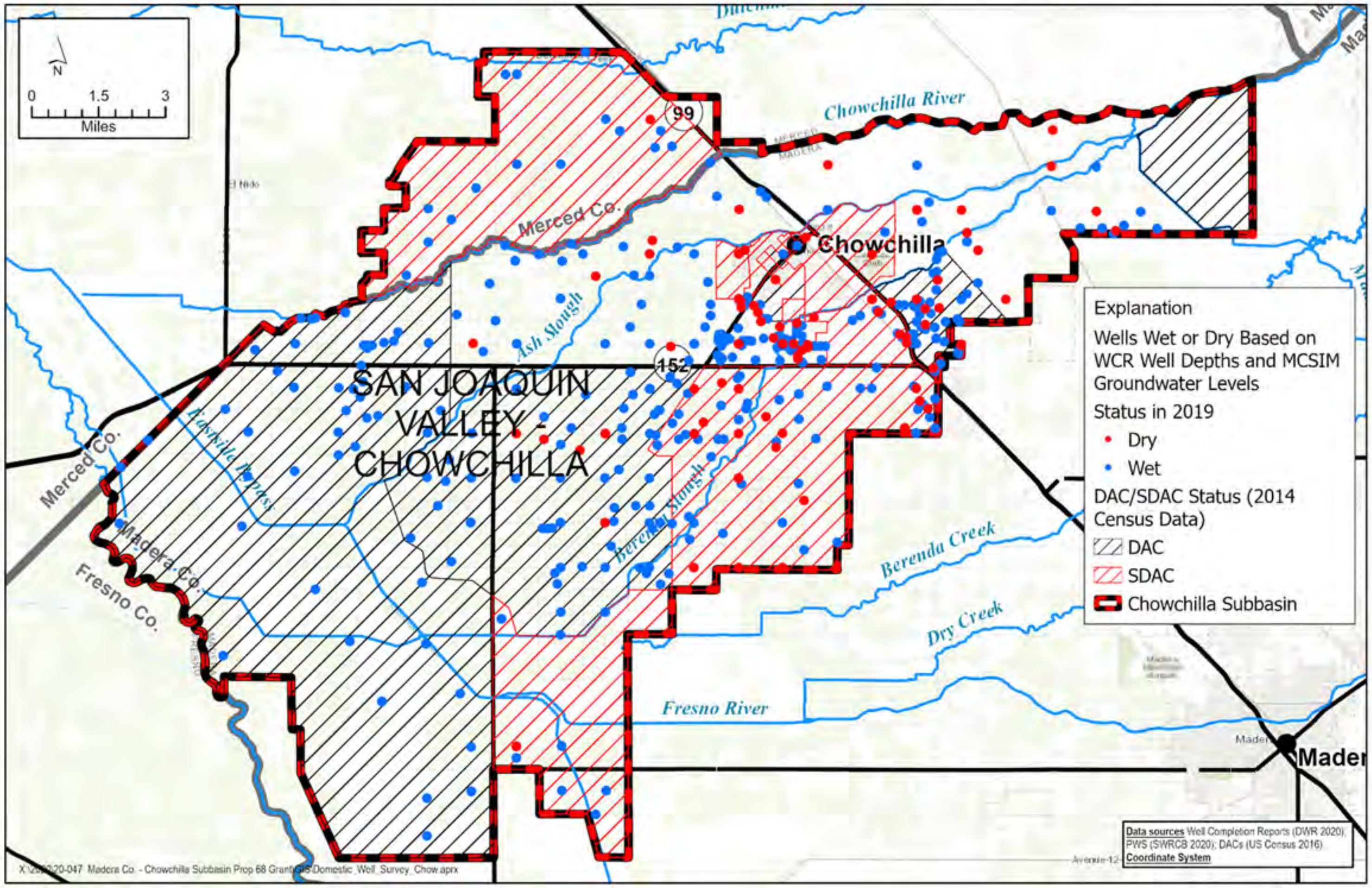

Figure 13a: Status of Domestic Wells in 2019 - Based on WCR Well Depths and Locations Compared to MCSIM Groundwater Depths.

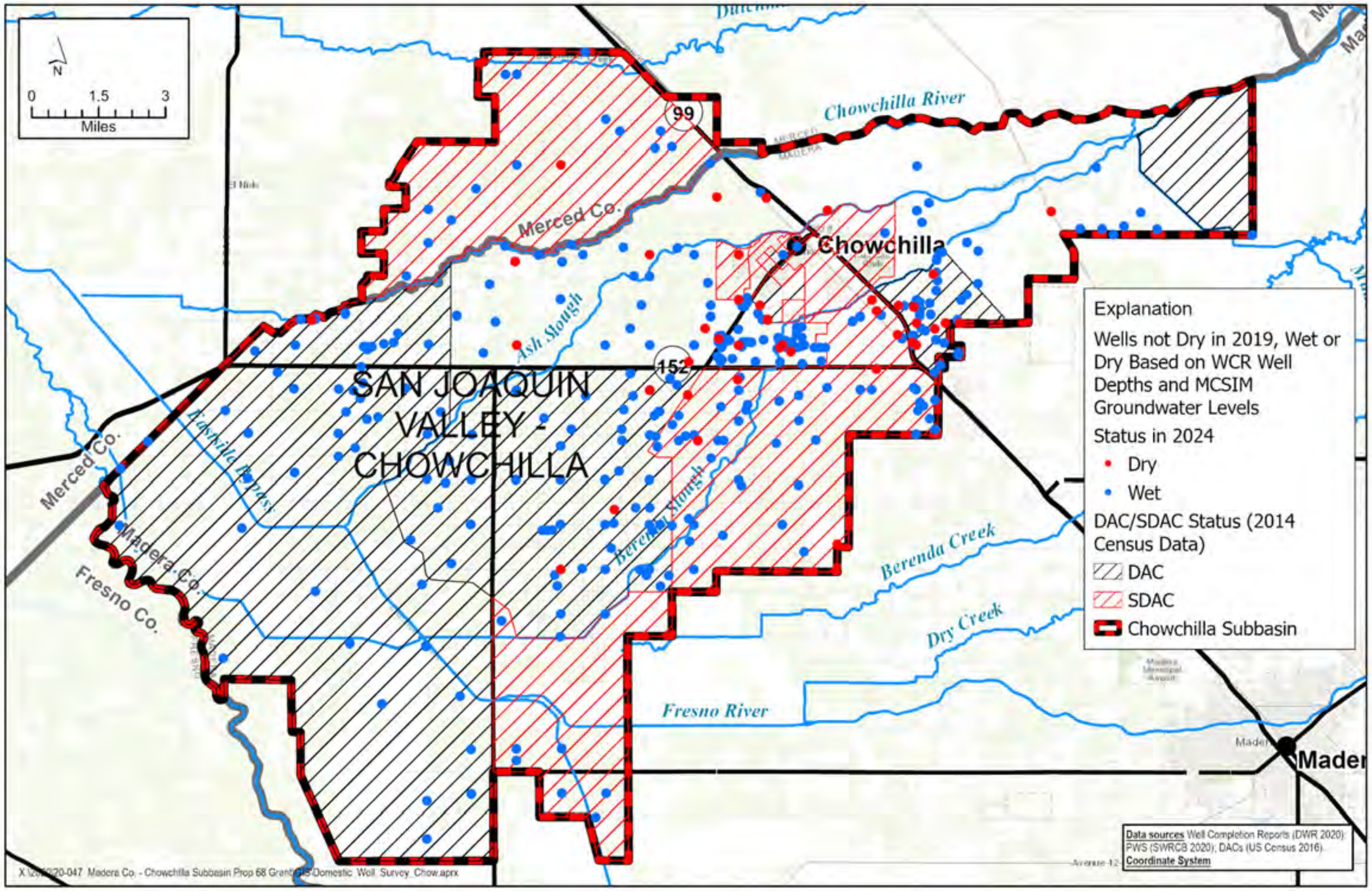

Figure 13b: Status of Wells in 2024 - Based on WCR Well Depths and Locations Compared to MCSIM Groundwater Depths.

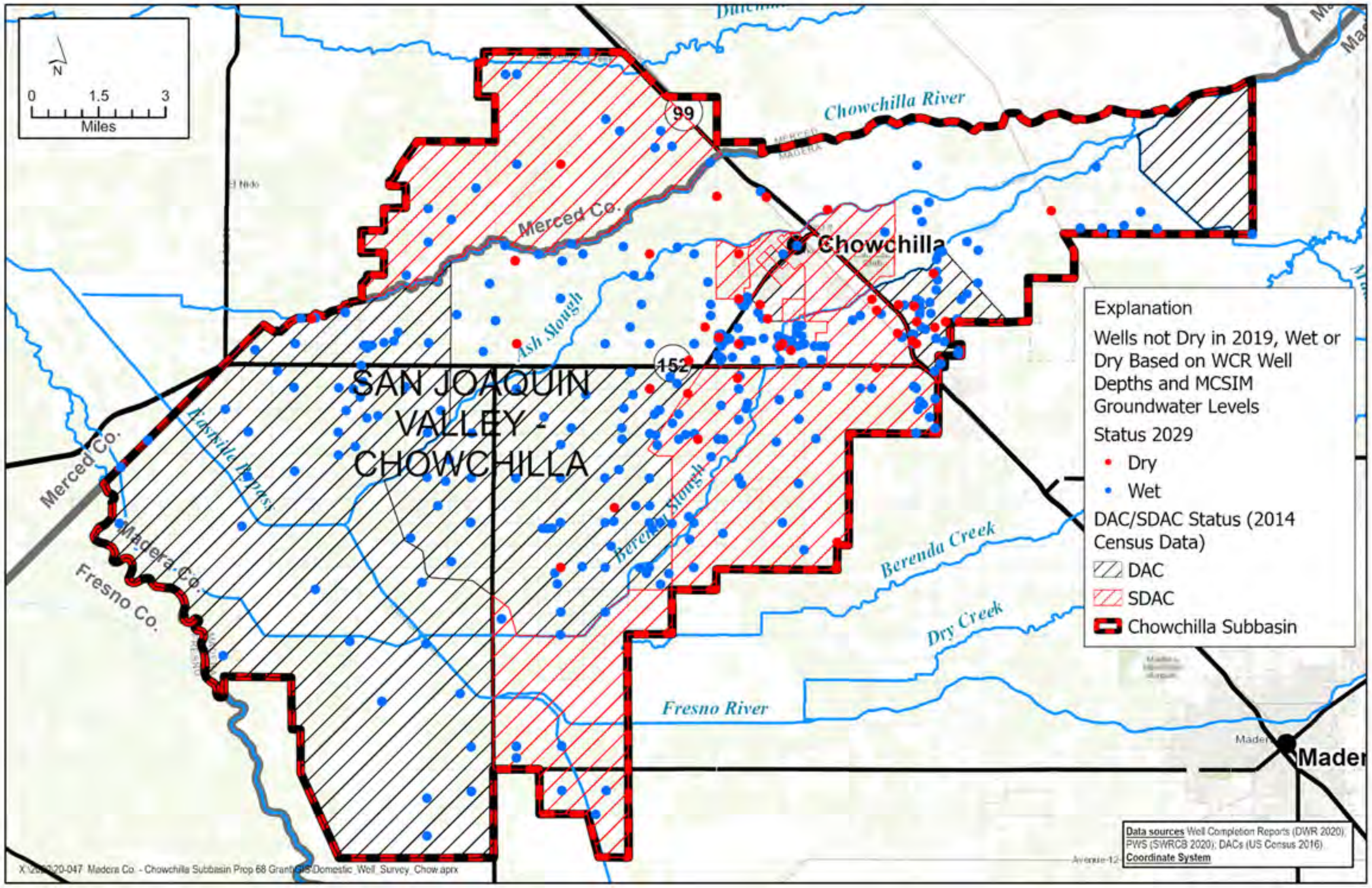

Figure 13c: Status of Wells in 2029 - Based on WCR Well Depths and Locations Compared to MCSIM Groundwater Depths.

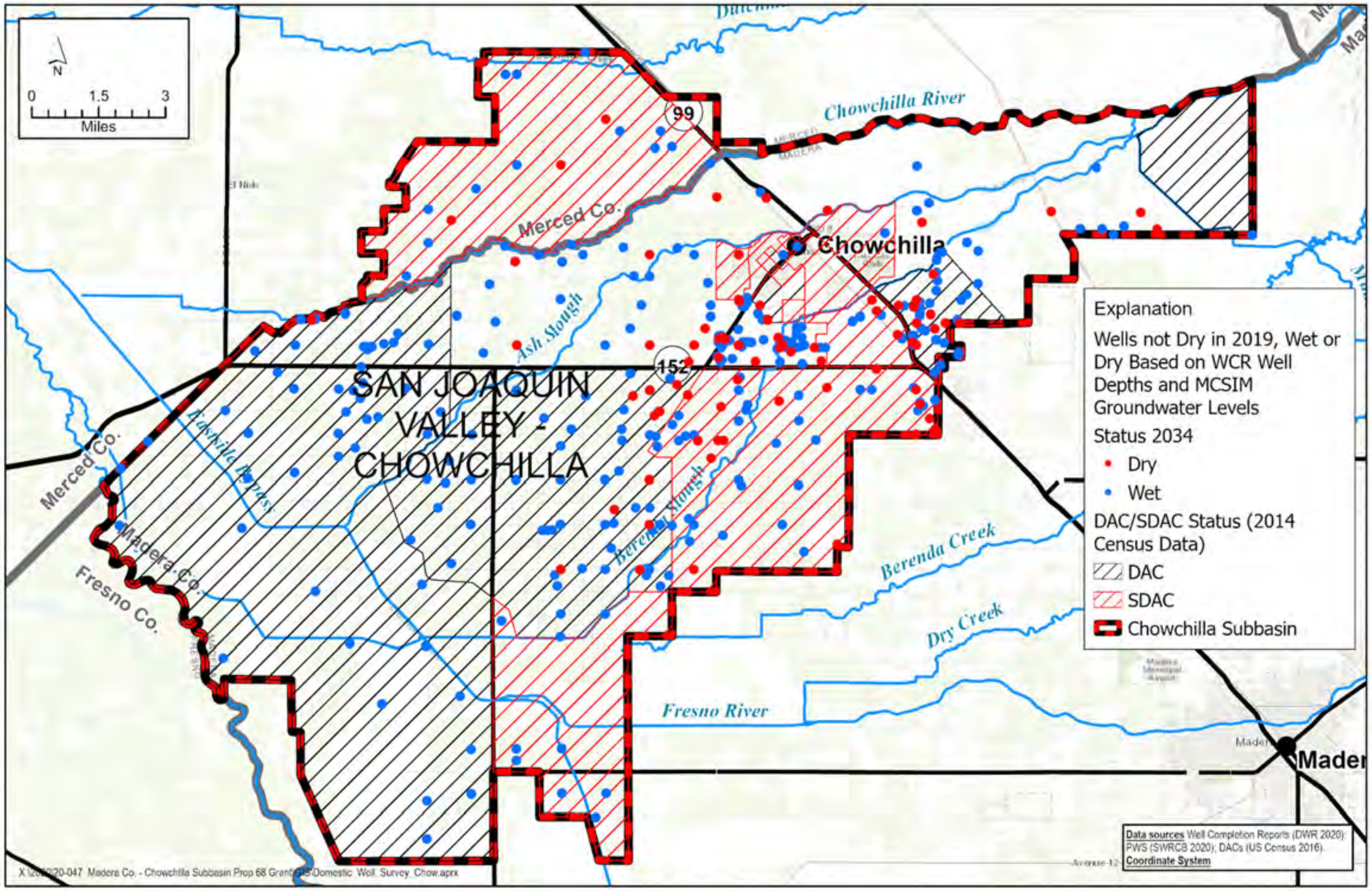

Figure 13d: Status of Wells in 2034 - Based on WCR Well Depths and Locations Compared to MCSIM Groundwater Depths.

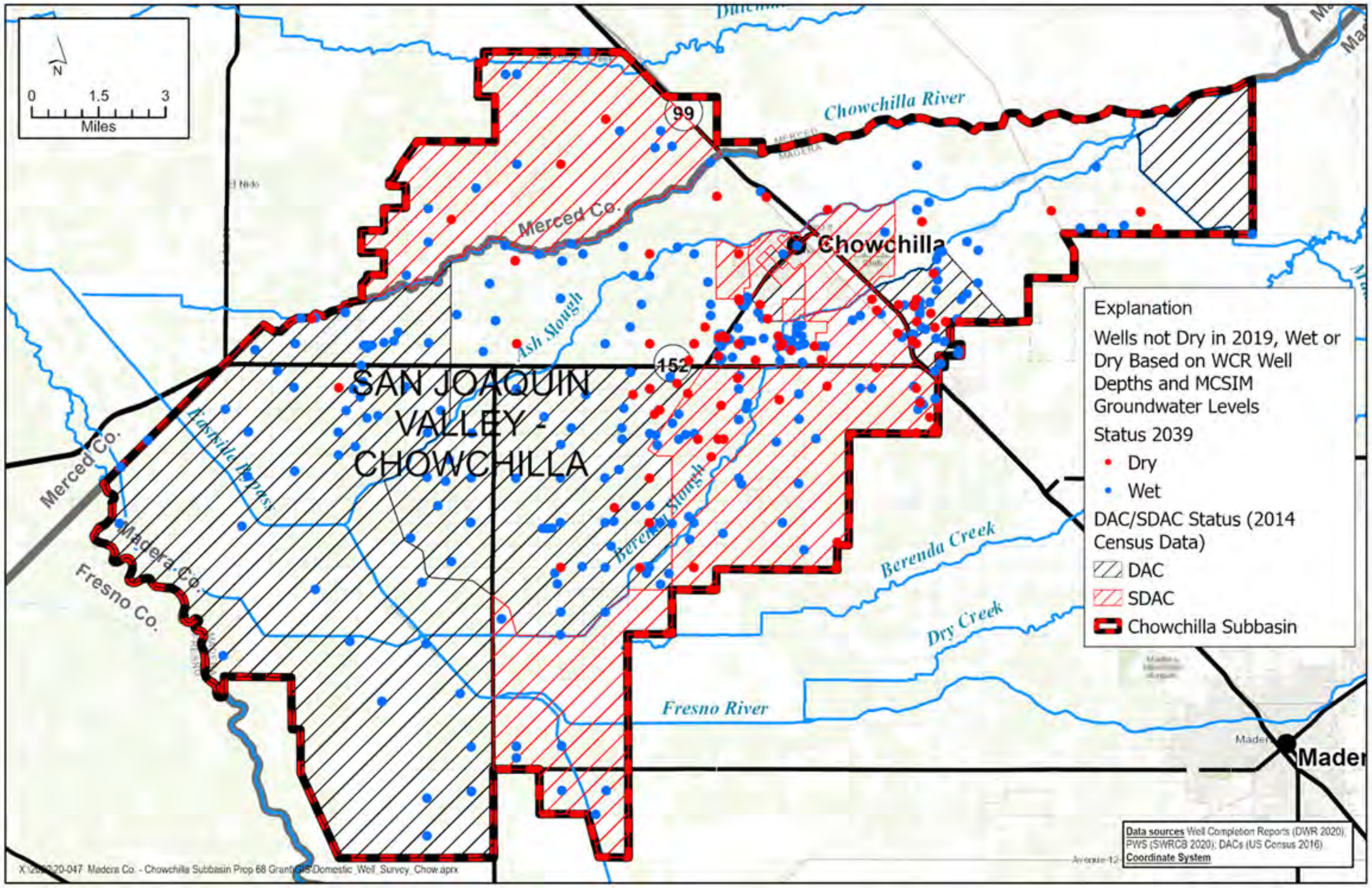

Figure 13e: Status of Wells in 2039 - Based on WCR Well Depths and Locations Compared to MCSIM Groundwater Depths.

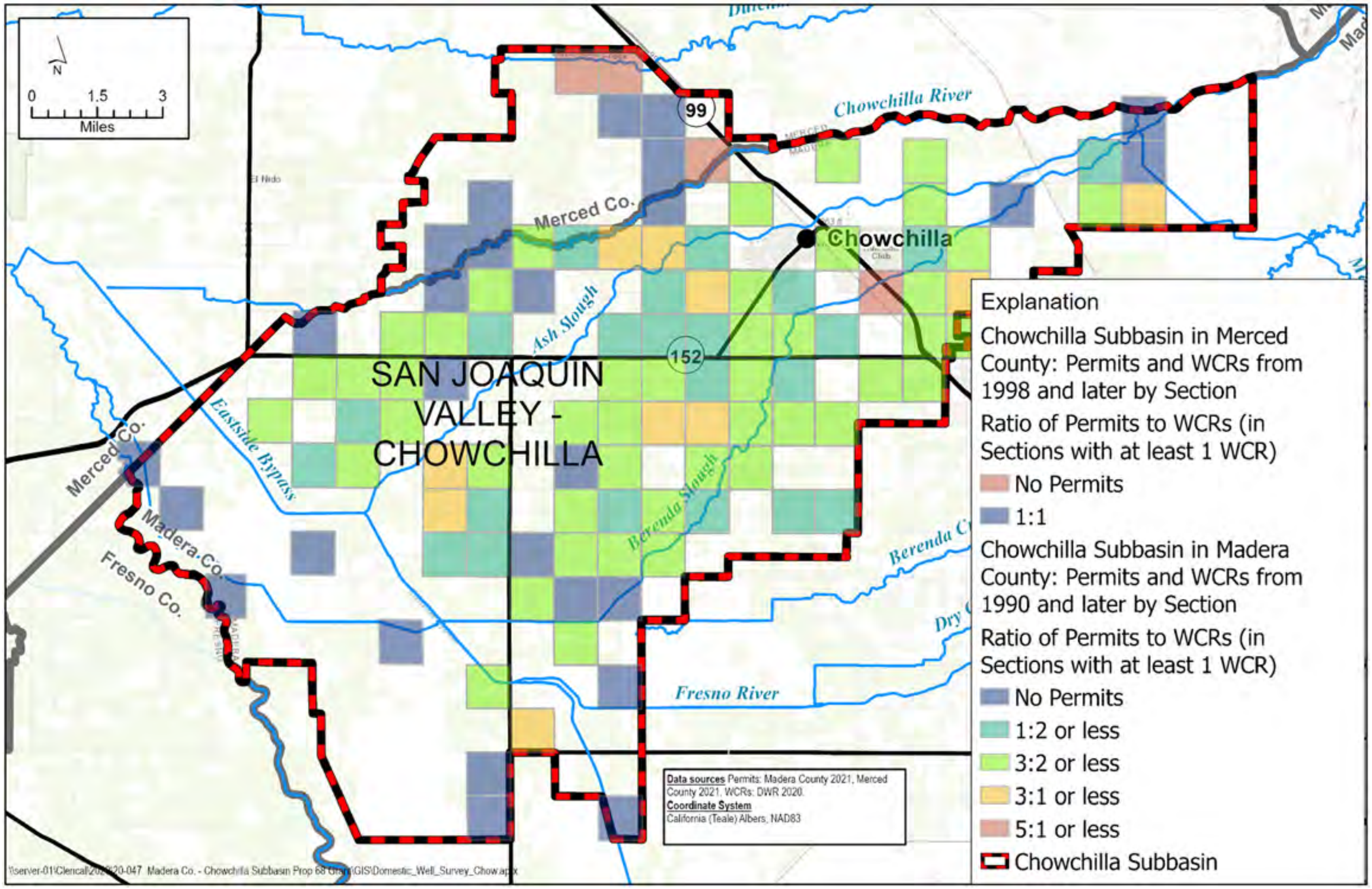

Figure 14: Map of Domestic Well Permits Compared to Domestic Well WCR (from 1990 and later) Locations.

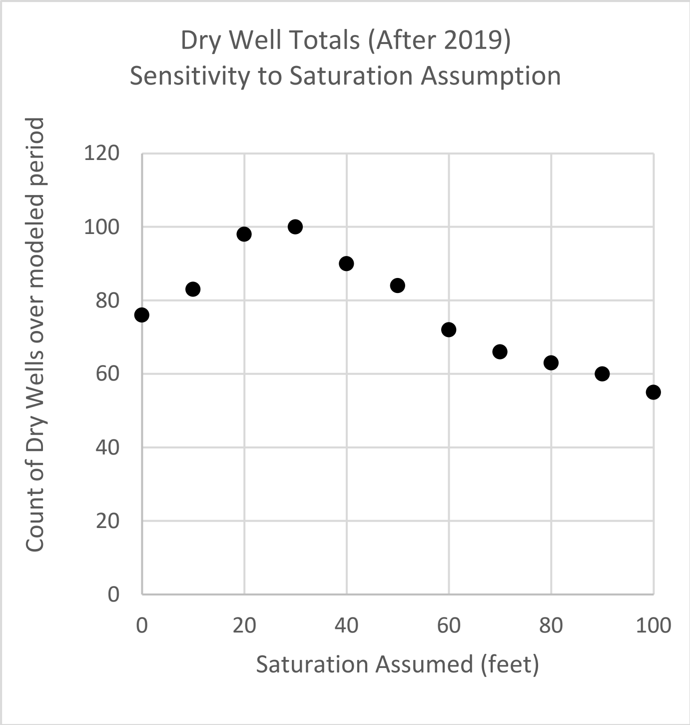

Figure 15: Counts of Dry Wells as a Function of Minimum Saturation Threshold.

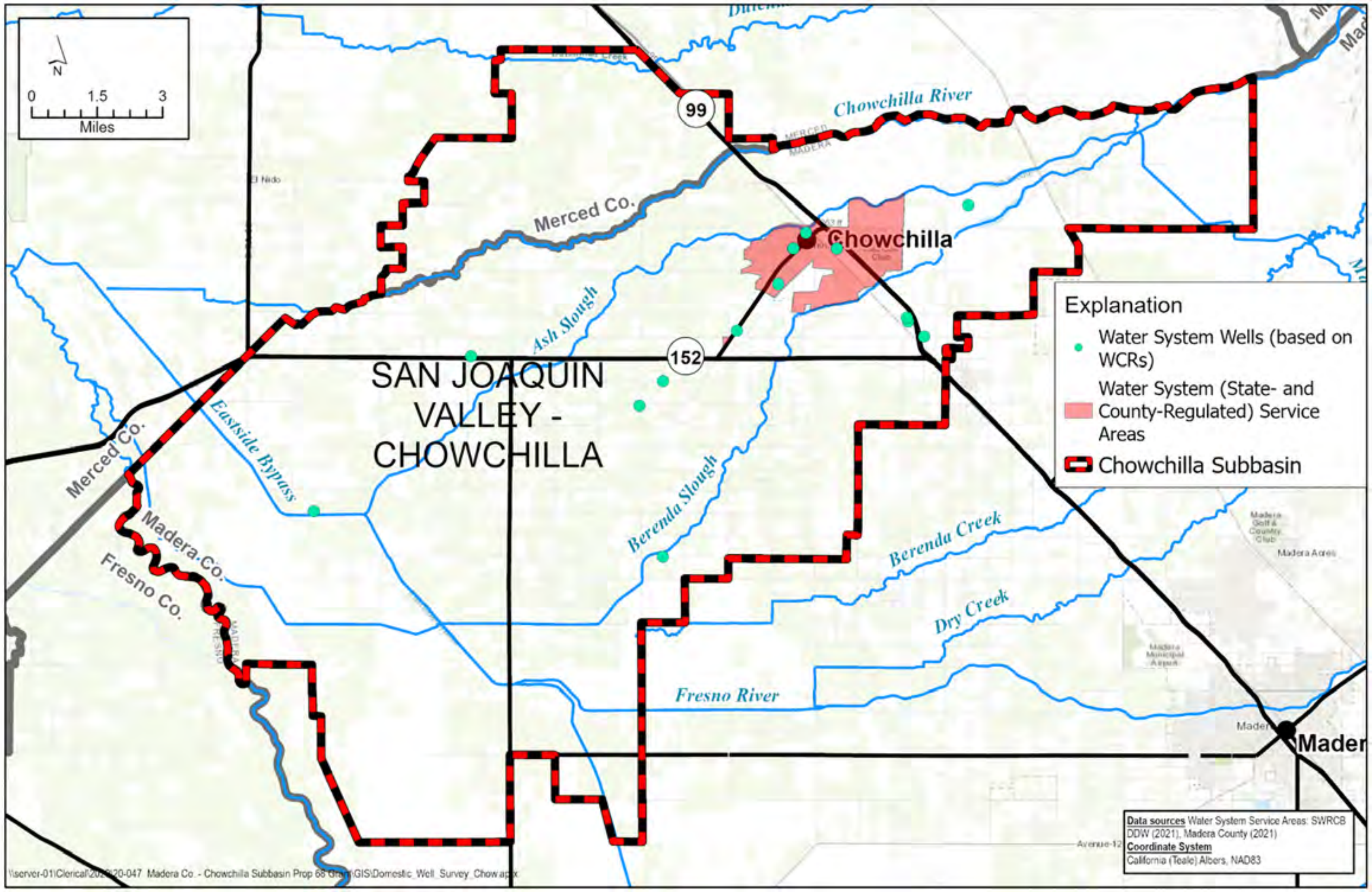

Figure 16: Public Water System and Other Municipal or Community Water System Wells. Based on WCR data.

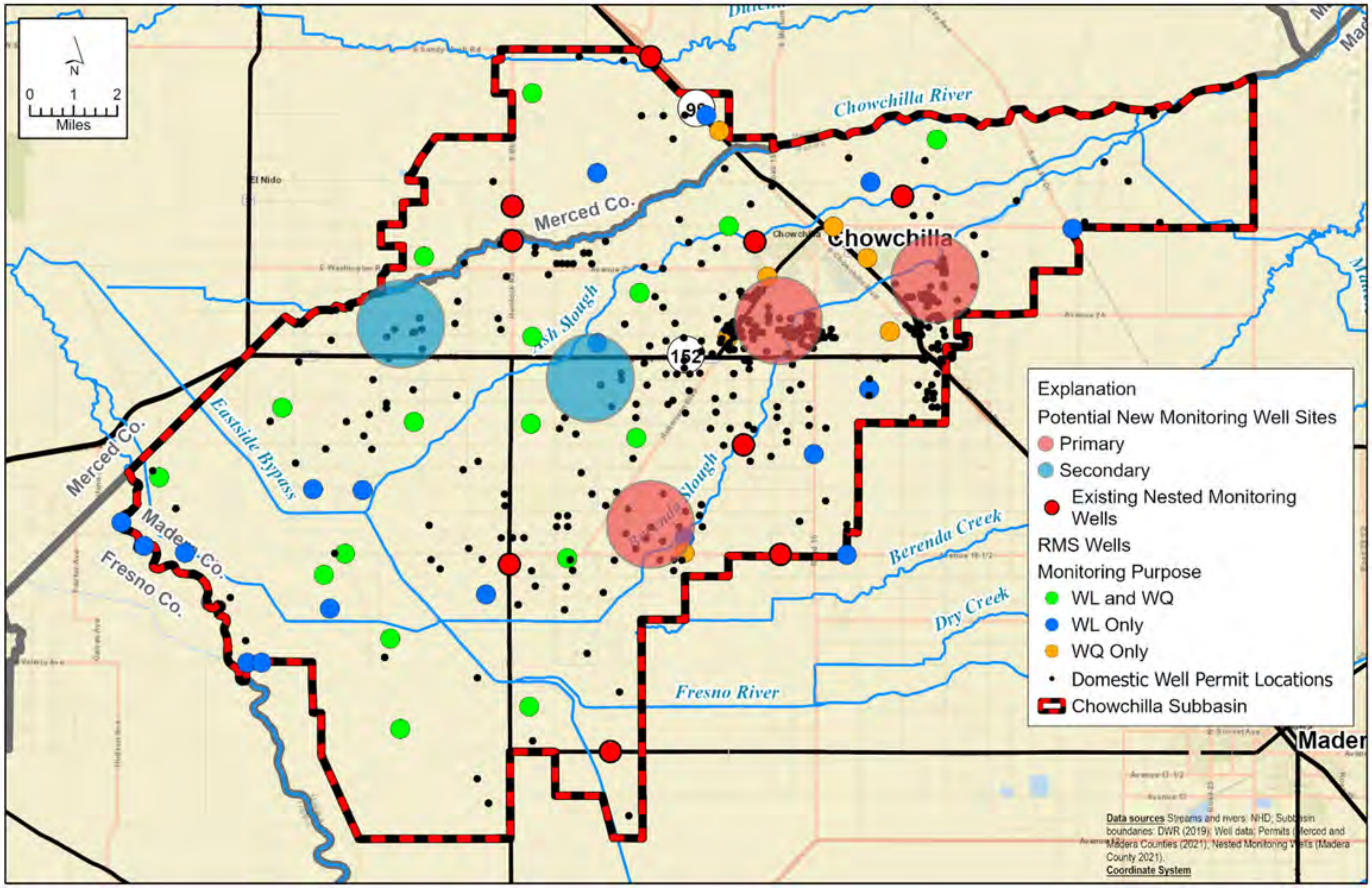

Figure 17: Map of Proposed New Monitoring Well Sites.

ATTACHMENT 1

Domestic Well Replacement Economic Analysis – Chowchilla Update

ERA Economics
Environment • Resources • Agriculture

ERA Economics
1111 Kennedy Place, Suite #4
Davis, CA 95616

Technical Memorandum

Subject: Domestic Well Replacement Economic Analysis – Chowchilla Update

By: ERA Economics

To: LSCE and the Madera County GSA

Date: January 10, 2022

Purpose and Background

In June 2019 ERA provided a technical memorandum (TM) estimating the cost and benefit of more rapid implementation of demand management under the Chowchilla Subbasin GSP. The economic analysis was included as Appendix 3C to the Chowchilla Subbasin GSP. The analysis was prepared with the best available data and information at that time. After finalizing the GSP, the LSCE and DE consultant teams have continued to assist the Chowchilla Subbasin GSAs with GSP implementation and annual GSP reporting. LSCE was engaged by the Madera County GSA to prepare an updated domestic well inventory for the subbasin.

The economic analysis included as Appendix 3C to the Chowchilla Subbasin GSP estimated the total cost of replacing domestic wells potentially impacted by declining groundwater levels under baseline conditions without SGMA and under the draft proposed GSP implementation plan (so-called "with-SGMA" scenario).

This technical memorandum (TM) serves as an update to those estimates by: (i) updating the project and demand management schedule to reflect the adopted allocation in the Chowchilla Subbasin, (ii) incorporating updated data and analysis on potentially impacted wells from the domestic well inventory, (iii) updating all costs and benefits to current dollars (e.g., well replacement costs), and (iv) refining the economic analysis to compare the cost and benefit of accelerating demand management specified in the GSP. That is, the 2019 analysis compared the draft GSP implementation to baseline conditions without SGMA, whereas this analysis compares the proposed plan with phased implementation of projects and management actions (PMAs) to an accelerated, immediate implementation of PMAs, notably with immediate full demand management to avoid further domestic well impacts.[1]

These updates to the data affect the resulting economic analysis and results. The 2019 estimate of domestic wells needing to be replaced without increased demand management was 40 wells, which at that time was doubled to account for potential under-reporting. In addition, a sensitivity calculation as

[1] Whereas the cost of immediate demand management implementation has been included, the effect on cost of accelerating recharge and supply projects has not yet been estimated. A full cost estimate of projects for all GSAs in the subbasin is still under development. If this additional cost were included, it would strengthen the conclusion of this analysis.

part of the earlier analysis verified that the conclusions would have held even if the number of affected wells were substantially larger. The updated domestic well inventory puts the number of domestic wells potentially needing replacement at 176 over the 20-year GSP implementation period. This TM briefly summarizes the updated analysis, results, and summary conclusions.

Summary Conclusions

Results of this updated analysis comparing the cost of accelerated PMA implementation to the benefit of avoided domestic well replacement costs support the general conclusion of the 2019 analysis. The loss in agricultural value from more rapid demand management still greatly exceeds domestic well replacement costs even though the estimated number of potentially dewatered domestic wells has increased and the cost of replacement for each domestic well has increased by 20 percent. That is, the results of the economic analysis show that the additional cost of more rapid demand management is substantially greater than the cost of replacing potentially dewatered domestic wells and paying higher pumping costs due to lower water levels. This supports the phased implementation schedule and domestic well mitigation program defined in the GSP.

Updated Assumptions

Assumptions and results below are summarized for each of the cost categories considered. All costs (or savings) are expressed as constant 2021 dollars converted to present value using a 3.5 percent real (inflation-free) discount rate[2]. The two implementation scenarios compared are referred to as *GSP implementation* (the phased implementation as described in the GSP) scenario and the *immediate demand reduction* (full demand reduction to eliminate overdraft from 2021 onward) scenario.

1. **Number of dewatered wells needing replacement**. Revised estimates of dewatered wells are calculated and described in the Technical Memorandum prepared by LSCE for the Chowchilla Subbasin Domestic Well Inventory. For this analysis, a total of 176 wells were estimated to be dewatered, spread across four 5-year periods. The cost analysis further assumed that well impacts would be evenly divided by year within each 5-year period[3]. For the comparison scenario with immediate demand reduction, it was assumed that none of those wells would need replacement.
2. **Costs to replace dewatered domestic wells**. The 2019 estimate of an average $25,000 per replaced domestic well is updated to $30,000 per domestic well.
3. **Groundwater pumping depth to water (DTW).** The average DTW for the GSP implementation scenario was provided from groundwater model projections described in the Chowchilla Subbasin GSP. The immediate demand reduction scenario is intended to represent immediate elimination of average annual overdraft. A time series was created that followed the

[2] The current federal discount rate for water projects is 2.25%, but a real rate of 3.5% better reflects borrowing conditions in Madera County. A 1.5% increase or decrease in the real discount rate does not affect the conclusions of the analysis.
[3] The timing of the well replacement within each 5-year period does not affect the conclusions of this analysis.

general hydrologic variation estimated for the GSP implementation scenario but held the DTW the same on average during the 2021-2040 implementation period. The ending (2040) difference in DTW between the two scenarios was then carried forward beyond 2040. These pumping depth differences are the basis for the estimated annual pumping cost savings.

4. **Changes in variable costs to pump groundwater, for both domestic and agricultural users.** Energy prices, estimated using a mix of PG&E's latest electricity rates for agricultural pumping, have increased substantially. The analysis now uses an average of PG&E's 2021 AG-B and AG-C peak and off-peak summer rates, resulting in an estimate of $0.40 per acre-foot per foot of lift for the variable cost to pump groundwater. As a result, more rapid demand management provides greater savings (avoided pumping lift) for domestic and agricultural pumping. All agricultural and domestic groundwater pumping in the basin would receive this avoided lift benefit from faster demand reduction.

5. **Costs of demand management under GSP implementation**. Costs of demand reduction have been revised based on the latest estimates of the net return to agricultural water use developed for planning the SALC program. In addition, pumping volumes have been updated to reflect current conditions and the planned ramp-down adopted in the Madera County GSA groundwater allocation ordinance (applicable to the GSP implementation scenario only). These values do not represent average returns to all lands and crops in the subbasin but rather the lands and crops more likely to participate in a demand reduction program. For purposes of this analysis, the lost net return from demand reduction is valued at $200 per acre-foot[4].

Results

The following discussion compares costs between the GSP implementation scenario and the (alternative) immediate demand management scenario. General observations are:

- Demand management costs are greater in the immediate implementation scenario because demand management would be implemented sooner (immediately) and for more years during the GSP implementation period. Recharge and supply projects' costs have not been included in this analysis, but their present value costs would also increase because they would be implemented sooner.
- Pumping costs are lower in the immediate demand reduction scenario because, by definition, the average annual overdraft is eliminated immediately. The effect (smaller DTW and lower pumping cost) is carried throughout the remaining years of GSP implementation and in perpetuity.

[4] The value of water depends on future crop market conditions. Note that a higher value (greater than $200 per acre-foot applied in this TM) would further increase the cost of accelerated demand management relative to avoided well replacement and additional pumping costs.

- Well replacement costs occur in the GSP implementation scenario but are not required in the immediate demand reduction scenario.
- The net effect of these differences in costs results in the GSP implementation scenario having a substantial cost advantage (by about $36 million in present value, or 16 percent) over the immediate demand reduction scenario. In other words, the Chowchilla Subbasin is better off (i.e., realizes benefits that exceed costs) implementing its phased GSP implementation plan and developing/funding the domestic well mitigation program to replace impacted wells than it is if it were to implement immediate demand reduction to avoid dewatering any domestic wells.

Table 1 summarizes the results of the economic analysis. All values are expressed in present value terms. The first two rows show the number of and cost to replace wells estimated to go dry in each scenario. The next rows present the pumping cost savings of the immediate demand reduction scenario relative to the GSP implementation scenario, broken down by domestic pumping and agricultural pumping. The next row shows the demand management costs. For the GSP implementation scenario, demand management is phased in at two percent per year initially, increasing to 6 percent per year until full demand management is reached by 2040. In contrast, the immediate demand reduction scenario implements the full demand management required in 2020, resulting in substantially higher demand management costs.

Table 1. Costs of GSP Implementation Scenario Compared to Costs of Immediate Demand Reduction Scenario - Summary Results for Chowchilla Subbasin, Present Value ($ in Millions)

	GSP Implementation with Well Replacement	Immediate Demand Reduction	Difference
Domestic Well Replacement			
Number	176	0	176
Cost, PV	$4.60	$0.0	$4.60
Pumping Cost (Savings), PV			
Domestic	NA	-$2.87	$2.87
Agricultural	NA	-$79.58	$79.58
Demand Mgmt. Cost, PV	$219.43	$342.37	-$122.94
Total Cost, PV*	$224.03	$259.91	-$35.88

* Totals may not add exactly due to rounding.

Discussion

Results indicate that the cost of implementing demand management on a faster trajectory (in this case, in year one of the implementation period) would not be cost effective from a subbasin-wide perspective. The avoided costs (fewer domestic wells requiring replacement) would be small ($4.6 million) relative to the additional lost agricultural net return[5] from immediate implementation ($122.9 million) for the Chowchilla Subbasin, even after accounting for pumping cost savings ($82.5 million). The general conclusions are robust to the assumptions used. That is, results are not sensitive to reasonable ranges in key assumptions, including the loss in net return per acre-foot of demand management, the total level of demand management, when demand management begins to scale in, or the cost of replacing a domestic well.

This analysis only compares the cost of well replacement to net costs of immediate demand management implementation; it has not considered the timing of other projects such as new surface water supplies or groundwater recharge. That comparison is not possible with current information, and the GSP implementation schedule already reflects an aggressive timeline for project implementation. The cost (in present value) of accelerating implementation of projects has also not been included here.The additional cost of accelerating a recharge project by, say five years, would be the increased present value of the project's capital and O&M cost stream. Costs of new supply and recharge projects have not been accelerated, so the present value of costs for immediate implementation is underestimated. Simply stated, including these additional costs would further support the conclusions of the analysis.

[5] Note that demand management would result in additional economic impacts to other county businesses and industries. These additional indirect impacts are not considered in this updated analysis but would only further support its conclusions.

ATTACHMENT 2

Chowchilla Subbasin – Evaluation of DWR Household Water Supply Shortage Reports and Self-Help Enterprises Tank Water Participants

Luhdorff & Scalmanini
Consulting Engineers

Technical Memorandum

DATE: February 8, 2022 PROJECT: 20-1-047

TO: File – Chowchilla Subbasin Domestic Well Inventory

FROM: Pete Leffler, Nick Watterson, Aaron King

SUBJECT: **Chowchilla Subbasin - Evaluation of DWR Household Water Supply Shortage Reports and Self-Help Enterprises Tank Water Participants**

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1. INTRODUCTION

To support efforts related to implementing the Chowchilla Subbasin Groundwater Sustainability Plan (GSP), the Subbasin completed a Domestic Well Inventory project that identified potential domestic wells in the Subbasin and analyzed potential impacts to domestic wells caused by lowering of groundwater levels historically and during the 20-year GSP implementation period starting in 2020. The Domestic Well Inventory for the Chowchilla Subbasin compiled information on domestic wells in the Subbasin from Well Completion Reports and County well permit datasets and compared these data to modeled groundwater levels in the Subbasin from the GSP over the period from 2014 through 2040. During development of the GSP, historical and future groundwater levels throughout the Subbasin were modeled based on historical conditions and projected future conditions. This memorandum summarizes a review of records in the Department of Water Resources (DWR) Household Water Supply Shortage Reporting System and also participants in the Self-Help Enterprises (SHE) Tank Water program, and includes a comparison of these two datasets with the results from analyses of domestic well impacts conducted as part of the Chowchilla Subbasin Domestic Well Inventory.

2. DWR HOUSEHOLD WATER SUPPLY SHORTAGE REPORTING SYSTEM

Overview of the Household Water Supply Shortage Reporting System

The DWR Household Water Supply Shortage Reporting System (https://mydrywell.water.ca.gov/report/) is a site for reporting of problems with private (self-managed, not served by public water system) household water supplies. The site was initially created in 2014 as part of drought emergency response efforts and continues to be used to collect information on household water supply shortages from private well or surface water sources. The data in the reporting system reflect information on water supply shortage issues voluntarily submitted by private, local, state, federal, and non-governmental individuals and organizations. Because the data do not undergo review or quality control by DWR, the reported information is not suggested to be complete in its accounting for all water supply shortages and it is also noted by DWR that there may be errors and omissions in data, duplicate entries, and records for non-household related water supply issues. Furthermore, during review of the data, many incomplete and inconsistent records were noted, with many reports providing very little detail for use in understanding the cause of the issue reported. There are a variety of potential causes for issues related to the quantity or quality of water produced by a well, and this can include issues related to the well pump, water distribution system, or the well structure, without relationship to groundwater conditions in the aquifer.

The submission of information to the Household Water Supply Shortage Reporting System is done through completion of a report submittal form (https://mydrywell.water.ca.gov/report/public/form), which includes questions related to the issue, including required entries on the following:

- Type of shortage: a) Dry well, b) low streamflow, or c) other
- Description of the water issue: a) well is dry (no longer producing water), b) reduction in water pressure/lower flows, c) well pumping sand/muddy water, d) well is catching air (have to wait to be able to pump, e) reduction in water quality, or f) other
- Primary use of the well or creek: a) household, b) agriculture/irrigation, c) combination of household/agriculture, or d) other
- Approximate date problem started
- County

As of January 2022, the reporting system included 3,769 entries across the state of California, with dates when the problem started spanning the period from 2012 through 2021.

Household Water Supply Shortage Records within Chowchilla Subbasin

The Household Water Supply Shortage Reporting System contains a total of 46 reports with locations in the Chowchilla Subbasin. The reports within the Subbasin were grouped into two categories according to the type of water supply issue indicated: 1) dry wells, and 2) reduced flow or impaired water quality. **Figure 1** presents the number of reported well-related issues by year within the Chowchilla Subbasin. Of the 46 reports within Chowchilla Subbasin, 41 were categorized as a dry well issue and six were categorized as reduced flow or impaired water quality issues. As illustrated on **Figure 1**, most water supply issues in the system were reported to have started in 2014, 2015, and 2021, with relatively fewer during other years. The greatest number of reports occurred during 2015 after multiple years of drought conditions in the area. **Figure 2** shows the locations of the water supply issue reports in the system. Most water shortage reports in the Subbasin are located in the central Subbasin.

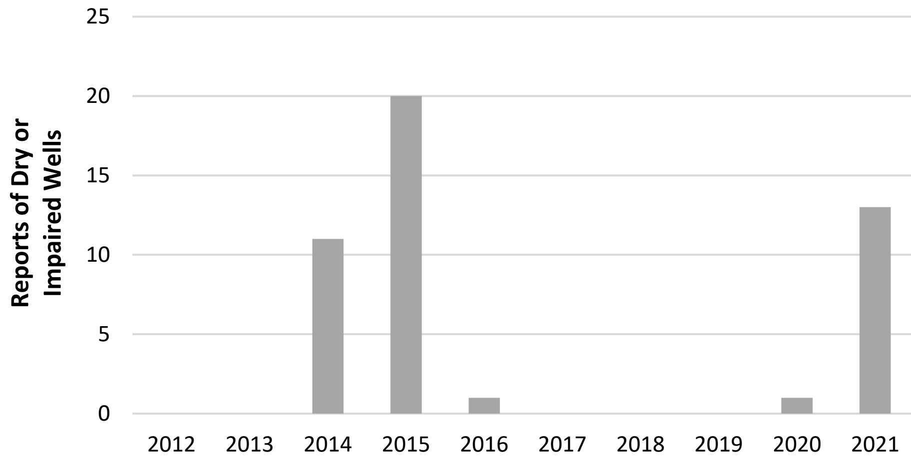
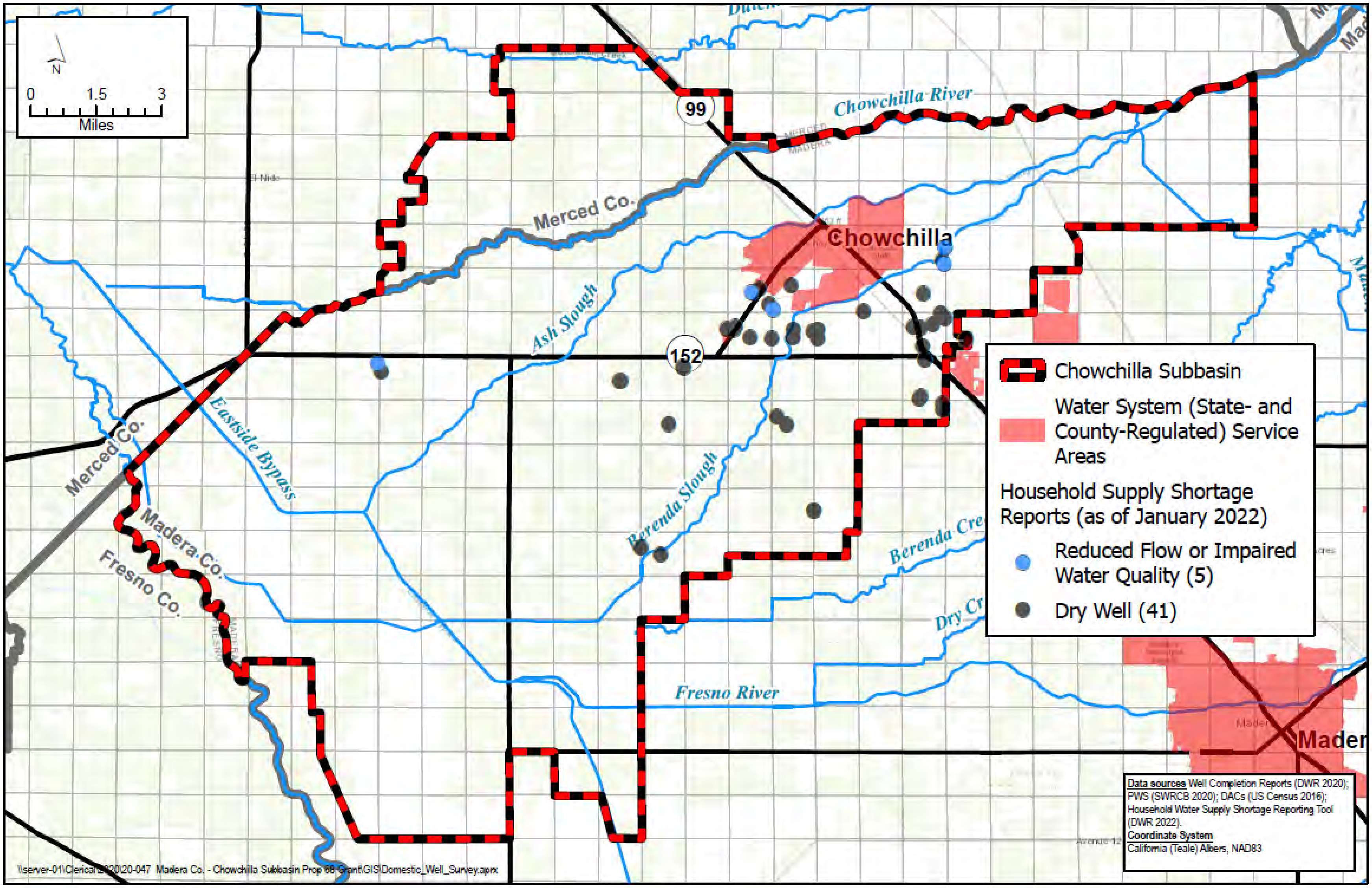


Figure 1. Chart of Household Water Supply Shortage Report Records in Chowchilla Subbasin



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Consulting Engineers

Figure 2
DWR Household Water Supply Shortage Reporting Data
Chowchilla Subbasin
Groundwater Sustainability Planning

3. SHE TANK WATER PROGRAM PARTICIPANT DATA

Overview of the SHE Tank Water Participant Data

The SHE Tank Water Program provides a temporary water supply solution for households experiencing a well water shortage in eight counties in and adjacent to the San Joaquin Valley: Fresno, Kern, Kings, Madera, Mariposa, Merced, Stanislaus, and Tulare. The SHE Water Tank Program assists households experiencing well water shortages by installing a water tank and hauling water and filling the tank to restore access to water for the home. The SHE Tank Water Program is intended as a short-term solution to provide participants access to water for one year while working towards a long-term solution. Data on participants in the SHE Water Tank Program as of January 2022 were provided by SHE (https://www.arcgis.com/home/webmap/viewer.html?webmap=377849cbc9c54046917d864a635e9674&extent=-120.0525,34.8083,-117.2593,36.0392). As of January 2022, the SHE Tank Water Program includes 769 participants in the eight-county area served by the program. The available Tank Water Program participant data only provide locations for participants without other attributes indicating the date or type of issue necessitating the reliance on tank water. There are a variety of potential causes for issues related to the quantity or quality of water produced by a well, and this can include issues related to the well pump, water distribution system, or the well structure, without relationship to groundwater conditions in the aquifer.

SHE Tank Water Participants within Chowchilla Subbasin

The Tank Water Program covers eight counties within the San Joaquin Valley, along with some areas located outside of the San Joaquin Valley and outside of DWR-designated groundwater basins (e.g., foothills areas). The SHE Tank Water Program includes 22 participants within the Chowchilla Subbasin. **Figure 3** presents a map of the Tank Water Program participants within the Chowchilla Subbasin. As illustrated on **Figure 3**, most of the Tank Water Program participants in the Chowchilla Subbasin are located in the area south of the City of Chowchilla. **Figure 4** is a map comparing the locations of SHE Tank Water participants and dry wells in the DWR Household Water Supply Shortage dataset. The spatial distribution of Tank Water participants and dry wells reported in the DWR dataset are very similar and likely include some of the same wells, although no information is available to evaluate such direct relationships in the two datasets.

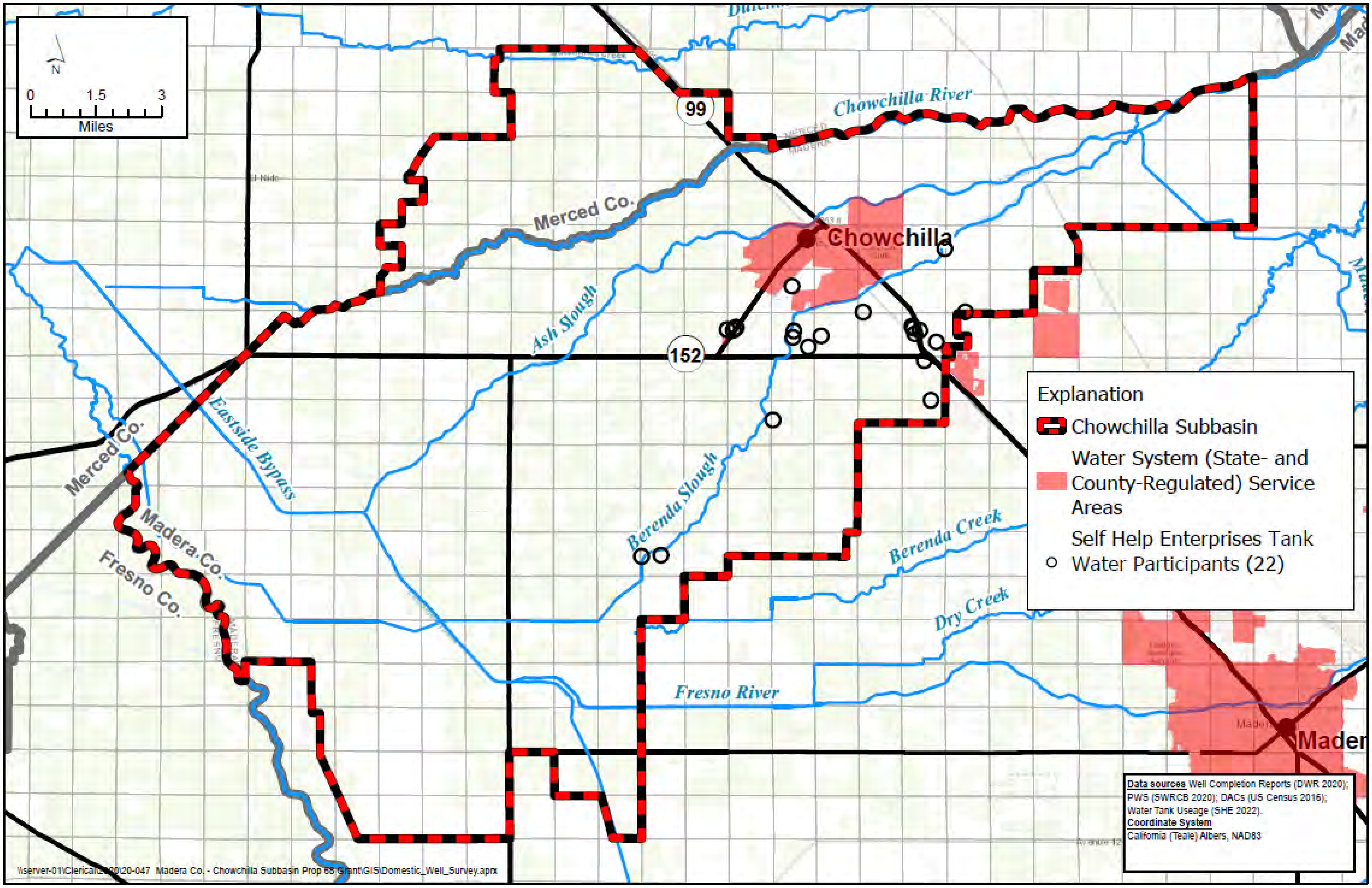

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Figure 3
Locations of Self Help Enterprises Tank Water Participants
Chowchilla Subbasin Groundwater Sustainability Planning

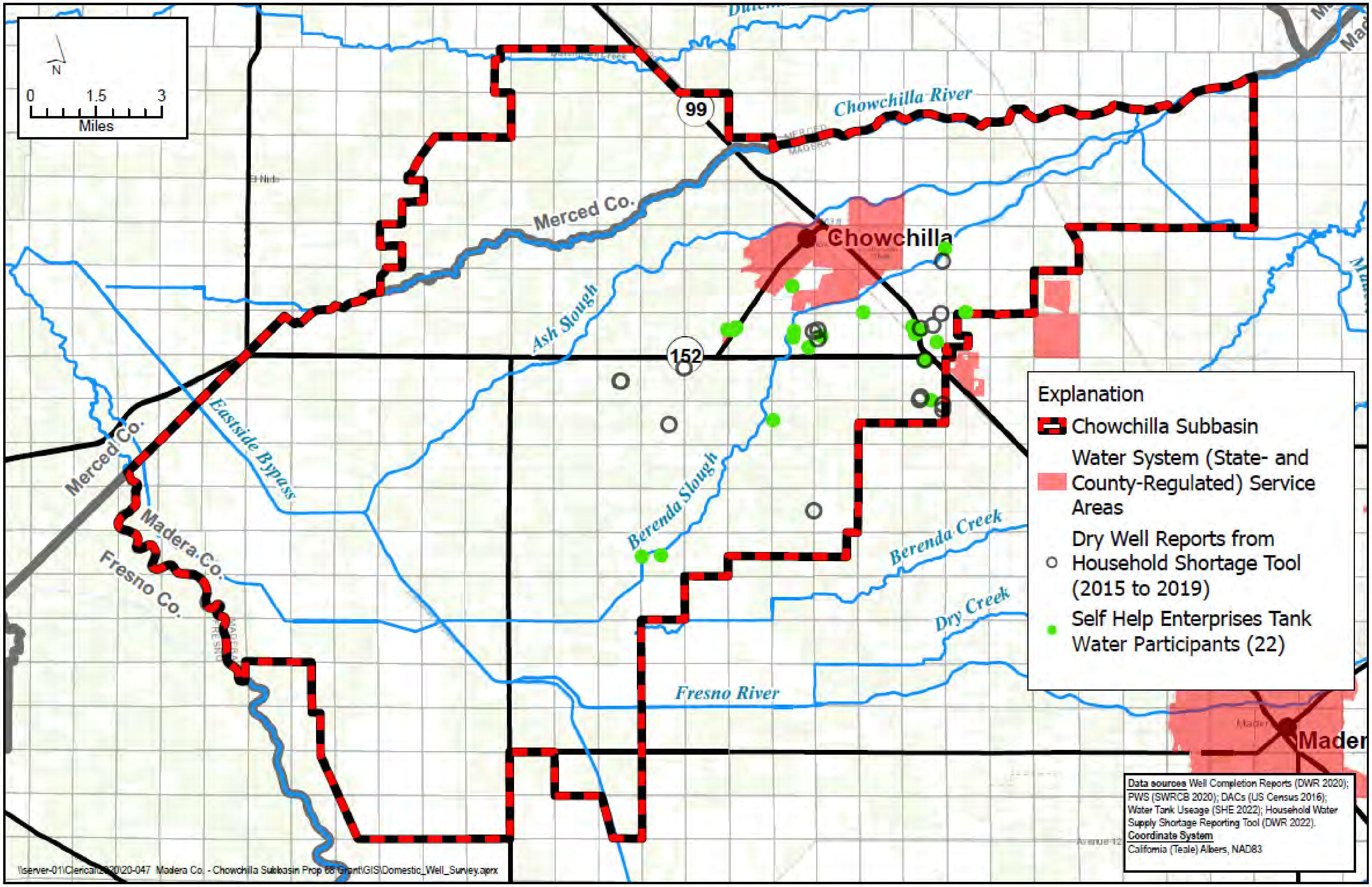

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Figure 4
Comparison of SHE Tank Water Participants and DWR Dry Well Reports
Chowchilla Subbasin
Groundwater Sustainability Planning

4. COMPARISONS OF DWR DRY WELL RECORDS AND SHE TANK PARTICIPANTS WITH ANALYSES OF DRY WELLS FROM THE DOMESTIC WELL INVENTORY

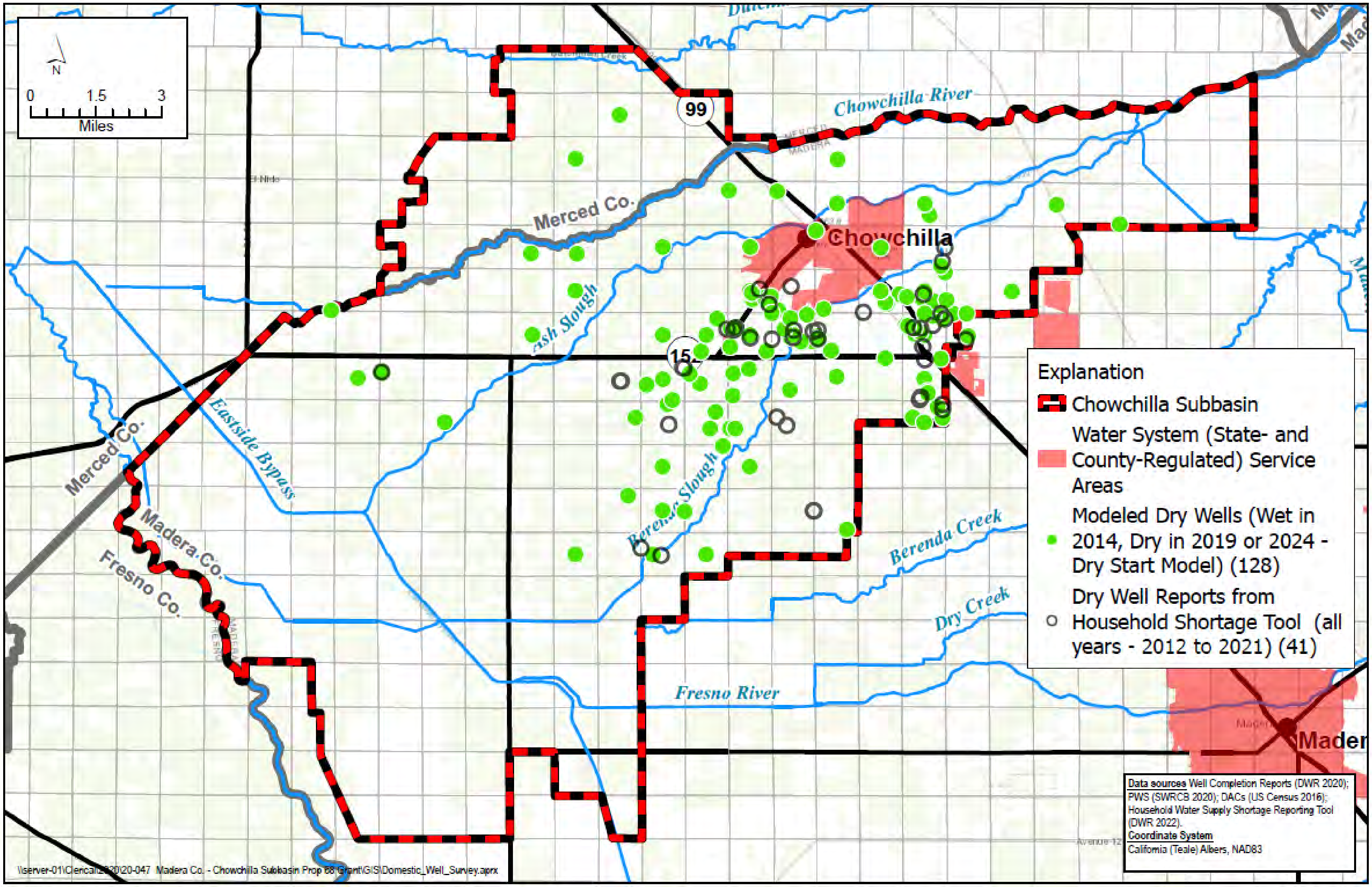
Analyses of potential domestic well impacts in the Domestic Well Inventory were conducted at five-year intervals based on modeled groundwater levels across the Subbasin. To understand differences between dry wells reported to the Household Water Supply Shortage Reporting System and also SHE Tank Water Program participants in relation to estimates of potential dry wells from the Chowchilla Subbasin Domestic Well Inventory analyses, the spatial distribution of dry wells in the Household Water Supply Shortage Reporting System dataset and Tank Water Participants were compared with modeled dry wells over the period from 2015 through 2024.

The comparisons presented in this TM are intended to provide a general sense for the spatial distribution of the different datasets, recognizing the datasets present different types of information related to domestic well issues. As noted above, there are a variety of potential causes for a well experiencing issues related to the quantity of water produced by a well that may be unrelated to groundwater conditions in the aquifer. Some of these issues may be reflected in the DWR Water Supply Shortage Reports and SHE Tank Water Program participants list. It is also likely that many households with wells that have gone dry have not reported such occurrences to the DWR Household Water Supply Shortage Reporting System and many of these households have also not participated in the SHE Tank Water Program. As described in the technical memorandum summarizing the Chowchilla Subbasin Domestic Well Inventory, analyses of potential dry domestic wells in the Domestic Well Inventory are based only on the relationship between available well construction (e.g., screen depth and total well depth) and simulated groundwater levels at each domestic well location.

Comparison of DWR Dry Well Records with Modeled Dry Wells in the Domestic Well Inventory

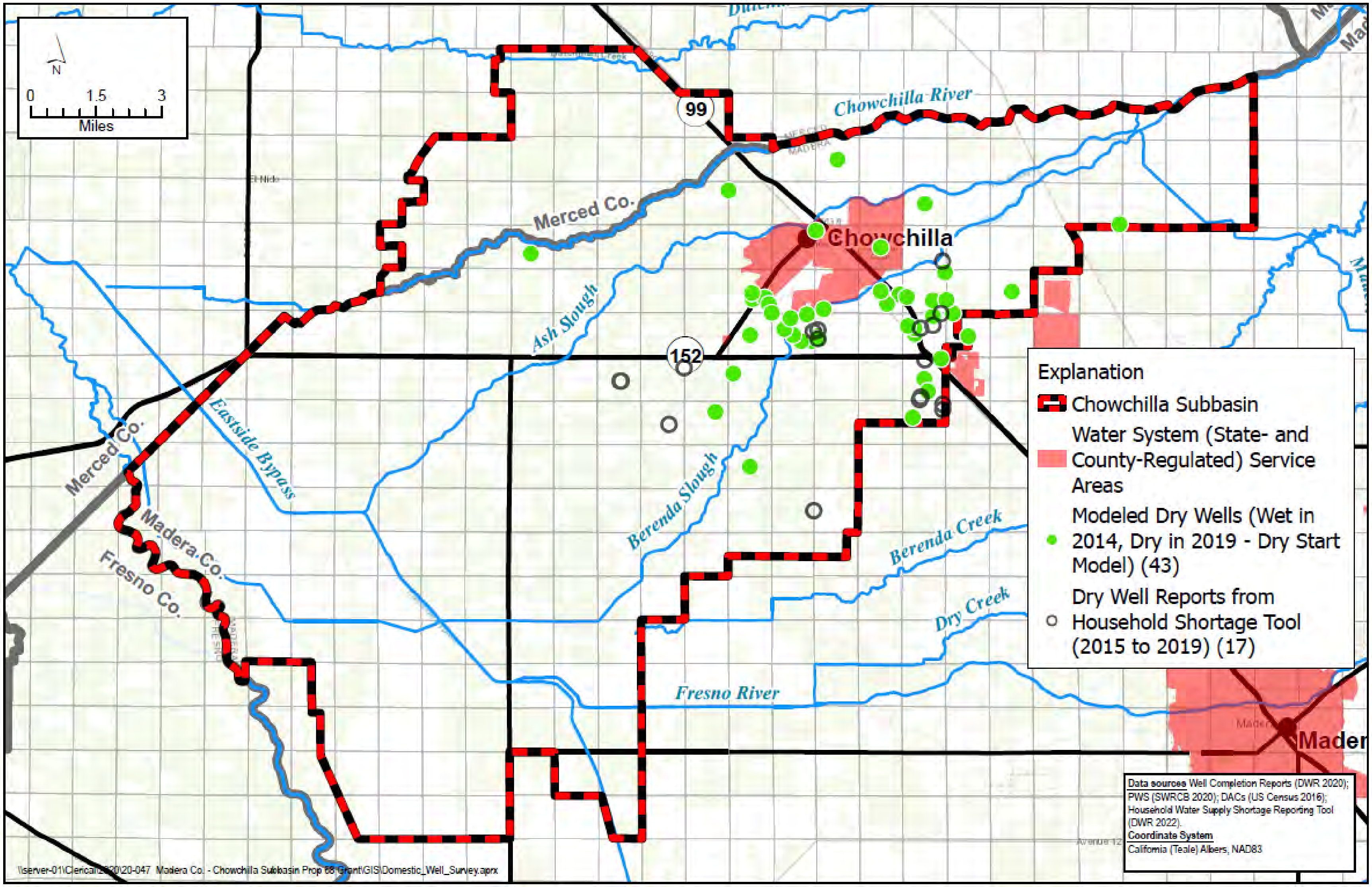
Maps comparing dry well records in DWR's Household Water Supply Reporting System with dry wells modeled as part of the Domestic Well Inventory are presented in **Figures 5 and 6**. **Figure 5** presents a comparison of all reported dry wells in DWR's system (2012 through 2021) with modeled dry wells estimated for the period 2015 through 2024 in the Domestic Well Inventory. **Figure 6** presents a comparison of reported dry wells during the years 2015 through 2019 in DWR's system with modeled dry wells between 2015 and 2019 in the Domestic Well Inventory. **Figure 6** provides a more direct spatial comparison of dry wells in the two datasets over the same five-year period, whereas **Figure 5** presents an overview of the spatial relationship between the two datasets spanning a longer timeframe. Although there are considerably more modeled dry wells than reports of dry wells in DWR's system in either comparison, the spatial patterns in the two datasets show many similarities, with most modeled dry wells and reports of dry wells occurring in areas south and southwest of the City of Chowchilla. Some of the differences in locations between the modeled dry wells and reported dry wells in **Figures 5 and 6** are likely a result of differing resolutions of locational information available in the two datasets.

LSCE



Luhdorff & Scalmanini
Consulting Engineers

Figure 5
Comparison of DWR Dry Well Reports with Modeled Dry Wells Between 2015 and 2024
Chowchilla Subbasin
Groundwater Sustainability Planning

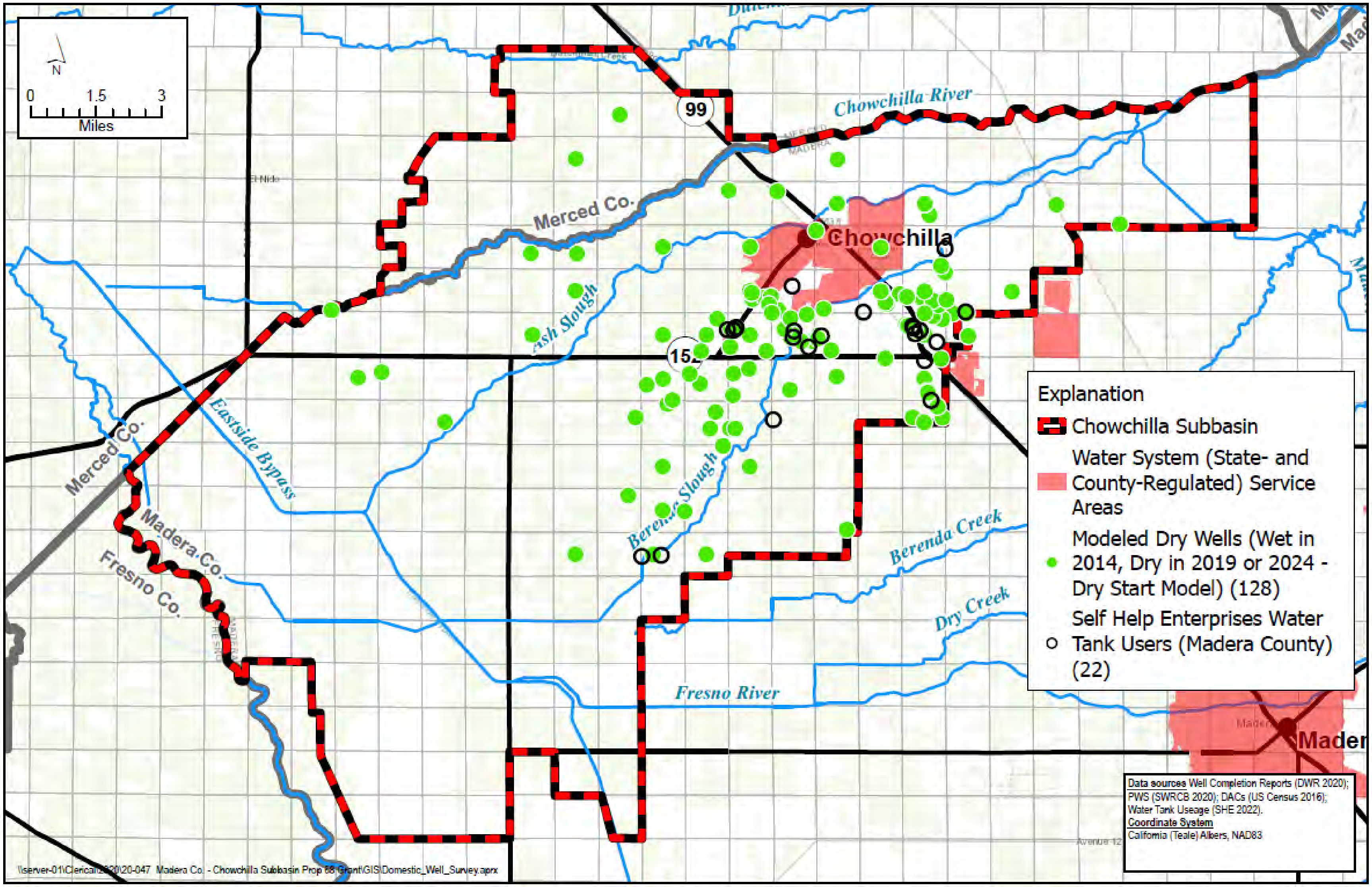


Luhdorff & Scalmanini Consulting Engineers

Figure 6
Comparison of DWR Dry Well Reports with Modeled Dry Wells Between 2015 and 2019
Chowchilla Subbasin
Groundwater Sustainability Planning

Comparison of SHE Tank Water Participants with Modeled Dry Wells in the Domestic Well Inventory

A map comparing SHE Tank Well Participants with dry wells modeled as part of the Chowchilla Subbasin Domestic Well Inventory are presented in **Figure 7**. **Figure 7** presents a comparison of all SHE Tank Water Program participants in the Subbasin as of January 2022 with modeled dry wells estimated for the period 2015 through 2024 in the Domestic Well Inventory. Although there are considerably more modeled dry wells than Tank Water Participants (as is the case with dry well reports in DWR's Household Water Supply Shortage System), the spatial patterns in the two datasets show many similarities with most modeled dry wells and SHE Tank Water Participants occurring in areas south and southwest of the City of Chowchilla.



Luhdorff & Scalmanini Consulting Engineers

Figure 7
Comparison of SHE Tank Water Participants with Modeled Dry Wells Between 2015 and 2024
Chowchilla Subbasin
Groundwater Sustainability Planning

Technical Memorandum:

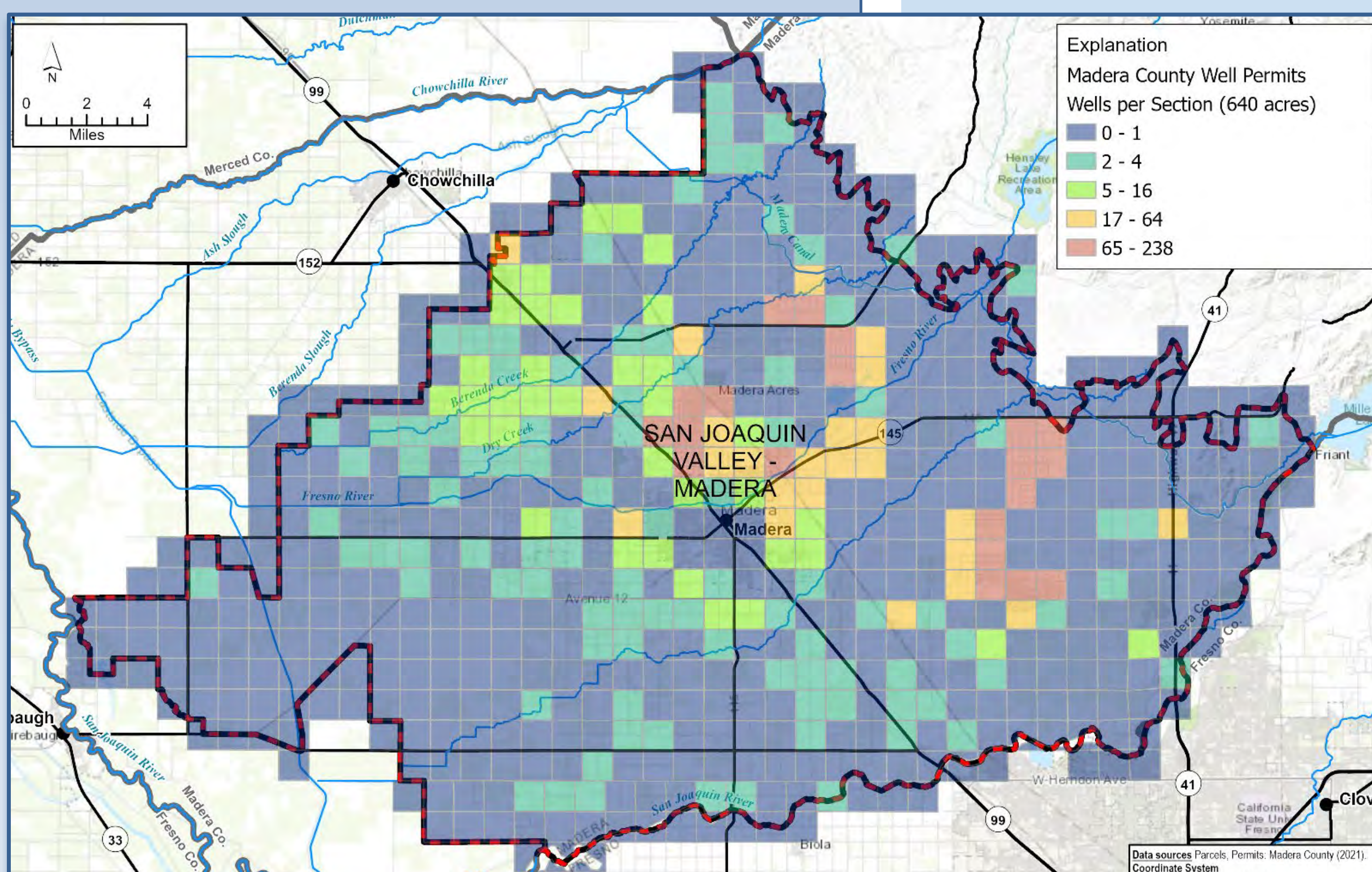
Domestic Well Inventory for the Madera Subbasin

Prepared for Madera County and the
Madera Subbasin Groundwater Sustainability Agencies

April 2022

Prepared by

Luhdorff & Scalmanini
Consulting Engineers



Technical Memorandum:

Domestic Well Inventory for the Madera Subbasin

This memorandum was prepared for Madera County and the Madera Subbasin Groundwater Sustainability Agencies to support implementation of the Madera Subbasin Groundwater Sustainability Plan.

Luhdorff and Scalmanini Consulting Engineers conducted the Domestic Well Inventory project for the Madera Subbasin and prepared this technical memorandum with assistance from ERA Economics.

Madera County and the Madera Subbasin Groundwater Sustainability Agencies appreciate and acknowledge funding received from the California Department of Water Resources under the Sustainable Groundwater Planning Grant Program, authorized by the California Drought, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (Proposition 68). This grant funding supported the completion of the Madera Subbasin Domestic Well Inventory project.

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ATTACHMENTS

1. Domestic Well Replacement Economic Analysis – Madera Subbasin Update
2. Madera Subbasin – Evaluation of DWR Household Water Supply Shortage Reports and Self-Help Enterprises Tank Water Participants

LIST OF ABBREVIATIONS & ACRONYMS

Acronym	Meaning
APN	Assessor Parcel Number
CDP	Census-Designated Place
CDWR	California Department of Water Resources
CEHTP	California Environmental Health Tracking Program
DAC	Disadvantaged Communities
DDW	Division of Drinking Water
DTW	depth to water
GPS	Global Positioning Satellite
GSP	Groundwater Sustainability Plan
LSCE	Luhdorff & Scalmanini, Consulting Engineers
LSWS	Local Small Water System
MCSIM	groundwater model
MD	Maintenance District
MHI	median household income
OSWCR	Online System for WCRs
PLSS	Public Land Survey System
PWS	Public Water System
SDAC	Severely Disadvantaged Communities
SDWIS	Safe Drinking Water Information System
SGMA	Sustainable Groundwater Management Act
SHE	Self-Help Enterprises
SSWS	State Small Water System
SSWS	State Small Water System
SWRCB	State Water Resources Control Board
TM	Technical Memorandum
WCR	Well Completion Report

1 INTRODUCTION

The Madera Subbasin Groundwater Sustainability Plan (GSP) includes maps, figures, analysis, and discussion of domestic wells and potential impacts from continued decline in regional groundwater levels during the GSP Implementation Period. The GSP provided the background and data analyses to illustrate the need for a Domestic Well Mitigation Program in Madera Subbasin and described how it is the most economically viable way to transition from current overdraft conditions to sustainable conditions in 2040. However, there was insufficient time during GSP development to conduct the more thorough inventory of domestic wells and the potential range of impacts to domestic wells under various scenarios of future groundwater conditions. This study supplements domestic well information provided in the GSP and provides an updated analysis that includes anticipated impacts to domestic wells during the GSP Implementation Period.

Madera County was successful in applying for a DWR grant under Prop 68 to conduct a more detailed well inventory, which is documented in this Technical Memorandum (TM). In addition, the grant funding provides for drilling and installation of nested monitoring wells at two sites in proximity to clusters of domestic wells to provide monitoring of current and future groundwater levels and groundwater quality. This TM includes recommendations for locations of these two nested well sites.

To prepare this domestic well inventory, approximations of the number, depths, and locations of domestic wells were developed from multiple available data sources. The total number of domestic wells indicated to be present according to the various data sources were reviewed and compared. Domestic well depths were then compared to historical, current, and predicted future local groundwater depths based on observed and modeled data from the groundwater model (MCSIM) developed for and described in the 2020 Madera Subbasin GSP. Due to the uncertainty in future climatic conditions for the GSP Implementation Period; two primary scenarios were evaluated to bracket the range of domestic wells that are estimated to go dry during the GSP Implementation Period. Estimated costs to replace domestic wells are also included in this TM.

This TM documents the available data sources for estimating numbers and locations of domestic wells, domestic well construction details, occurrence of domestic wells inside and outside of public and small community water systems, analyses to estimate the number of domestic wells that may go dry through 2040 based on two different climatic sequences, and sensitivity analyses to evaluate how various assumptions impact estimates of the number of dry wells. Using the results from the domestic well inventory and analysis, an updated economic analysis was also conducted comparing the tradeoffs of implementing a Domestic Well Mitigation Program during the Implementation Period versus immediately implementing demand reduction in the Subbasin to avoid significant and unreasonable adverse impacts on domestic well users. This economic analysis is included as **Attachment 1** (Domestic Well Replacement Economic Analysis) and provides an update to Appendix 3.D of the Madera Subbasin GSP. **Attachment 1** incorporates the latest results from the domestic well inventory relative to the total number of domestic wells estimated to go dry during the GSP Implementation Period. The economic analysis evaluated the difference in costs for implementing a Domestic Well Mitigation Program concurrent with gradual reductions in groundwater pumping over the twenty-year Implementation Period compared to not having a Domestic Well Mitigation Program and immediately implementing demand management and other PMAs to eliminate the overdraft in the Subbasin.

2 DOMESTIC WELL INVENTORY DATA SOURCES AND COMPILATION

Data from a variety of public agencies were assembled for consideration in the project. Compiled datasets included the following.

- Well Completion Report (WCR) Database from California Department of Water Resources (CDWR) Online System for WCRs (OSWCR)
- Madera County well permit database (records since 1990)
- Madera County Assessor's Parcel data
- Public Water System (PWS) service area boundaries and PWS well locations from State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW)
- State Small Water System (SSWS) service area boundaries from Madera County
- Census block-level household counts from the US Census Bureau
- Disadvantaged Community boundaries from DWR

With the exception of the Madera County well permit database, all of the above-listed datasets were available in geospatial (e.g., GIS) formats. The well permit database was provided as tabular data, which was converted to geospatial information as described below.

2.1 DWR WCR Database

The primary source for well construction data in the subbasin is the CDWR WCR database (CDWR, 2020). Well drillers are required to submit a WCR to DWR for all wells drilled and constructed in the State of California. DWR has tabulated information from WCRs for the State, including data from WCRs dating as far back as the early 1900s. The tabulated WCR information include well type and construction characteristics such as the intended use of the well, well depths, and screened intervals along with location, construction date, permit information, and other details included on the WCR. Although completed WCRs commonly include additional notes on borehole lithology and a variety of other types of information, lithology and some other well information included on WCRs is not entered or maintained in the DWR WCR database. It is notable that many well attributes in the WCR database are blank or incomplete because of missing or illegible information provided on the WCRs. Additionally, well locations in the WCR database are commonly only provided to the center of the Public Land Survey System (PLSS) section in which it is located, which translates to a locational accuracy of approximately +/- 0.5 mile.

2.1.1 Domestic Well WCRs

As part of the project, initial quality checks were conducted on the WCR database to identify obvious inconsistencies in well data, including conflicting well locations (e.g., latitude, longitude, PLSS coordinates) and construction (e.g., well depths, top and bottom of screens). Such questionable information and records were flagged for additional consideration during subsequent analyses. For the purpose of this domestic well inventory project, only WCRs indicated to be domestic water supply wells were included in the analysis. To limit potential double counting of domestic wells, only WCRs for new well construction (i.e., not well repairs/modification or destruction) were included in the domestic well inventory.

The number of well records within the Madera Subbasin in the WCR database exhibit a notable increase starting in about 1970 as indicated by domestic WCR counts by decade presented in **Table 1**. This shift may be partly due to changes in the Water Code relating to well data collection methods and reporting requirements that were instituted in 1969. The number of WCRs for domestic wells in the Madera Subbasin increased by a factor of six times around 1970, from around 100 WCRs in the 1960s to over 600 in the 1970s.

2.1.2 WCR Dates

The typical lifespan of a small water well is estimated to be 30 to 50 years based on the durability and longevity of typical domestic well materials, which are commonly constructed of PVC casing. Wells drilled prior to 1970 are also unlikely to still be in operation because of long-term trends in groundwater levels in the Subbasin.

For these reasons, only WCRs for wells with dates on or after 1970, were included in the domestic well inventory and associated analyses. DWR's WCR database includes 265 domestic well new construction WCRs located in the Madera Subbasin that do not have any recorded installation or permit dates. For this well inventory and analysis, these 265 wells were included in the analysis even though some fraction of them may have been constructed prior to 1970. A total of 4,822 domestic wells constructed since 1970 were considered in the project based on WCR records.

2.1.3 WCR Locations

Wells with WCRs marked as domestic were selected and mapped based on one of four geolocation methods, depending on what information was available in the tabulated data. Only wells with installations in 1970 or later were considered, or those with no available date of installation. The geolocation methods, in order of priority, are as follows:

1. Global Positioning Satellite (GPS) – 4 wells
2. Assessor Parcel Number (APN) – 2387 wells
3. Address – 1397 wells
4. Public Land Survey System (PLSS) – 1034 wells

A total of 4,822 domestic wells were located within the Madera Subbasin using these methods (**Figure 1a**). Wells located by PLSS are typically placed at the center of the section in which they are located, and thus may be out of position by as much as about 0.5 mile (half the typical width of a section). Other sources of location error include changes in APNs over time; poorly matched addresses; and incorrect WCR entries for PLSS values, GPS coordinates, APNs, or addresses. Since many of the location dots for domestic wells plot on top of each other in **Figure 1a**, the locations of domestic wells in the Subbasin by Township/Range/Section mapping are displayed in **Figure 1b**.

2.2 Well Permit Records

Under county regulation, a well permit is required prior to drilling and constructing a domestic well. Records of well permits were provided by Madera County as a tabular dataset (Madera County Environmental Health, 2020); no GIS data were initially available for the well permits. The period of record for the well permits begins in 1990. Limited information on individual wells is available in the well permit dataset, although most well permits include APNs or well addresses, which can be used for locating wells. Well uses in the permit dataset were inconsistently entered and required considerable review and modification to standardize well uses for identifying likely domestic well permits.

2.2.1 Domestic Well Permits

A subset of 7,505 permits for all of Madera County was identified as likely domestic wells based on the indicated well use. The well uses retained as representative of likely domestic wells include the following:

1. Domestic (7300 permits),
2. Domestic Replacement (25 permits),
3. Shared (54 permits),
4. Dairy (36 permits),
5. No Use listed (90 permits).

"Shared" wells are typically domestic wells that are also used for irrigation. "Dairy" wells are typically used for semi-industrial, and irrigation uses on a dairy, but in some cases can also be used for domestic water supply. Wells without a listed use were included in an effort to be conservative in the domestic well inventory.

2.2.2 Locating Well Permits

Of the 7,505 domestic well permits (7,362 with APNs) for all of Madera County, the portion applicable to Madera Subbasin were identified based on APNs associated with them. Multiple permits refer to the same APN in some cases with only 6,498 unique APNs listed as having domestic well permits in the database. Domestic well permits in the County well permit database were located by matching the listed APN with the county parcel data when possible. Following this approach, 4,115 domestic well permits were matched to 3,605 unique parcels located within the Madera Subbasin. For the 143 well permits without APNs, 79 permits were expected to be located within the Subbasin based on the fraction of permits with APNs that were determined to be within the Subbasin.

In addition to APNs, the well permit database includes site addresses for most (7,323) of the wells. Through geocoding of addresses in the well permit database, 95 of the well permits without APNs were located within the Subbasin.

Though locating of well permits based on APNs and site addresses, approximate locations for all but one of the 7,505 domestic well permits were determined. Using these locations, the total number of domestic well permits in the Subbasin was determined to be 4,210 (at 3,700 unique locations) out of 7,505 domestic well permits in the database. A map of the domestic well permits located in the Madera Subbasin is presented in **Figure 2a**. Since many of the location dots for domestic wells plot on top of each other in **Figure 2a**, the count of domestic wells in the Subbasin by Township/Range/Section mapping is displayed in **Figure 2b**. The relationship between County well permits and WCRs is summarized in **Table 2** and described further in Section 3.2.3.3 Scaling Estimates.

2.3 County Assessor Parcel Data

County Assessor parcel GIS data were provided by Madera County (Madera County Assessor's Office, 2020), including land use and other characteristics for each APN indicating the presence of a dwelling. The parcels dataset includes 34,365 unique APNs within the Madera Subbasin. Of those, 24,192 are listed as having dwellings associated with them (**Figure 3**). Although the County parcel dataset does not include records related to the presence of domestic wells on parcels, the presence of a dwelling on a parcel is interpreted to suggest the presence of a drinking water supply, including in some areas the potential for a domestic well to exist. This includes parcels that are included within a public water system service area.

2.4 Water System Data

Public Water System, State Small Water System (SSWS), and Local Small Water System (LSWS) service area boundaries from State and local data sources were used to map and evaluate where and how many inferred well locations occur inside of a water system service area and therefore may not be supplied by a domestic well. Water system boundaries are a key dataset for comparing with potential domestic well locations identified through analysis of WCRs, parcels, and permits. The service area boundaries for water systems identified in the Subbasin are presented on **Figure 4** based on the evaluation of PWS, SSWS, and LSWS boundaries as described below.

2.4.1 State Regulated Systems

The PWS boundaries are part of an archived dataset developed by the California Environmental Health Tracking Program (CEHTP) and now maintained by the SWRCB DDW (SWRCB, 2021). This dataset is a publicly available GIS feature class of system boundaries provided voluntarily by water system operators over the period from 2012 to 2019. Previous assessments of this dataset suggest it includes approximately 85 percent of community water systems, although this can vary by region within the state. Of the state regulated PWS boundaries, 21 were identified to have service areas within Madera Subbasin.

2.4.2 County Regulated Systems

The PWS service area dataset from DDW is not intended to include county-regulated systems. Madera County Public Works representatives reviewed the PWS boundaries and provided additional service area boundary data for county-regulated water systems (Madera County Environmental Health, 2021). The County provided 12 water system boundaries that are within the Madera Subbasin. Of these, 8 were for water systems that already had boundaries in the CEHTP dataset. In cases where boundaries were available from DDW and Madera County, the union of the two boundaries was retained for use in the analysis. The resulting addition of four new systems increased the total number of water systems in the Subbasin to 25. County staff reviewed the combined water system boundaries and stated it appears complete.

2.4.3 Public Water System Wells

PWS well locations were downloaded from the SWRCB GAMA website (SWRCB, 2021) and used to check for any water system wells in areas not covered by the water systems service area boundaries data. All PWS wells were located within previously delineated water system service area boundaries.

2.5 Community Data

2.5.1 Census

United States Census data (US Census, 2016) were used for cross-checking and comparison with domestic well WCRs, domestic well permits, and parcels with dwellings in the Subbasin. The Census data include counts of households by Census area (e.g., block, tract, designated place). The Census data were evaluated to assess whether they could inform the count and locations of domestic wells in the Subbasin. To approximate the number of households that might have a domestic well, Census block area were converted to randomly located points within each block equal in number to the count of households per block. The resulting 28,695 points represent an estimate of the number of households within the Subbasin that might have a domestic well (**Figure 5**). This number is slightly higher than the number of parcels with dwellings in the Subbasin (24,192), a result which might be expected because multiple households can occupy a single parcel. This includes households that are included within a public water system service area.

2.5.2 Disadvantaged Communities

DWR defines Disadvantaged Communities (DACs) as communities with an annual median household income (MHI) less than 80 percent of the Statewide annual MHI (PRC Section 75005(g)), and SDACs as communities with an annual MHI less than 60 percent of the Statewide annual MHI. The statewide median household income (MHI) for the Census American Community Survey (ACS): 2014-2018 dataset is $71,228. Therefore, a community where the MHI is less than $56,982 meets the DAC threshold and a community where the MHI is less than $42,737 meets the SDAC threshold.

DWR provides a standardized GIS layer of Disadvantaged Communities and Severely Disadvantaged Communities (DACs, SDACs) (DWR, 2021). These data are available as Census Designated Places, Census Tracts, or Census Blockgroups. The Tract-level data are simply aggregated from the Blockgroup-level data and were not used in the current analysis. Place-level data are not congruent with Blockgroups or Tracts, typically following established neighborhood boundaries. Place-level data provide a more focused description of the regions that qualify as DAC or SDAC; however, the Place-level data is only available in Census-Designated Places (CDPs), and these do not capture more diffuse residential neighborhoods. DACs and SDACs are found in both urban and rural areas in Madera Subbasin. **Figure 6** shows the locations of the Census Designated Places identified as DACs or SDACs by the definition above.

3 ANALYSIS AND RESULTS

Estimates of domestic wells were developed through analysis and comparison of the data sources discussed above. Estimates of the number and locations of domestic wells in Madera Subbasin were made using four different sources of data and approaches: from WCRs, well permits, parcels with dwellings, and Census households. Domestic well WCRs and well permits provide a more direct indication of the existence (past or present) of a domestic well whereas the parcel data and Census data provide a basis for inferring the existence of domestic wells. The County well permit database is believed to provide the most accurate estimate of the numbers and locations of domestic wells constructed during the available data record (since 1990).

The completeness of the well records in County well permit data are expected to be greater than the WCR database because although regulations state that WCRs are required to be submitted to DWR for all constructed wells, there has historically been little or no verification at the County or State level that a well driller submits a WCR to DWR after a well is completed. In cases where a WCR is submitted, the time elapsed between when a well is drilled and when a WCR is submitted to DWR can be highly variable and information provided on WCRs may not be complete. There are also additional steps involved in entering WCRs into DWR's database after receiving a WCR, which may also introduce timing delays or data entry errors. In contrast, although there is generally no information about a given well's design provided in the County well permit database, there is a fee to obtain a well permit and permits are typically obtained by the driller immediately prior to starting work on a project. Therefore, it is believed that most permitted wells are constructed even if a corresponding WCR is never submitted to DWR by the well driller.

The locational accuracy of well permit records are also believed to be better because most well permit records include data on the parcel where the well is permitted. Many of the WCR records only indicate location by the PLSS section in which the well is located.

Although the well permit data are believed to be more complete and provide better locational accuracy of wells, only the WCR data have information on well depths and other well construction details (**Figure 7a**, **Figure 7b**). Additionally, while WCRs and well permits generally have a date associated with each record indicating the approximate date of well construction, the parcel and Census datasets do not. However, estimates of well counts based on parcel and Census data do provide a sense for the maximum possible number of domestic wells, and also a comparative check on the relative spatial density of domestic wells in the Subbasin.

Water system service area boundaries were used to refine domestic well estimates derived from parcel and Census household counts, with the expectation that all parcels and households within a water system boundary are served water by the water system and therefore do not rely on a domestic well. The locations and count of permits and WCRs were assumed to be correct, regardless of their location relative to a PWS service area.

With this information, estimated locations and counts of domestic wells in the Subbasin were developed and well depths were compared to historical groundwater levels and model-simulated future groundwater levels (based on the modeling conducted during GSP development) to evaluate potential impacts to domestic wells from changing groundwater levels in the Subbasin. The methods and results from these analyses are described below.

3.1 Analysis of Domestic Well Locations and Counts

3.1.1 Domestic Well WCRs

The domestic well WCRs since 1970 were compared with water system boundaries. Because the WCRs are records of actual wells that were constructed, those located within a water system service area are assumed to be correctly located. It is possible that wells that pre-existed the establishment of a water system in an area may remain in use after the water system is operational; however, the frequency of this occurring is not known.

Of the 4,822 domestic wells represented by WCRs in the Subbasin, 559 are located within the known water system boundaries (**Figure 8**). This represents approximately 11 percent of the domestic well WCRs in the Subbasin. Some of these domestic well WCRs may be associated with wells that no longer actively supply domestic drinking water. Nevertheless, WCRs within a water service area boundary were still considered in the domestic well inventory and analysis described below, which is a conservative assumption relative to likely domestic well counts.

3.1.2 Domestic Well Permits

Similar to the WCR estimate, permits are expected to accurately identify well locations, but domestic well permits may exist for wells drilled and constructed prior to the operation of a water system in an area. The use of such wells may have been discontinued when a residence was hooked up to a water system, although this may not always be the case and some domestic wells within water system service areas may still be operational.

In contrast to the WCR dataset, which relies on submittal and entry of a WCR in DWR's database, the County well permit dataset is expected to be a more comprehensive representation of the wells drilled in the County for the period over which it spans (1990 to present). Although the comparisons across different datasets described below highlight differences between data sources and the estimates of domestic wells derived from each, this study did not attempt to assess the accuracy of the well permit database in relation to actual domestic wells.

Of the 4,210 domestic well permits in the Subbasin, 333 are located within known water system boundaries. This represents approximately eight percent of the domestic well permits in the Subbasin. Some of these domestic well permits may be associated with wells that no longer actively supply domestic drinking water. Nevertheless, domestic well permits within a water service area boundary were still considered in the domestic well inventory and analysis described below.

3.1.3 Parcels with Dwellings

For the purpose of assessing the maximum possible number of domestic wells in the Subbasin, all parcels with a dwelling but not within a water system service area were counted. In this approach, a parcel is considered within a water system service area if its centroid is within the service area.

Based on these criteria, within the Madera Subbasin there are a total of 24,192 parcels with dwellings, 5,898 of which are outside of the service area boundaries of all 29 PWS and County-regulated systems serving residential parcels. These 5,898 parcels representing potential domestic well locations are presented on **Figure 9**. There are several areas within the Madera Subbasin with a high density of parcels with dwellings that are not covered by a water system boundary.

3.1.4 Census households

Due to the irregular shape of Census blocks and the inconsistent alignment of blocks with other important boundaries in the Subbasin (e.g., Subbasin, water service areas) the Census data provided limited utility for the inventorying of domestic wells, although they do provide an approximate check on the maximum overall number of potential domestic wells in the Subbasin. Conversion of the Census household counts to points and comparing to water system service areas provides estimates between 7,109 and 7,393 potential households outside of the water system service areas. Although the total number of parcels and total number of households within the Subbasin are reasonably consistent, the number of households estimated to be outside of the water system service areas is considerably higher than the number of parcels outside of the water system service areas and is not believed to be an accurate metric for inventorying domestic wells.

3.1.5 Comparisons of Domestic Well Location Information Sources

3.1.5.1 Domestic Wells Within PWS Service Areas

While most residences within a PWS service area are supplied with drinking water by that PWS, it is not unusual for wells that were drilled prior to the creation of the PWS to be retained and used for part, or all, of a residence’s use, including for drinking water or landscape irrigation.

Of the 4,822 WCRs since 1970 located in the Madera Subbasin, 559 are located within a water system service area. Of the 4,210 permits (since 1990) located within the Madera Subbasin, 310 were located within a water system service area. These represent approximately 12 percent and seven percent, respectively, of the wells identified from these data sources.

Of the 24,192 parcels with dwellings noted in the APN dataset, 18,294 are within a water system boundary. Similarly, of the 28,708 households in the Subbasin indicated by the 2010 Census data, 21,503 are within a water system service area.

The count of known locations of permits and WCRs within water systems, when compared to the number of residences within those systems based on parcel and Census data, represent between one and three percent of the number of residences within those service areas. This suggests that the number of domestic well permits and WCRs located within water system boundaries is a small fraction of the number of likely residences within those water system areas. Accordingly, this comparison suggests that neither the WCR nor well permit data identify a large number of domestic wells within water system boundaries. Although this does not speak to the accuracy of the WCR and well permit data in locating wells in other areas of the Subbasin, they do not appear to identify an unreasonable number of domestic wells within areas covered by water systems.

3.1.5.2 Comparing WCR Locations to Well Permits

The Madera County well permits dataset is believed to be more complete in representing wells drilled in the County, but it only extends back to 1990. To provide an appropriate comparison between the WCR dataset and the well permit dataset, a subset of the WCRs since 1990 (those dated after 1989), were considered. In the Madera Subbasin, roughly two-thirds of domestic well WCRs have construction dates after 1989. For this analysis, WCR records without construction dates are assumed to be drilled in 1990.

The subset of domestic wells with WCRs since 1990 has many similar characteristics as the dataset for WCRs since 1970, with several noteworthy differences. As shown in **Table 3**, proportionally, the WCR dataset since 1990 has fewer WCR records located in water system service areas. This is reasonable, as it is consistent with the understanding that many of the domestic well WCRs located within water system service areas are for wells drilled prior to the creation or expansion of those water systems.

There is no direct linkage between WCRs and well permits on record (i.e., WCRs commonly do not indicate well permit numbers) for majority of the wells, and the available method for geolocating records for a given well present in both datasets may differ. However, it was determined that 2,691 of the parcels associated with permit locations coincided with WCR locations for domestic wells (**Figure 10**).

This relatively low rate of coincidence is most likely a function of poor accuracy of the WCR locations. The permit location error is generally related to the area of the parcel within which they are located and is commonly less than half the distance of the maximum parcel dimension. As parcel size decreases, the accuracy of the locating of well permits tends to increase. Many WCR locations have much higher error, especially those that rely on locations from the PLSS section centroid.

3.1.5.3 Comparing Domestic Well Permits with Parcel Characteristics

Of the 95 well permit locations produced by geocoding addresses in the well permit database, 62 did not fall within a parcel. Such locations generally occur between parcels on streets. For these locations, the attributes from the nearest parcel were used to compare. The parcel Use Codes for the 3,700 unique locations are summarized here:

1. One residence: 88%
2. Two residences: 7%
3. Urban Non-Residential: 3%
4. Agricultural: 2%

Of the 4,210 domestic well permits (at 3,700 unique locations), 3,672 permits (87 percent of permits) at 3,205 unique locations (87 percent of unique locations) were in parcels with dwellings, as indicated on the parcel dataset, suggesting that a residence is present on the parcel associated with the well permit (**Figures 11a and 11b**).

3.1.5.4 Comparisons of Parcels with Dwellings and WCRs

Of the 5,898 parcels listed as having dwellings in the Madera Subbasin, and not within a water system boundary, 1,901 coincide with the location of WCRs located as described above. A total of 285 parcels with dwellings located within water systems also coincided with WCR locations (**Figure 12**). Nearly all the dwelling parcels within water system boundaries and also intersecting WCRs are located in the Maintenance District (MD) 10 – Madera Ranchos water system.

3.1.6 Final Domestic Well Count and Location Estimates

The County permit database includes 4,210 domestic (or considered domestic for this analysis) wells installed since 1990. For providing a direct comparison of the domestic well counts from the WCR database, the count of WCRs was limited to WCRs with dates since 1990 (3,446 domestic well WCRs) to allow for direct comparison to available County permits. This comparison yields a ratio of 1.22 between the domestic well permit count and the domestic well WCR count. Well permits are believed to provide a more complete representation of wells constructed in the Subbasin, but these permit records do not contain information on well perforations and depths and only date back to 1990. As a result, the ratio of well permits to WCRs for the period since 1990 provides a useful metric for scaling of results derived during the evaluation of potential impacts on domestic wells from changing water levels, an analysis which relies heavily on well construction information available only on WCRs. The domestic well impacts analysis is described below.

3.2 Evaluation of Potential Domestic Well Impacts

A key consideration in the implementation of the GSP for the Madera Subbasin is the potential occurrence of impacts to domestic well users due to declining water levels. As part of implementing the GSP, the Subbasin is in the process of evaluating and designing a Domestic Well Mitigation Program targeting domestic wells that may be impacted by future declines in groundwater levels. To support this effort, the effects of historical and future groundwater levels on domestic wells in the Subbasin were evaluated.

This analysis involved comparing domestic well perforation and depth information to historical groundwater levels and potential future groundwater levels, as simulated by the groundwater model (MCSIM) utilized during the GSP development. Simulated groundwater level conditions from MCSim were used to estimate the number of domestic wells that may go dry during the GSP implementation period from 2020 through 2040, the period during which the Subbasin will be working towards achieving sustainability as required by the Sustainable Groundwater Management Act (SGMA). WCR records for domestic wells (and the well construction information provided on WCRs) were used to estimate well depth information for evaluating impacts. The ratio of well permits to WCRs (1.22) was used to upscale the results derived from these analyses conducted using WCR data.

3.2.1 WCR Domestic Well Construction Information

Of the 4,822 domestic well WCRs in the Madera Subbasin, 4,524 included some information on perforated interval (top of bottom of perforations) or total depth. As mentioned earlier, several inconsistencies in construction information were noted in the initial WCR dataset (e.g., total well depth less than depth to top of perforations, depth to bottom of perforations less than top of perforations), so multiple levels of quality checks were conducted on the well construction data in the WCR database to assess the reliability of the information. Only WCR records determined to have sufficiently reliable well construction information (i.e., lack of obviously conflicting information on the well construction) were included in the summary and analyses relating to domestic well construction in the Subbasin. In analyses using well perforations (screens), where data for bottom of perforations was not available, the reported total well depth was used. A total of 3,834 WCRs included top of screened interval information. For wells lacking information for either bottom of perforations or top of perforations, the average values for wells in the same section were used. Where a section had fewer than three wells with reported depth or top of screen data, the average values from wells in the same section and the eight surrounding sections were used. This resulted in estimates of top and bottom of perforated Intervals for all 4,822 domestic well WCRs in the Subbasin. **Figure 7a** and **Figure 7b** show the depth of domestic wells in the Subbasin based on these estimates.

3.2.2 Domestic Well Impacts Analysis Methods

Simulated groundwater levels output from the MCSim model developed by Luhdorff & Scalmanini, Consulting Engineers (LSCE) and described in the 2020 GSP for Madera Subbasin were queried to produce depth to water (DTW) datasets for the Subbasin for the period from 1989 through 2070. MCSim is a multi-layered model and based on review of the well data and consideration of the hydrogeologic conceptual model and groundwater conditions described in the GSP, model layers 3 and 4 were determined to most appropriately correspond with the production zones for most domestic wells in the Subbasin. The simulated DTW datasets for model Layers 3 and 4 were used to extract DTW values for different time periods at all WCR locations; DTW values at each domestic well WCR location were compared with the top and bottom of perforations (screens) values for each WCR. Based on this comparison, the wells were assigned DTW values for either model Layer 3 or 4. If a well was screened at least 50 percent in Layer 4 or deeper, the well was assigned DTW values for Layer 4. If more than 50 percent of the screened interval was above Layer 4 (in Layer 3 or shallower) then Layer 3 DTW values were assigned to the well.

Simulated depth to water model output for Layers 3 and 4 for the years from 1989 to 2039 were then compared to the screened intervals for each domestic well (WCR) to assess if each well was wet or dry during each year. For each year, the fall simulated DTW (on October 31st) in layers 3 and 4 of the model were assessed for each well location.

The analysis was performed using different analysis periods and methods. Generally, the analysis was conducted using five-year analysis periods, with the first analysis period starting in 1989 and extending to 2014 or 2015 followed by shorter five-year intervals thereafter. Analyses included comparisons based on snapshots of DTW conditions at the end of each analysis interval (generally five-year analysis periods) and separate comparisons based on the maximum depth to water found during each analysis period. Variations of analyses were also performed using simulated model output from the projected model run used in the GSP and also separately on a model run utilizing a projected future hydrology that included drier conditions during the early years of the GSP Implementation Period, conditions that are more consistent with the recent hydrology experienced in the area. In all analyses, if the simulated DTW in the assigned model Layer at a well location falls below the required minimum level of saturation in relation to the depth of the well, either at the end of each analysis period (or in the year within each five-year period that generally had the lowest water levels) for the maximum DTW scenario), the well was considered to have gone dry during the analysis period. Once a well was concluded to have gone dry in an analysis scenario, it was removed from the pool of potential wells that could go dry in subsequent years. The sensitivity of model results to different assumptions, analysis periods, and WCR data restrictions were tested and evaluated.

The parameters used in the analysis are defined as follows:

P = the base year for the analysis periods. This defines the end of the initial historical analysis period (after 1989) during which wells were evaluated for historically having gone dry. This is generally Fall 2019, indicating a historical analysis period of 1989-2019, but 2018 was also used as the ending year for the historical period during sensitivity analyses (because groundwater levels in 2018 were generally lower than in 2019).

S = minimum saturation threshold above the well total depth for a well to remain wetted. This is assumed to be 10 feet in the baseline analysis, but the sensitivity of analysis results to varying this value was conducted to evaluate the influence of this parameter on analysis results.

E = the earliest year of installation for the WCRs considered. This reflects the cutoff year for the construction date on WCRs intended to reflect wells that may have been active at the time of the base year considered based on typical domestic well life expectancy.

Appropriate scaling of the results of these impacts analyses based on WCR was also considered based on the ratio (1.22) of domestic well permits to domestic well WCRs determined previously. This ratio is developed from a direct comparison of domestic well permits and WCRs with dates since 1990. The scaling ratio is developed for the entire Subbasin and is assumed to have limited spatial or temporal bias across the Subbasin or across the period since 1990. The potential for bias in the ratio has not been evaluated.

The baseline analysis scenario of potential domestic well impacts involved the parameters listed below.

- Snapshots of DTW at the end of each analysis period
- The ending year for historical analysis is 2019, with historical analysis period 1989-2019 (P = 2019). Corresponding analysis periods as follows:
    - 1989-2019
    - 2020-2024
    - 2025-2029
    - 2030-2034
    - 2035-2039

  The analysis periods were selected to correspond with the dates of the Interim Milestones and preparation of Five=Year Update Reports.

- Minimum well saturation threshold of 10 feet (S = 10).
- Using projected model run from GSP (without early sequence of dry years).
- Wells analyzed based on the WCR count of wells installed since 1970 (E = 1970).

Because the early years of the projected model period, including during the early GSP implementation period, have been dry, an alternative analysis scenario evaluated potential domestic well impacts based on simulated groundwater levels from a model run that starts with a drier sequence of years. This analysis involved the same parameters as the baseline analysis (described above) but used simulated groundwater levels from a different projected model run with an early dry period.

3.2.3 Results of Domestic Well Impacts Analyses for Baseline GSP Climate Scenario

In the baseline analysis scenario described above, a total of 739 of the 4,822 domestic wells (from WCRs) analyzed are indicated to have gone dry during years prior to 2020. A total of 772 wells are projected to go dry between 2020 and 2039 (**Table 4a**); the analysis suggests 287 dry wells of the total of 772 occurring during the period 2020-2024. **Table 5a** includes the results for this analysis when scaled up by a multiplier of 1.22 based on the ratio of well permits to WCRs.

3.2.3.1 Spatial Distribution of Dry Wells

Figures 13a to **13e** show the distribution of dry wells (and remaining wetted wells) in each of the analysis years for the baseline analysis. The predicted dry wells are clustered in the eastern parts of the Subbasin, with a greater number of dry wells predicted along and to the east of Highway 99. There are two higher-density clusters located north of the Fresno River and south of Dry Creek, and an especially large cluster in the Madera Ranchos area south of highway 145 and north of Avenue 12 in the southeastern part of the Subbasin.

Most of the domestic wells that are predicted to go dry over the 20-Year GSP Implementation Period in the Base Case occur in the 2020-2024 and 2030-2034 five-year intervals (**Tables 4a and 5a**). Groundwater levels stabilize and begin to recover after 2035 and no additional wells are predicted to go dry in the Base Case after 2035. The timing of domestic wells going dry is closely related to the assumed sequence of average, dry, and wet years applied for the Base Case, which is based on a historical sequence of years that represent overall average conditions for the 20-Year period.

3.2.3.2 Impacts on Disadvantaged Communities

Some dry domestic wells are predicted to occur in DAC and SDAC areas. The Fairmead area and City of Madera area SDACs are predicted to see significant numbers of wells going dry during the implementation period. In addition, the Valley Lake Ranchos, Lake Madera Country Estates, and Bonadelle Ranchos 5 neighborhoods, all located in Census blockgroups east of the City of Madera that qualify as DACs, are predicted to see significant numbers of wells going dry (**Figure 13f**).

Nonetheless, based on the analysis presented here, DACs and SDACs will not be disproportionately impacted by declining groundwater levels. Rather, these neighborhoods will see impacts proportional to the number of domestic wells and the depth of decline in water levels in their regions, as with any other wells examined in non-DAD/SDAC areas. DACs and SDACs in the Madera Subbasin are primarily located near urban centers, and thus near existing water system service areas. Opportunities for annexation or consolidation of DACs and SDACs into existing State- or County-regulated systems may provide better value than efforts to deepen existing wells in these areas.

3.2.3.3 Scaling Estimates

The previous analyses are all based on WCR counts of wells drilled since 1970 or 1990. A more accurate number of wells, however, is more likely the number of Permits in the permit database provided by Madera County.

Figure 14 shows that the spatial distributions of the two datasets are similar. As shown in that figure, the areas with large differences between the WCR and Permit datasets (shown as red and blue in the figure) are smaller areas that are peripheral in the Subbasin. The largest portion of the Subbasin is represented by ratios near 1:1 (from 0.8:1 to 1.2:1). The region of the Subbasin near the City of Madera and to the north has a higher ratio of permits to WCRs, and this is an expected outcome due to the denser population and presence of municipal water systems in that area. Therefore, simply scaling the count of wells up for each period should be adequate. The number of Permits for wells installed since 1990 is 122% of the number of WCRs for wells in the same period, averaged over the Subbasin (**Table 2**).

Scaling the results up to match the expected number of wells based on the Permits-to-WCRs ratio of 1.22:1 yields 942 wells going dry between 2020 and 2040 (**Table 5a**).

3.2.4 Results of Domestic Well Impacts Analyses for Alternative Dry-Start Climate Scenario

The same analysis was conducted as described above for the GSP Climate Scenario, but instead using an alternative climate sequence for the GSP Implementation Period with more dry years at the beginning of the 20-Year climate sequence. In the alternative analysis scenario, a total of 755 of the 4,822 domestic wells (from WCRs) analyzed are indicated to have gone dry during years prior to 2020. A total of 1,294 wells are projected to go dry between 2020 and 2039 (**Table 4b**); the analysis suggests 350 dry wells of the total of 1294 occurring during the period 2020-2024. **Table 5b** includes the results for this analysis when scaled up by a multiplier of 1.22 based on the ratio of well permits to WCRs.

3.2.5 Sensitivity Analyses on Potential Domestic Well Impacts

To understand influences from different analysis assumptions and parameters, sensitivity analyses were conducted on a number of aspects of the analysis. These sensitivity analyses evaluated different approaches to evaluating the DTW at well locations over each analysis period (e.g., DTW at end of period vs maximum DTW during analysis period), the required minimum saturation threshold for concluding a well is dry, and different cutoff dates for WCRs included in the analysis.

3.2.5.1 Snapshot of Depth at End of Reporting Period vs. Maximum Depth During Reporting Period

The baseline analysis described above compares domestic well depths to groundwater levels at the end of each Five-Year Update reporting period using the years 2019, 2024, 2029, 2034 and 2039. As noted previously, these baseline analysis periods were selected because the final year of each period aligns with the IM and Five-Year Update reporting periods. However, if the lowest groundwater levels do not align with the end of each analysis period, this method may not capture the full extent of potential impacts on domestic wells.

By choosing analysis period ending years as 2023, 2028, 2033, and 2038, the lowest groundwater levels in each five-year period will typically be captured along with the lowest pre-2020 groundwater levels (generally occurring in 2015 or 2018). Therefore, a separate analysis was performed using the maximum DTW in each five-year period. This analysis results in a small decrease (23 wells) in the total number of wells (749) expected to go dry between 2020 and 2040 compared to the Base Case (**Table 6**). The reason for the decrease of dry well occurrence between 2020 and 2040 is this analysis results in more wells going dry prior to the start of the GSP implementation period in 2020 due to the lowest pre-2020 groundwater levels occurring prior to Fall 2019, (which is the year used in the Base Case to determine well going dry prior to 2020). Therefore, the base case with a greater number of wells going dry between 2020 and 2040 is used for further sensitivity analyses described below because it is a more conservative estimate of dry wells.

3.2.5.2 Minimum Saturation Threshold

The baseline analysis comparing DTW and total well depths included a minimum well saturation threshold that a well is considered dry when the groundwater levels falls below a level less than 10 feet above the bottom of the well. This baseline assumption was based on the expectation that the required saturation in a domestic well is not great because of the generally low pumping rates required for domestic wells. The sensitivity of analysis results for this minimum saturation assumption were evaluated using alternative minimum well saturation levels. Sensitivity to the minimum saturation threshold was tested by varying the parameter (S) and observing the change in the count of wells going dry in each analysis period (**Table 7**).

The number of wells going dry over the period from 2020 to 2039 increases as the minimum saturation threshold is increased from 0 feet to 30 feet and then decreases with greater minimum saturation thresholds (**Figure 15**). The reason for this pattern is that at minimum saturation thresholds exceeding 30 feet, more wells are considered to be going dry before 2020 relative to after 2020 for those greater thresholds (i.e., the threshold applies both before and after 2020). The number of dry wells at the saturation threshold of 10 feet is 772, it increases to 890 at 30 feet, and at 50 feet it declines to 735. This analysis suggests that the number of wells expected to go dry is sensitive to the saturation threshold applied, but the relationship between saturation threshold and number of dry wells predicted after 2019 varies depending on how many wells go dry before 2020. Considering the results of this sensitivity analysis and the previous discussion regarding saturation needed to support typical domestic well pumping rates, the application of a minimum saturation threshold of 10 feet is interpreted to be a reasonable threshold for estimating the potential number of domestic wells that may go dry during the GSP implementation period.

3.2.5.3 WCR Cutoff Dates

The influence on results from varying the earliest year of WCR records used in the dry well analysis was also evaluated. As expected, the average well depths for older wells tend to be shallower than younger wells, likely because of the declining water levels that have occurred in the area and the resulting need to drill to greater depths to ensure reliable water supply. This trend towards deeper wells is illustrated in a comparison of the average total well depths for WCRs since 1970 and those since 1990, as presented in **Table 3.**

The changes in the numbers of total wells analyzed and the resulting numbers of dry wells drop as the cutoff date for WCRs is increased. The change from a WCR cutoff year of 1970 to 1975 has minimal (less than 10 percent) impact on all counts, but as this cutoff date in increased further the dry well count drops faster than the total well count (**Table 8**). The implication of this trend is that as the WCR cutoff date is moved forward in time from 1970, older wells that would be counted as going dry are not included in the analysis, resulting in a smaller number of wells predicted to go dry. Although many wells constructed since 1970 likely are no longer in existence or actively use, the 1970 WCR cutoff date provides an appropriately conservative estimate of wells predicted to go dry during the implementation period.

3.2.6 Potential Replacement Costs for Wells Impacted

The potential costs for addressing domestic well issues were evaluated in some detail. These costs were largely based on discussions with drillers who install domestic wells and replace pumps on a regular basis. These costs are summarized in **Table 9**, and include lowering a domestic well pump ($1,000 to $2,000), replacing a domestic well pump ($5,000 to $7,000), and drilling/installing a new domestic well to replace an existing well ($25,000 to $35,000). Estimates of total costs for a Domestic Well Mitigation Program were based on estimates of total number of dry wells expected to occur between 2020 and 2039, with WCRs scaled to the number of County well permits and considering both the GSP climate scenario and the alternative dry-start climate scenario for the GSP Implementation Period.

3.2.7 Updated Economic Analysis

As described in the Introduction, **Attachment 1** (Domestic Well Replacement Economic Analysis) incorporates updated estimates provided in this TM for the number of dry domestic wells into an economic analysis intended to replace Appendix 3.D of the Madera Subbasin GSP with newer information. The economic analysis evaluated the difference in costs for implementing a Domestic Well Mitigation Program concurrent with gradual reductions in groundwater pumping over a twenty-year period vs. not having a Domestic Well Mitigation Program and immediately implementing demand management and other PMAs to eliminate the overdraft in the subbasin to avoid significant and unreasonable adverse impacts on domestic well users. The overall conclusion remains consistent with the GSP: the cost of implementing a Domestic Well Mitigation Program is significantly less than the alternative.

3.3 Public Water System Wells

PWS wells data are maintained by the State Water Resources Control Board Division of Drinking Water in the Safe Drinking Water Information System (SDWIS); however, these data are incomplete at this time. In the Madera Subbasin, only 7 PWS wells are listed in SDWIS. Therefore, the WCR database was queried for PWS wells. There were 82 wells drilled in 1970 or later and tagged as “Municipal” or “Public”. This discrepancy is due, in part, to the fact that WCRs do not typically distinguish between Public Water Systems and other residential water systems serving more than one household. When a well driller fills out the WCR, the “Municipal” box is checked if the well is to be used for any purpose other than irrigation, industrial processes, or domestic single-household use. These can include PWS wells but can also include Local Small and State Small Water System wells (LSWS and SSWS, respectively), and wells used for drinking water at facilities such as rest stops, churches, schools, and other locations that sometimes are not supplied by a local PWS. The wells identified here are shown in **Figure 16**.

Depth to the bottom of perforated interval ranged from 30 to 1000 feet below ground surface in these wells. Of the 82, 10 were drilled prior to 1970 and are not considered here. These wells were compared to the snapshots of Depth to Water for the model years 2019, 2024, 2029, 2034, and 2039, with the GSP climate scenario. **Table 10** shows the results of this analysis.

Based on the comparison with the modeled depths to groundwater at these 5-year intervals, 10 PWS or other municipal wells are expected to have gone dry by 2020, and another 3 over the implementation period. Further analysis with data provided by individual well-operators would be required to identify specific water systems that are vulnerable.

3.4 Comparison of Estimated Domestic Well Impacts to Online Databases

The estimated numbers and locations of dry wells described in this TM (modeled dry wells) were compared to two available datasets related to reported domestic well supply issues: DWR’s Household Water Supply Shortage Reporting System, and Self-Help Enterprises (SHE) Tank Water Program participants (**Attachment 2**). While the assumptions underlying the estimates of modeled dry wells in this TM differ in some regards to the well issues included in these two datasets, the spatial patterns in modeled dry wells are very similar to the spatial patterns in the DWR and SHE datasets. Overall, the total numbers of modeled dry wells estimated in this TM are greater than the number of well issues included in the DWR and SHE datasets; however, it is likely that not all dry wells have been reported in these other two datasets. More details on the DWR Household Water Supply Shortage Reporting System dataset and the SHE Tank Water Program participants dataset and comparisons of these datasets to modeled dry wells presented in this TM are provided in **Attachment 2**.

4 PRIORITIZATION OF AREAS FOR ADDITIONAL MONITORING

Expansion of the monitoring network is important for areas of the Subbasin with higher densities of domestic drinking water wells. In addition, the dry well analysis performed above was used as a guide to locating areas that should be more closely monitored. The monitoring network should consider the presence of vulnerable populations, such as those reliant on groundwater and DAC/SDAC areas. Another key variable was to consider the locations of existing nested monitoring wells installed recently at seven locations throughout the Madera Subbasin.

The domestic well inventory analysis conducted for this study illustrates that domestic wells are most concentrated along and east of Highway 99, and that dry domestic wells are predicted to be most prevalent east of Highway 99. There are two existing nested monitoring wells located along Highway 99 in the northern portion of Madera Subbasin and one nested monitoring well located east of Highway 99 about mid-way between the eastern subbasin boundary and Highway 99 in the northern portion of Madera Subbasin. The two most dense clusters of domestic wells occur east of Highway 99 along Avenue 21 (Valley Lake Ranchos and Lake Madera Country Estates) and immediately south of Highway 145 (Madera Ranchos area). These are considered primary areas for siting of new nested monitoring wells (**Figure 17**). Four secondary areas for potential consideration of monitoring well siting were also identified in areas of significant but less dense domestic well clusters; these locations would fill gaps between existing nested monitoring wells and improve overall spacing and density of nested well monitoring sites in Madera Subbasin.

5 REFERENCES

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6 TABLES

Table 1. Summary of domestic well WCRs by decade.

WCR Date Range	WCRs in Date Range	Cumulative WCRs since Beginning of Date Range
Pre-1950	1	4721 (4986)
1950-1959	57	4720 (4985)
1960-1969	106	4663 (4928)
1970-1979	614	4557 (4822)
1980-1989	762	3943 (4208)
1990-1999	1323	3181 (3446)
2000-2009	1444	1858 (2123)
2010-2019	381	414 (679)
2020-Plus	33	33 (298)
Unknown	265	(265)

Table 2. Comparisons between different estimation methods.

	WCR (Installed Since 1970)	WCR (Installed Since 1990)	Permits (Records back to 1990)	Parcels	Census
Total Domestic Well Count or Estimate	4822	3446	4210	5898	7205
Domestic Well Count Excluding Wells Located within Water System Boundaries	4263	3099	3877	5898	7205
Domestic Well Count Inside Water System Boundaries	559	347	333	0 (parcels within WS excluded)	0 (blocks within WS excluded)
Domestic Well Percent of WCR-Based Count (1990-plus)			122%	138%	169%
With Depth Recorded	4522 (94%)	3249 (94%)	0	0	0
Location Precision	Varies	Varies	Parcel	Parcel	Census Block

Table 3. Relative Similarity Between Wells Recorded Since 1970 and Those Recorded Since 1990.

	Count of WCRs within the Madera Subbasin		1990 Set Percent of 1970 Set
	Since 1970	Since 1990	
Total Count	4822	3446	71%
Count within PWS	559	347	62%
Count Outside of PWS	4263	3099	73%
Count with Total Depth	4522	3249	72%
Average Total Depth	341 feet	365 feet	n/a

Table 4a. Summary of Dry Wells for Base Case. Wells drilled in 1970 or later, based on snapshot of depth to groundwater at end of period. Assumes 10 feet of well saturation above bottom of screen.

Year Range	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	97	4083	**287**	3796	287
2025 to 2029	0	3796	**152**	3644	439
2030 to 2034	0	3644	**333**	3311	772
2035 to 2039	0	3311	**0**	3311	772
During the period 1989 to 2019, prior to the implementation period, the model suggests 739 wells went dry.				Total	**772**

Table 4b. Summary of Dry Wells for Dry Start Case. Wells drilled in 1970 or later, based on snapshot of depth to groundwater at end of period. Assumes 10 feet of well saturation above bottom of screen.

Year Range	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	97	4083	**350**	3717	350
2025 to 2029	0	3796	**834**	2883	1184
2030 to 2034	0	3644	**110**	2773	1294
2035 to 2039	0	3311	**0**	2773	1294
During the period 1989 to 2019, prior to the implementation period, the model suggests 755 wells went dry.				Total	1294

Table 5a: Adjusted estimates of dry wells for Base Case based on WCRs since 1970 upscaled using ratio of permits to WCRs (1.22).

Year Range (Oct 31st Minimums)	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	118	4981	350	4631	350
2025 to 2029	0	4631	185	4446	536
2030 to 2034	0	4446	406	4040	941
2035 to 2039	0	4040	0	4040	941
During the period 1989 to 2019, prior to the implementation period, the model suggests 902 wells went dry.				Total	**941**

Table 5b: Adjusted estimates of dry wells for Dry Start Case based on WCRs since 1970 upscaled using ratio of permits to WCRs (1.22).

Year Range (Oct 31st Minimums)	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	118	4962	427	4535	427
2025 to 2029	0	4535	1017	3518	1443
2030 to 2034	0	3518	134	3384	1578
2035 to 2039	0	3384	0	3383	1578
During the period 1989 to 2019, prior to the implementation period, the model suggests 921 wells went dry.				Total	1578

Table 6: Dry Well Summary Based on Snapshots of Groundwater Depth at End of Periods ending in 2015, 2018, 2023, 2028, 2033, and 2038.

Year Range (Oct 31st Minimums)	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells Based on 5-Year Minimum
2019 to 2023	150	4015	**248**	3767	248
2024 to 2028	0	3767	**167**	3600	415
2029 to 2033	0	3600	**334**	3266	749
2034 to 2038	0	3266	**0**	3266	749
During the period 1989 to 2018, prior to the period described in this table, the model suggests 807 wells went dry.				Total	749

Table 7: Effect of Varying Saturation requirement on Dry Well Counts.

Saturation Setting	Dry Wells Total After 2019
0	539
10	605
20	642
30	682
40	625
50	569
60	543
70	554
80	518
90	394
100	325

Table 8: Effect of Varying Minimum Installation Year on Counts of Wells and Dry Wells.

Well Counts	Earliest Installation Year						
	1970	1975	1980	1985	1990	1995	2000
Total Count of WCRs in Comparison	4822	4690	4208	3972	3446	2625	2123
Fraction of 1970 (Total Count of Wells)	1.00	0.97	0.87	0.82	0.71	0.54	0.44
Total Count of Dry Wells	1511	1444	1289	1198	1001	711	534
Fraction of 1970 (Dry Wells)	1.00	0.96	0.85	0.79	0.66	0.47	0.35
Count of Dry Wells Prior to 2020	739	688	580	518	396	251	186
Fraction of 1970 (Dry Prior to 2020)	1.00	0.93	0.78	0.70	0.54	0.34	0.25
Count of Dry Wells from 2020 to 2039	772	756	709	680	605	460	348
Fraction of 1970 (Dry Wells 2020 to 2039)	1.00	0.98	0.92	0.88	0.78	0.60	0.45

Table 9: Summary of Domestic Pump and Well Costs.

Issue	Type of Problem	Solution	Related to GSP	Typical Cost
Water level in well below pump setting depth	**Pump**	**Lower Pump**	**Yes/No**	**$1,000 to $2,000**
Pump not working (old age or pump-related issue)	**Pump**	**Replace Pump and Equipment**	**No**	**$5,000 to $7,000**
Well casing/screen failure (due to old age)	**Well**	**Replace Well**	**No**	**$25,000 to $35,000**
Water level below bottom of well	**Aquifer**	**Replace Well**	**Yes**	**$25,000 to $35,000**

Table 10: PWS and other Municipal Wells - Dry Well Summary Based on Snapshots of Groundwater Depth at End of Periods ending in 2019, 2024, 2029, 2034, and 2039.

Year Range (Oct 31st Minimums)	New Wells Drilled	Total Wetted Wells Year Start	**Wells Going Dry**	Total Wetted Wells Year End	Sum Of Dry Wells
2020 to 2024	1	62	2	60	2
2025 to 2029	0	60	0	60	2
2030 to 2034	0	60	1	59	3
2035 to 2039	0	59	0	59	3.
During the period 1989 to 2019, prior to the implementation period, the model suggests 10 wells went dry.				Total	3

7 FIGURES

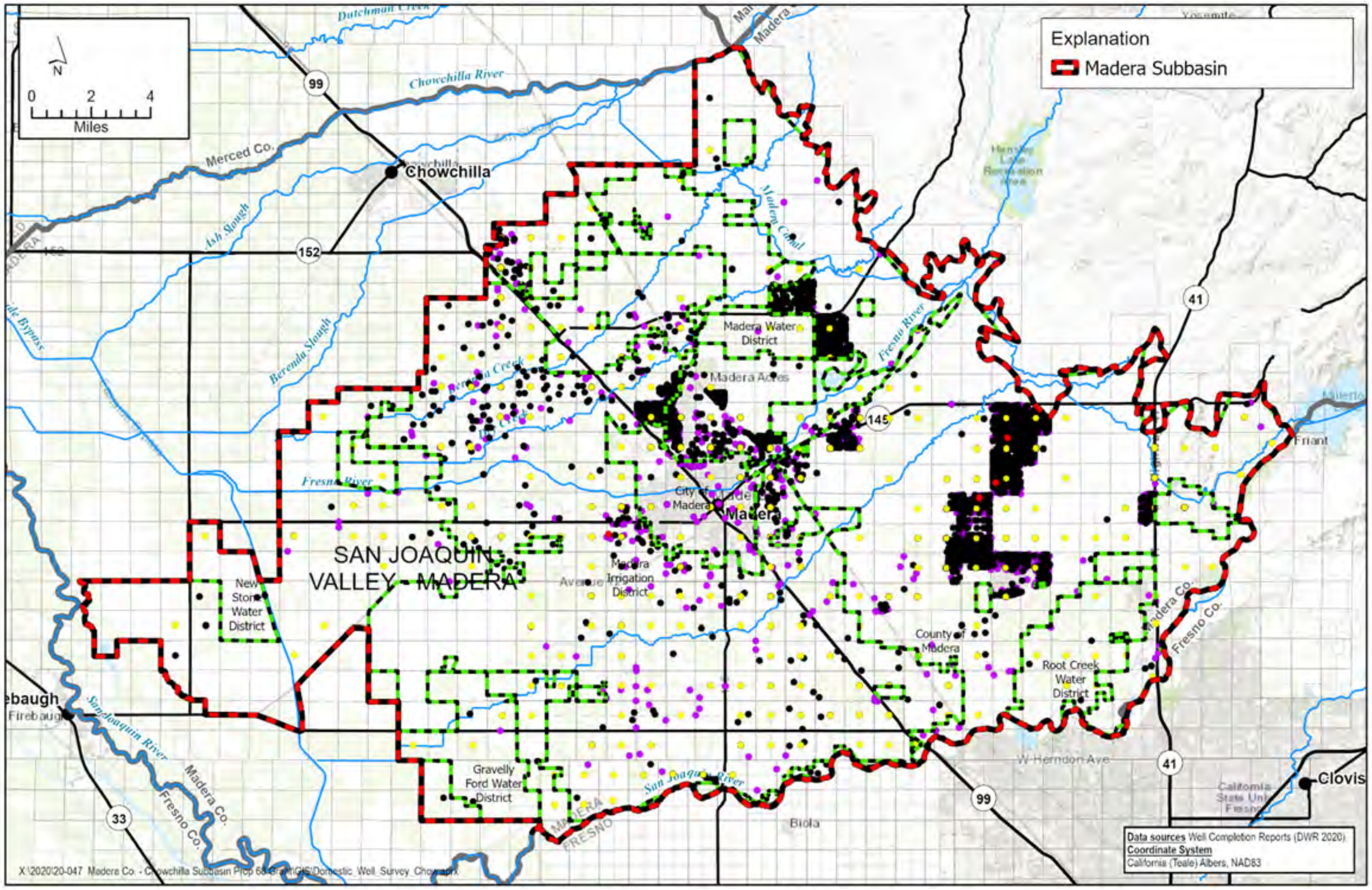


Figure 1a. Well Permits for new construction domestic wells located by best available method.

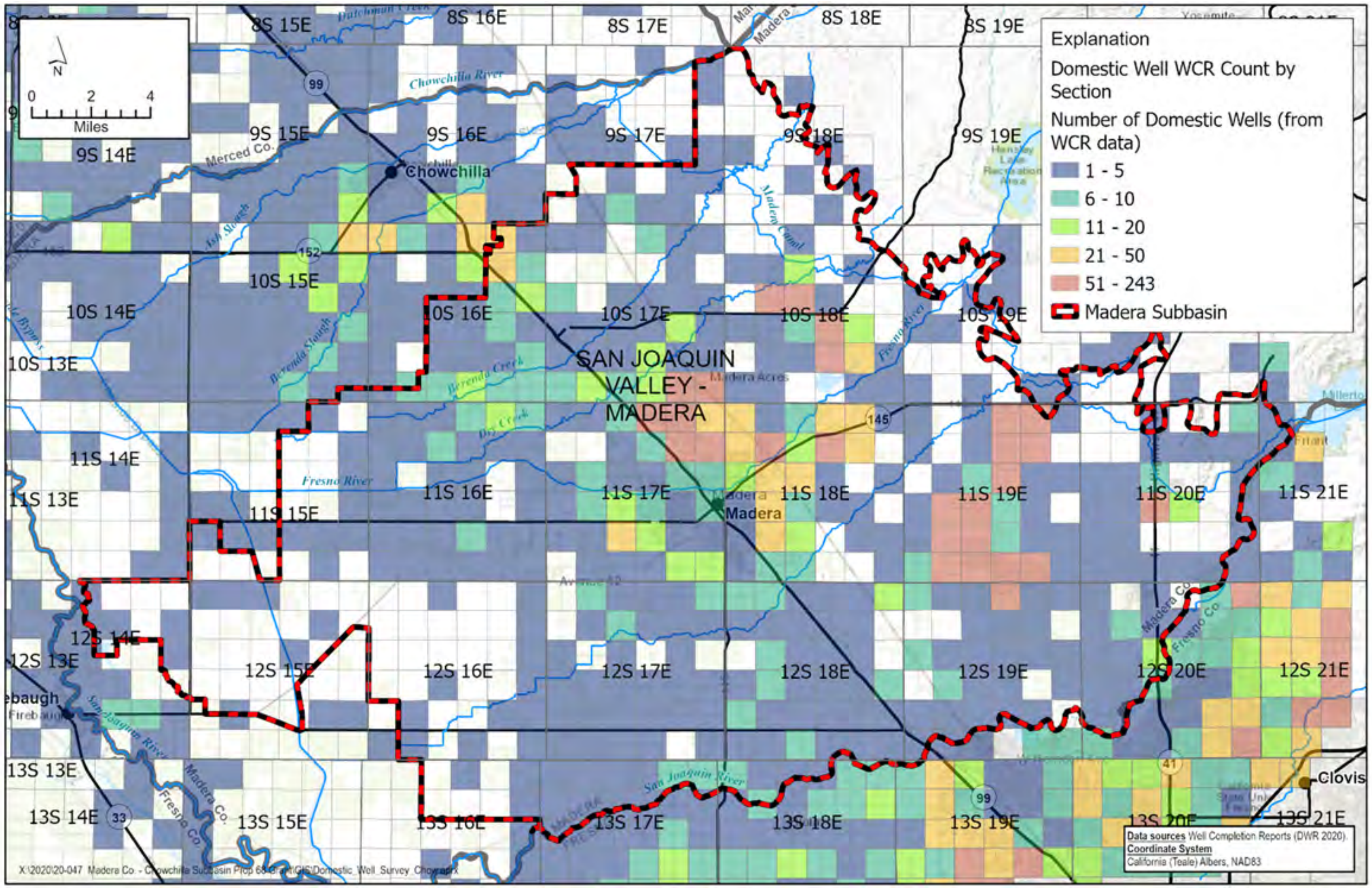


Figure 1b. Well Completion Report new construction domestic well counts by Section.

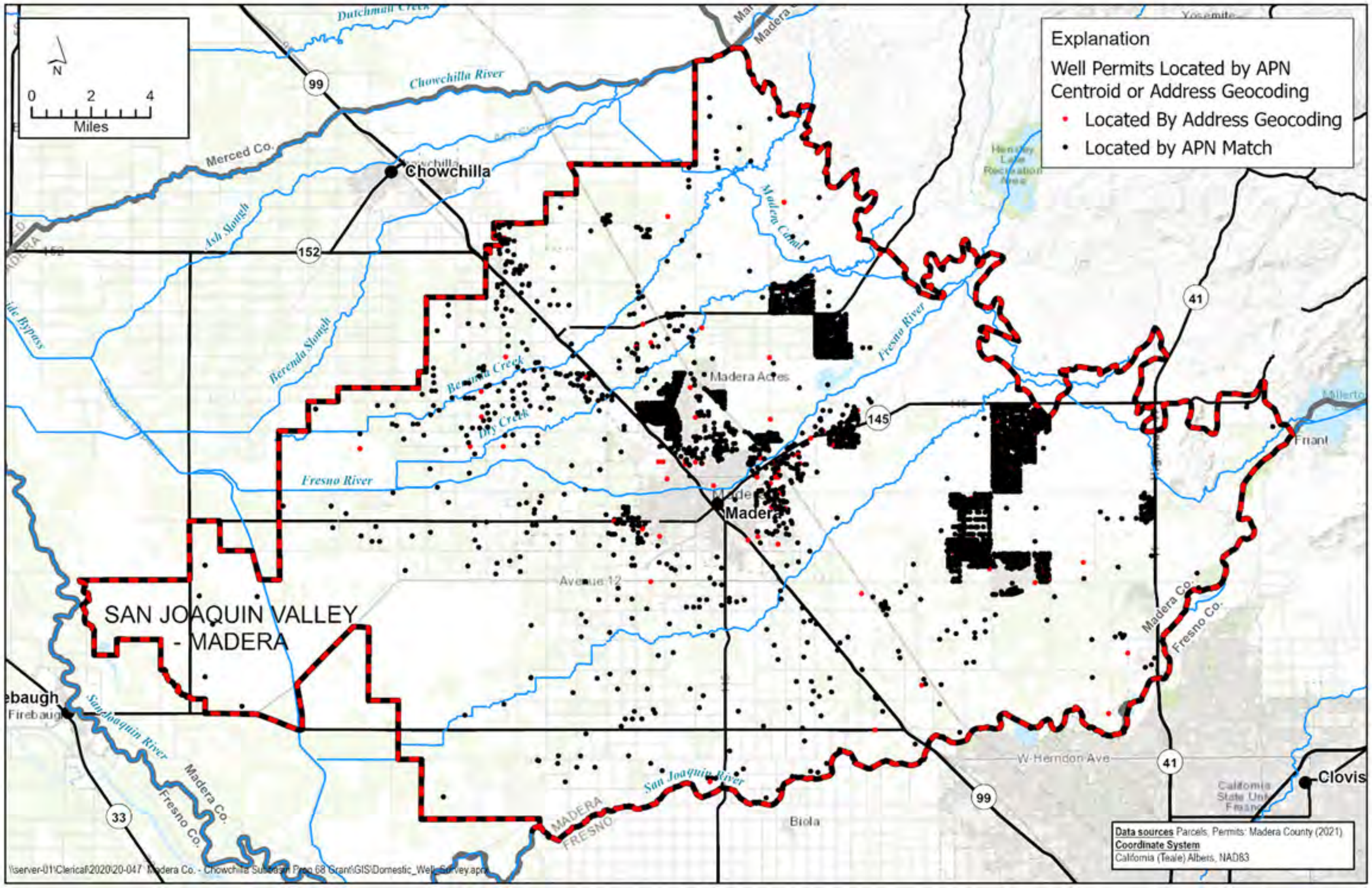


Figure 2a: Permit locations and geolocation method in Madera Subbasin.

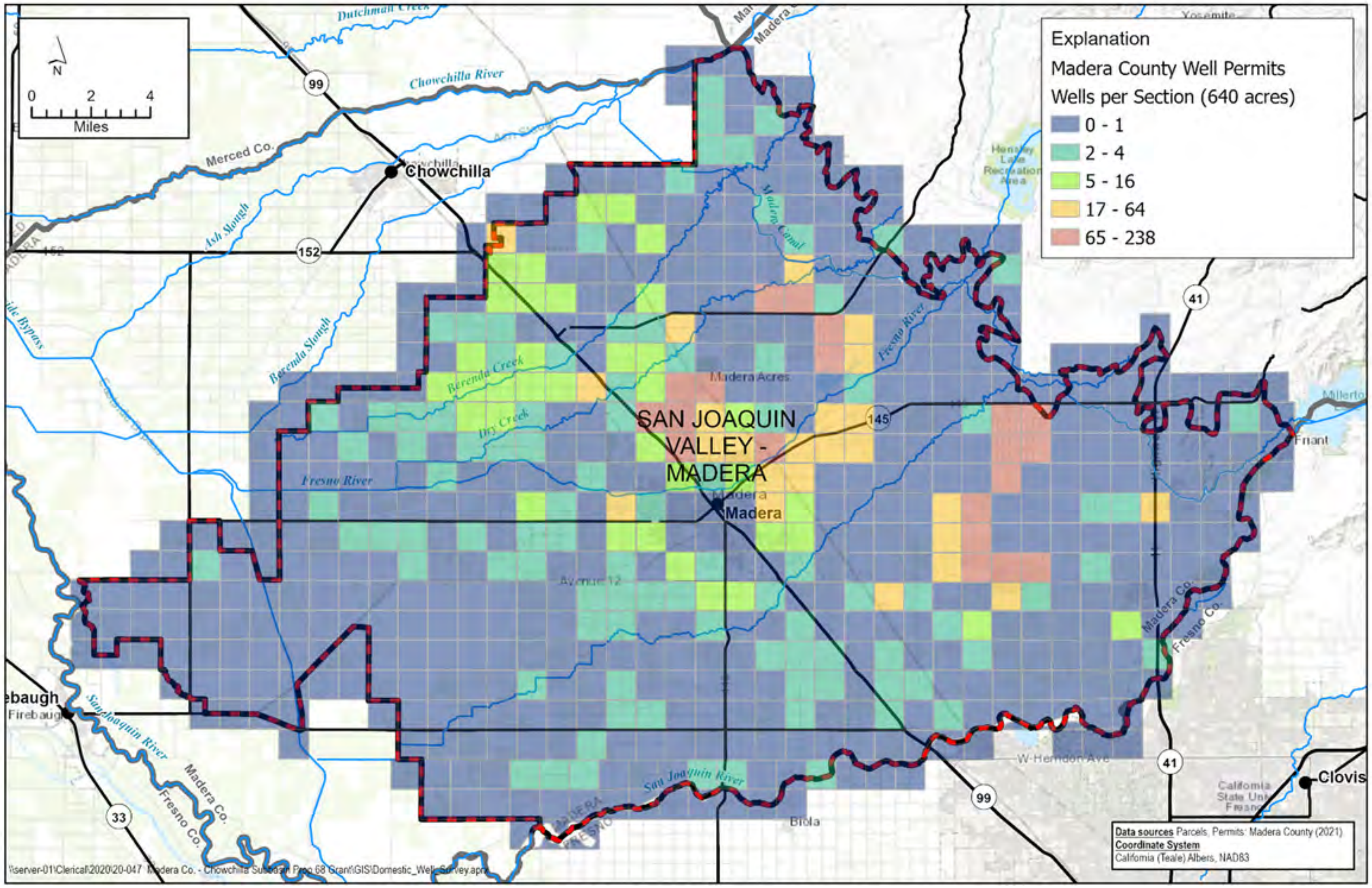


Figure 2b. Permit location counts by Township/Range/Section.

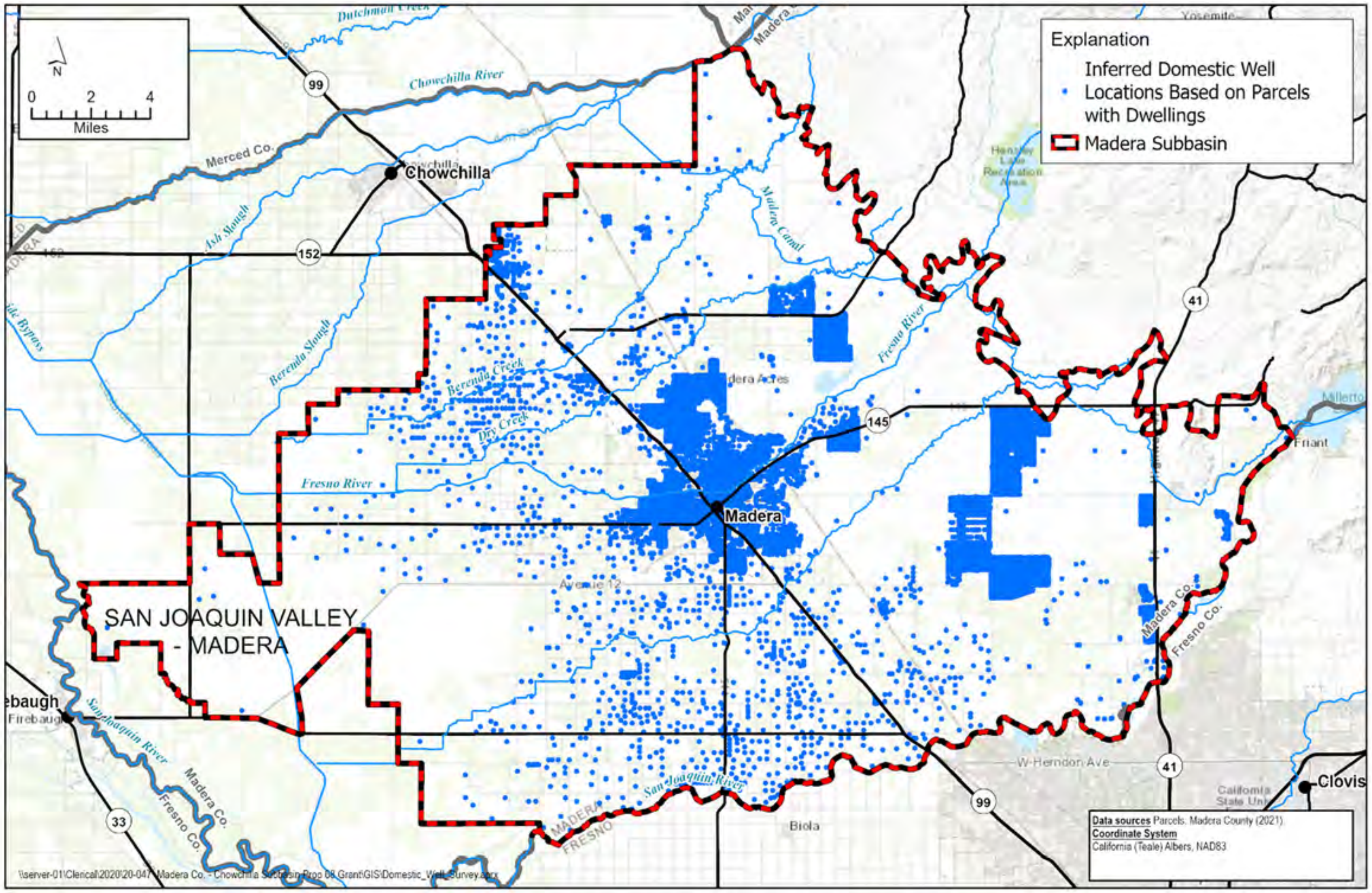


Figure 3: Inferred well locations based on Parcel Dwelling Status.

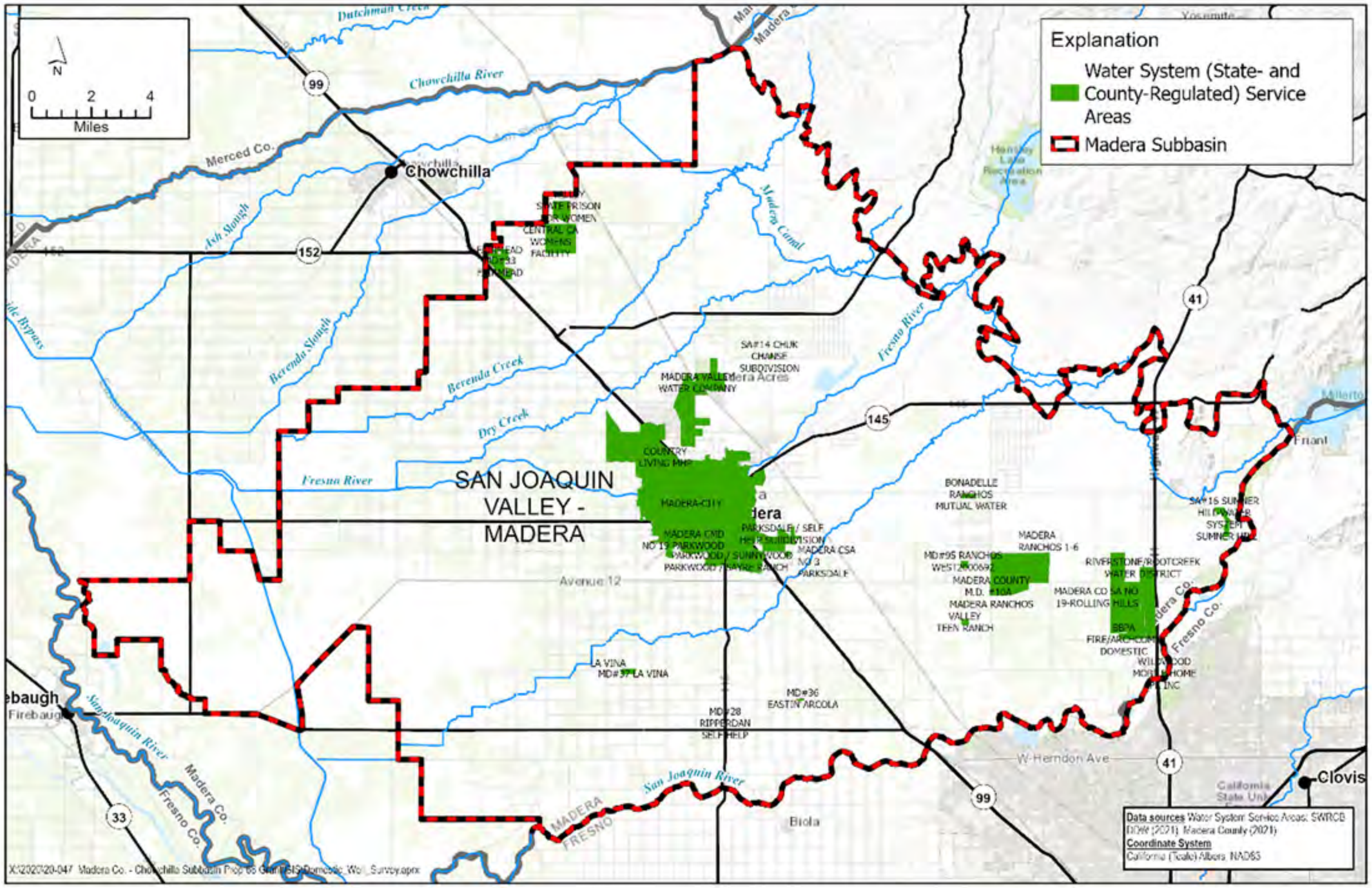


Figure 4: Water System Boundaries in Madera County.

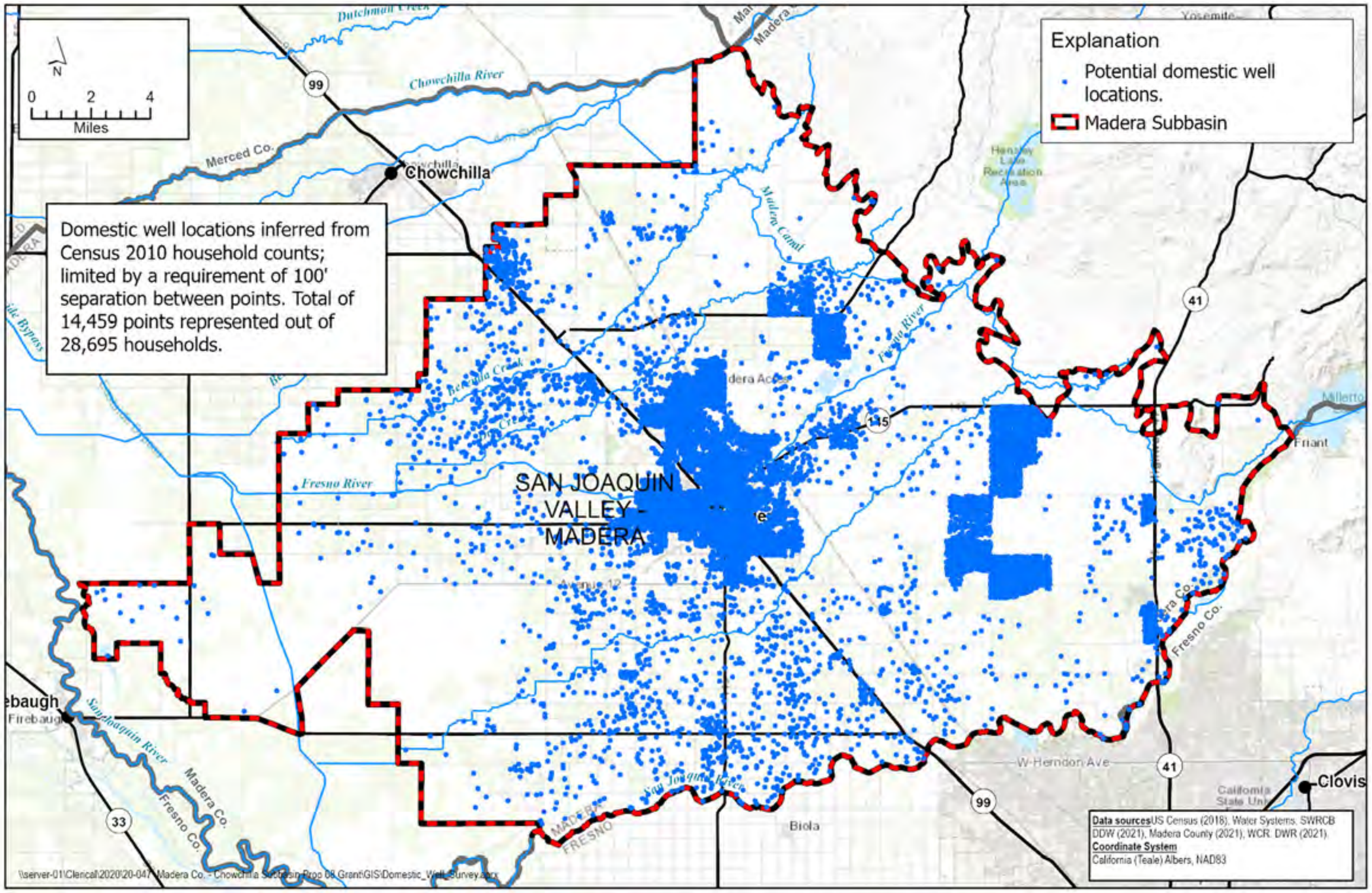


Figure 5: Inferred well locations based on 2010 Census Household counts.

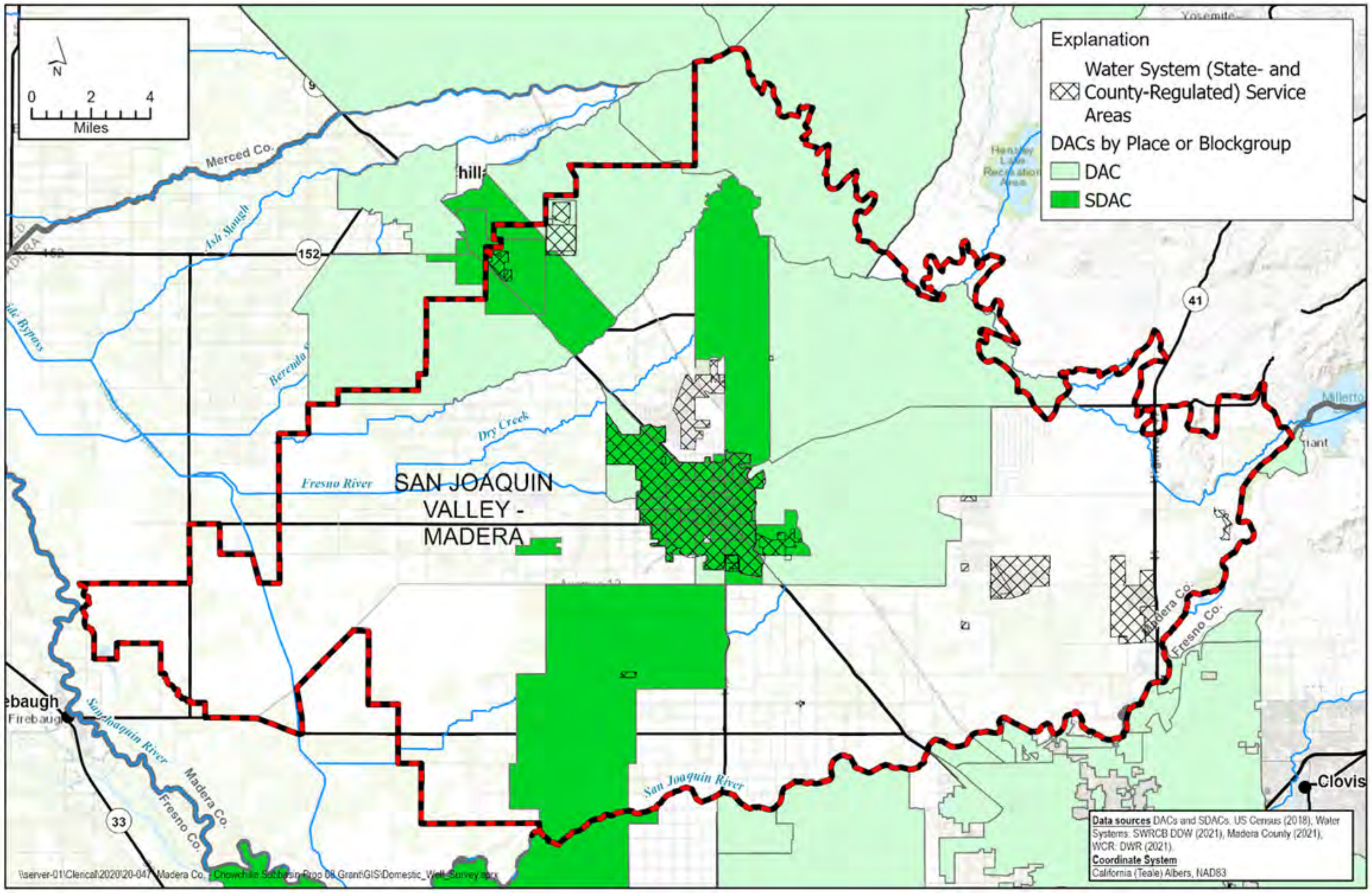


Figure 6: DACs and SDACs in the Madera Subbasin.

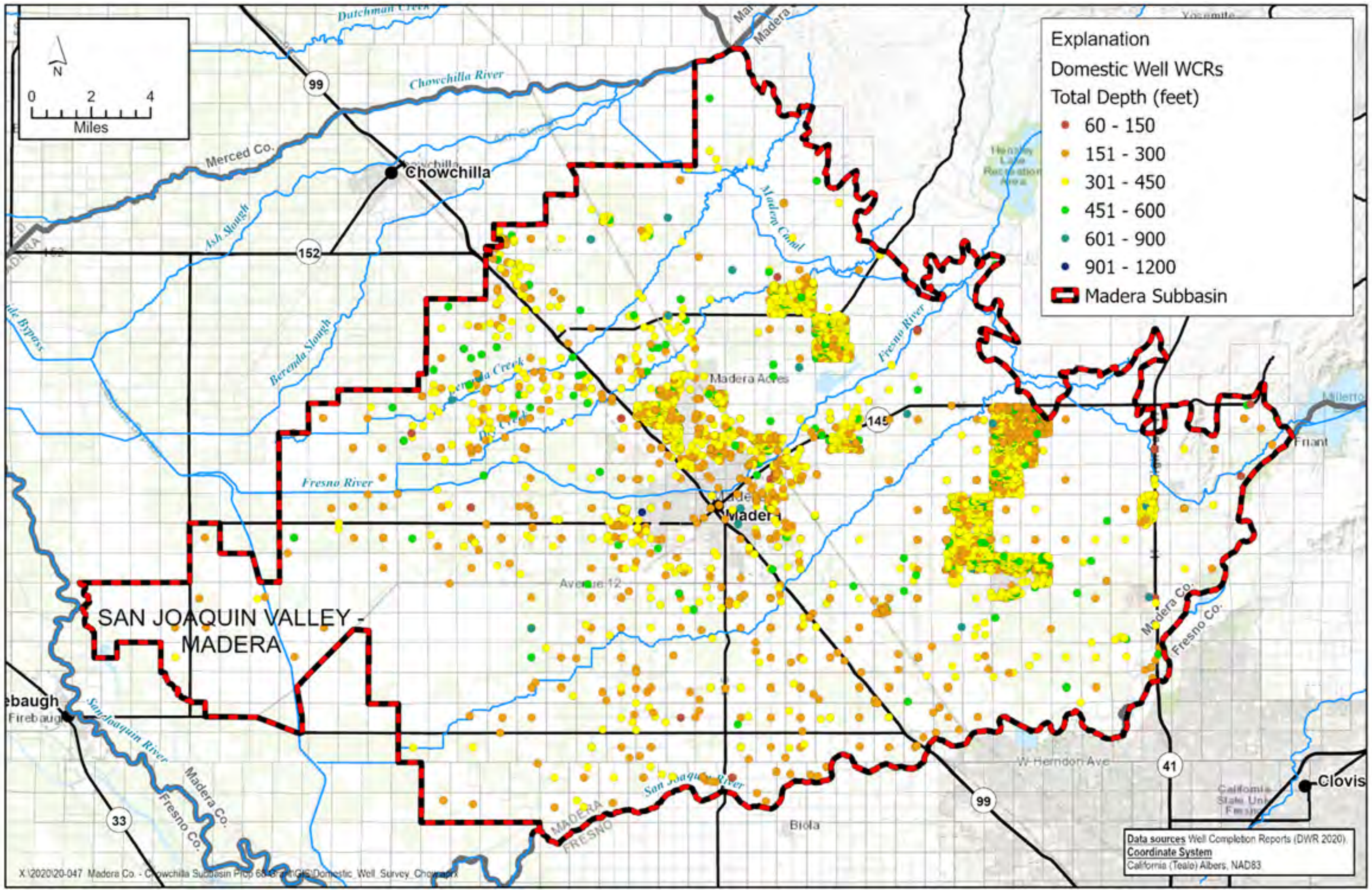


Figure 7a: Domestic wells in Madera Subbasin with depth from WCR.

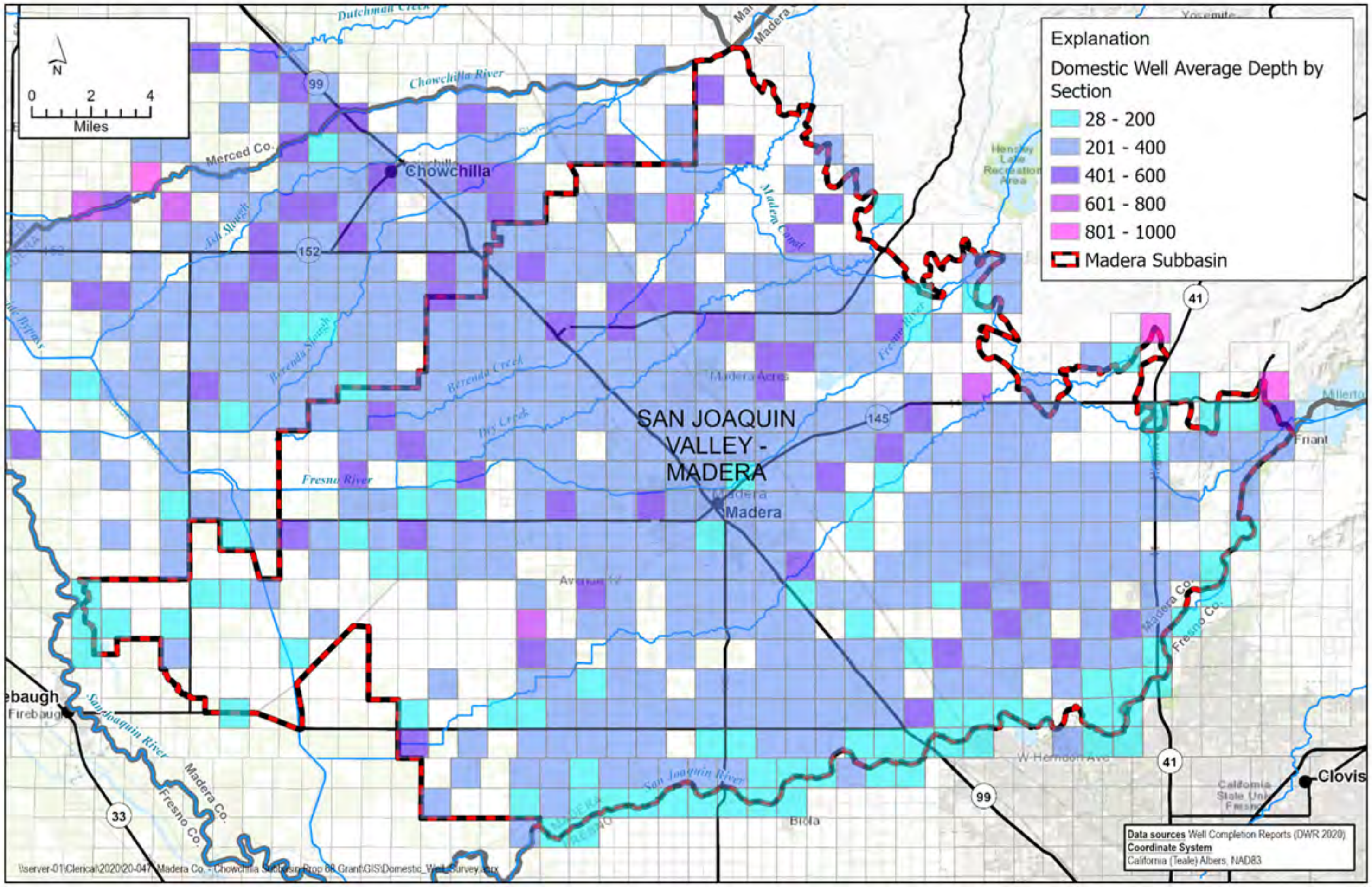


Figure 7b. Domestic Wells in Madera Subbasin with Average Depth by Township/Range/Section.

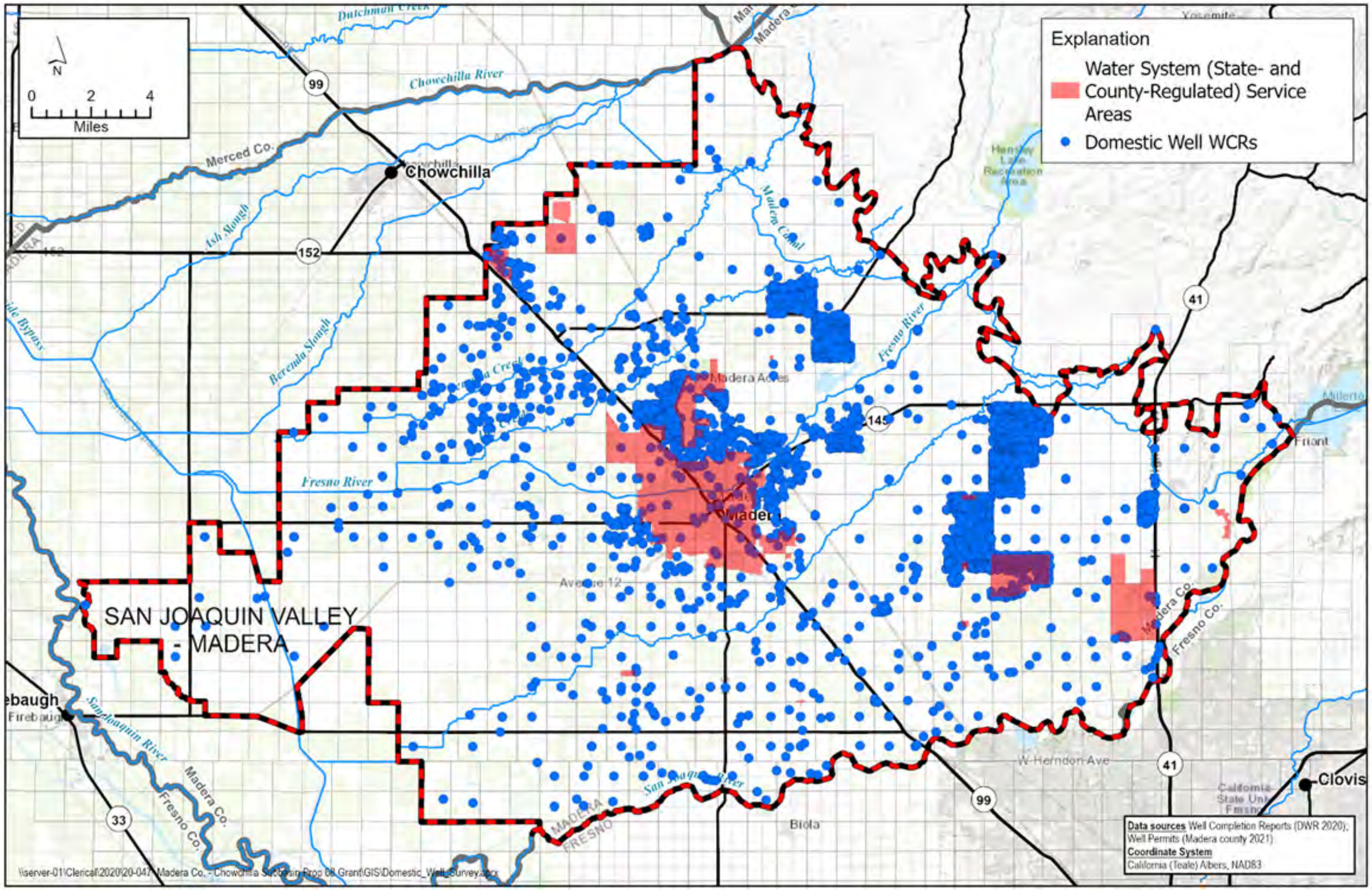


Figure 8: Domestic WCRs compared with Community PWS, County Maintenance Districts, and Community Service Areas.

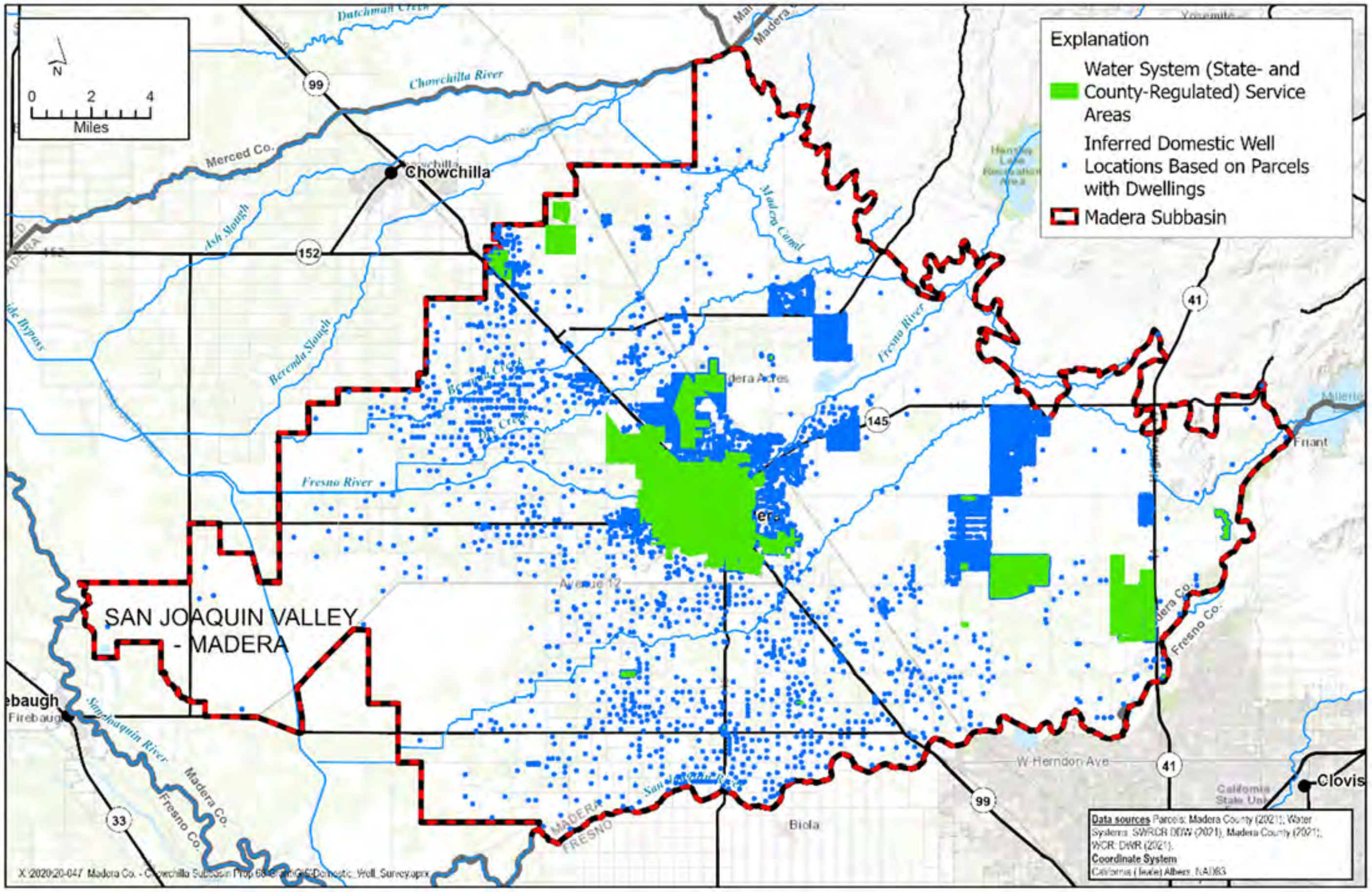


Figure 9: Parcels with Dwellings as Inferred Well Locations. With Community PWS, County Maintenance Districts, and Community Service Areas.

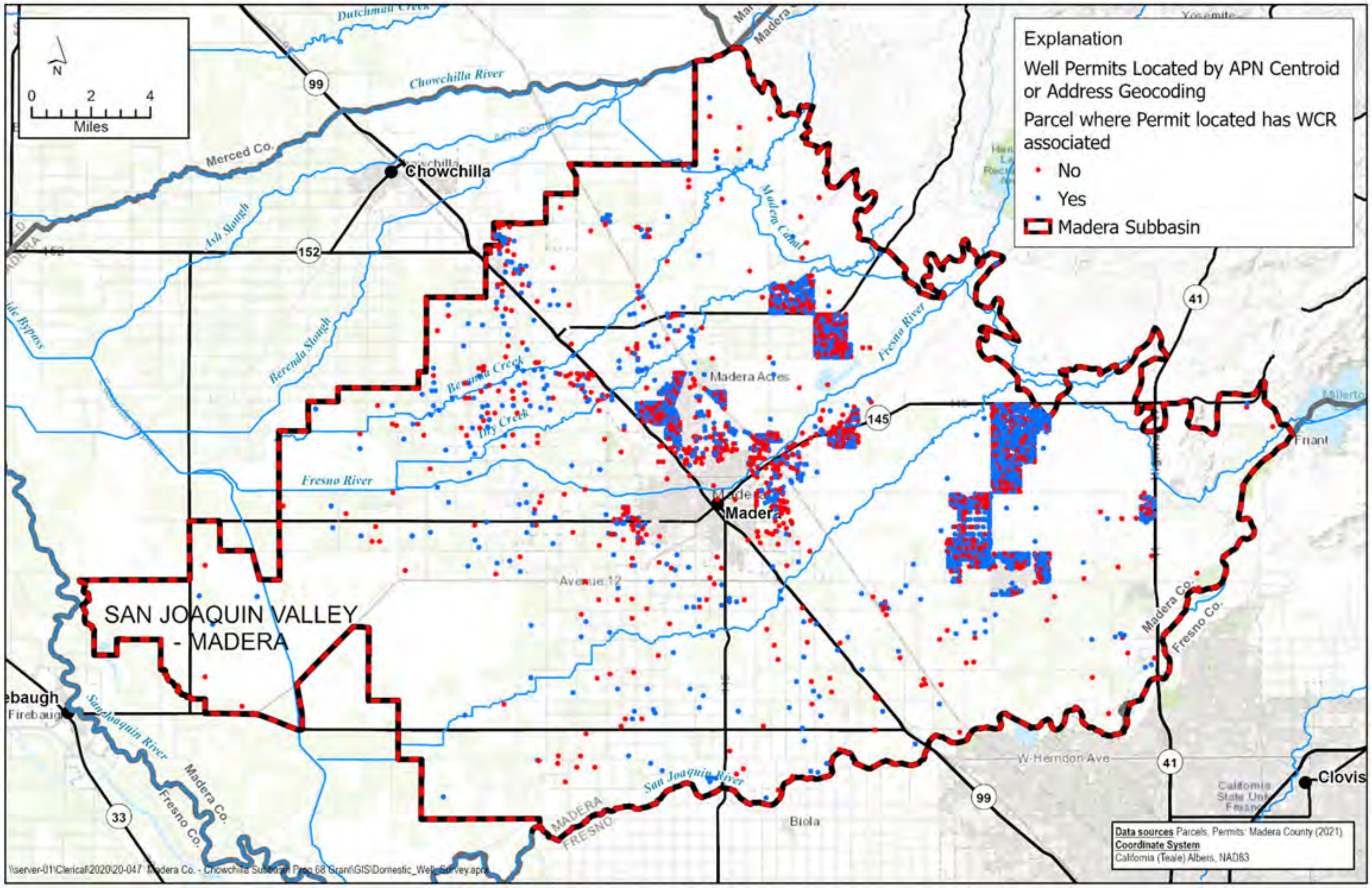


Figure 10: Permit locations with colocated WCRs.

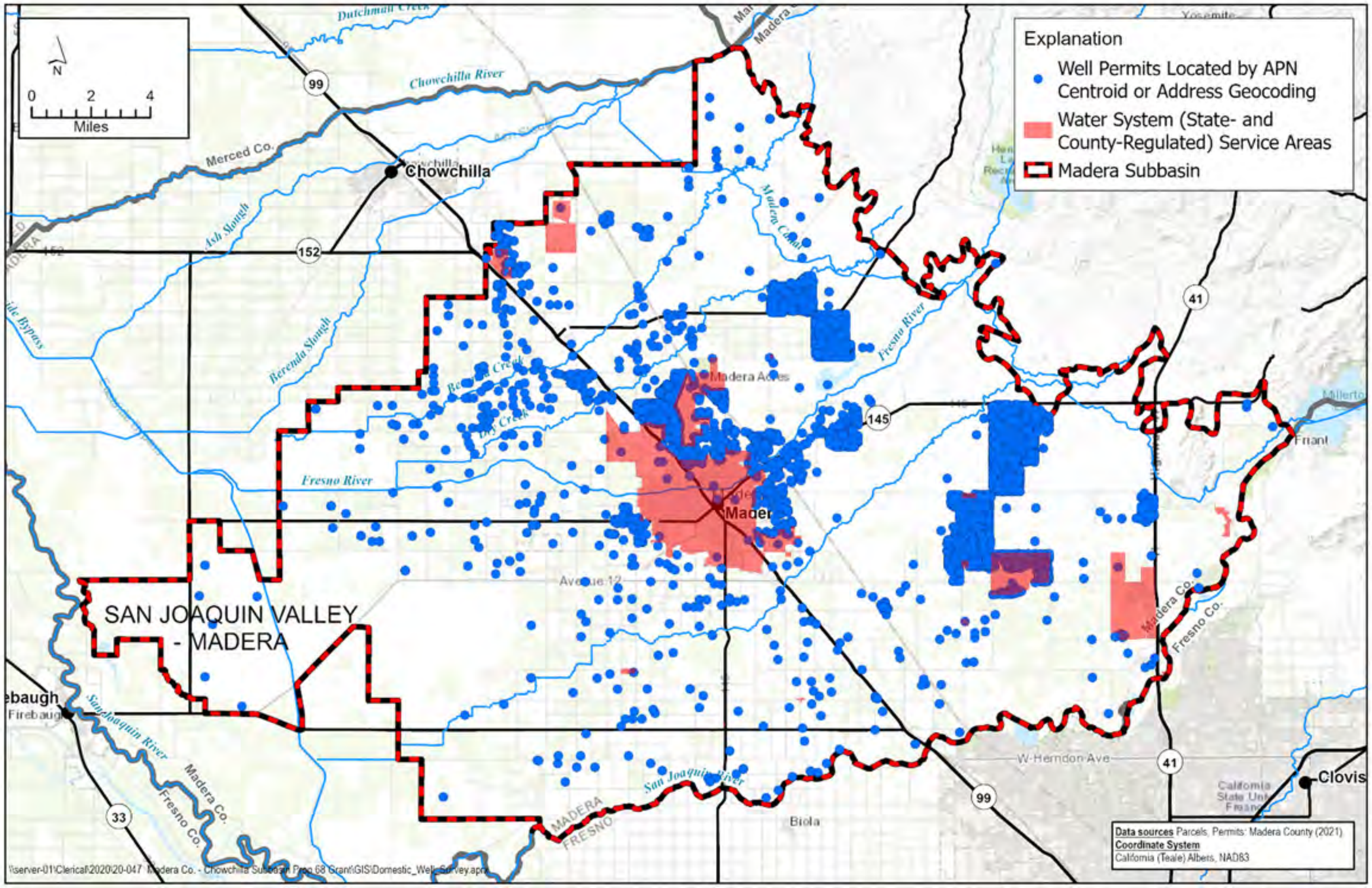


Figure 11a: Domestic Well Permits Compared with PWS, Community Service Districts and County Maintenance Districts.

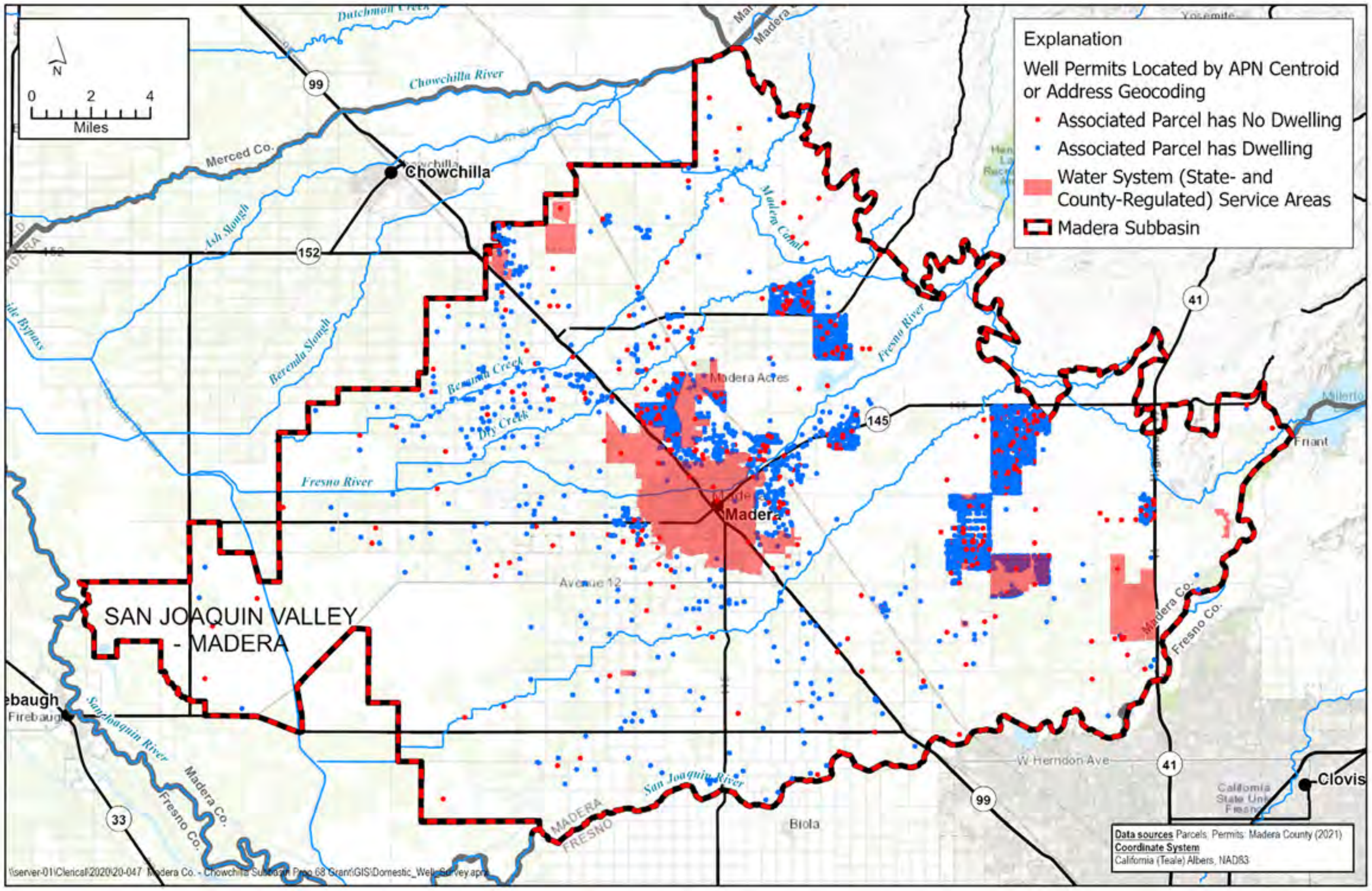


Figure 11b: Domestic Well Permits Compared with Parcel Characteristics.

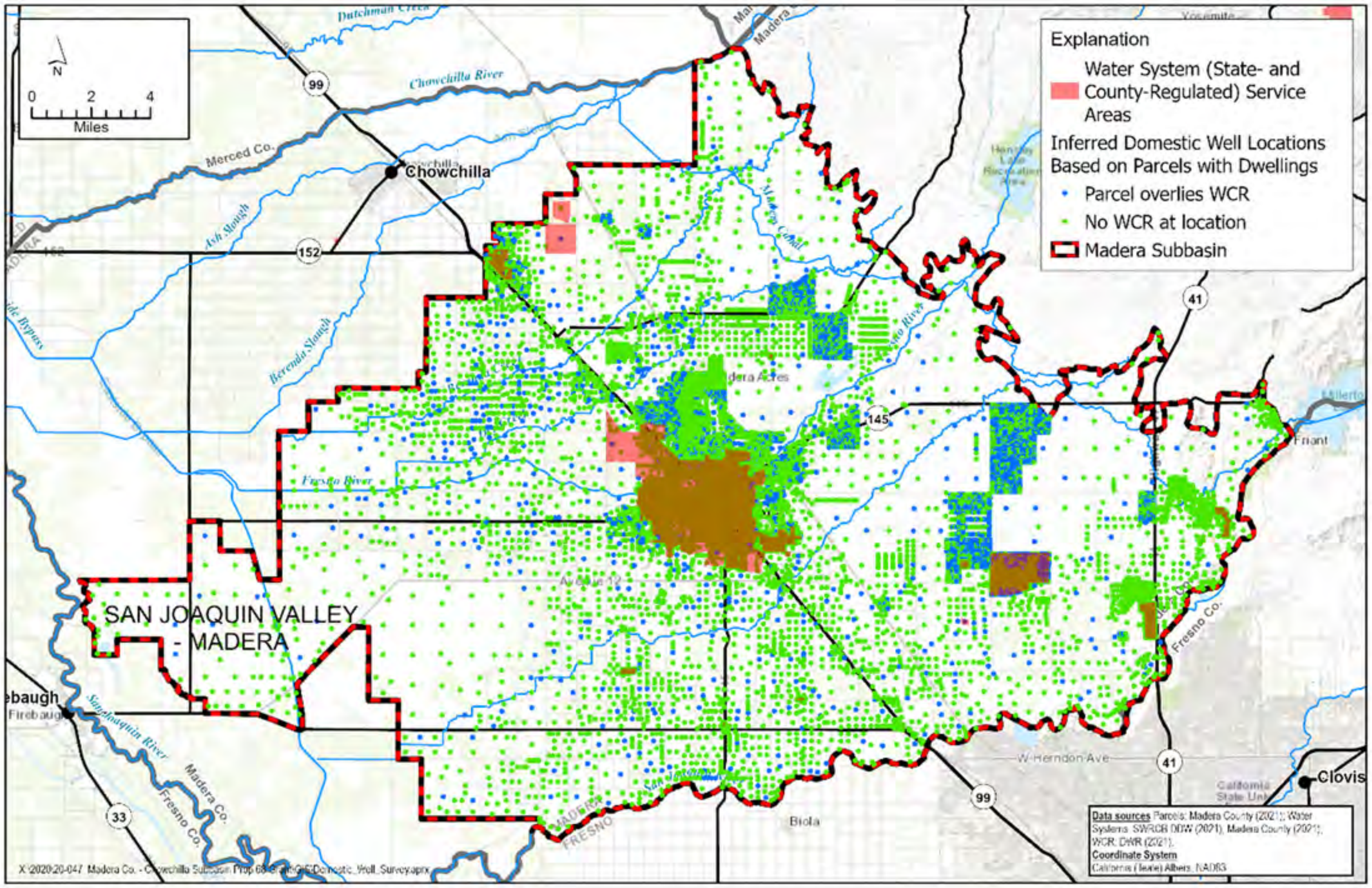


Figure 12: Inferred Domestic Well locations based on Parcels with Dwellings, with Water Systems and presence/absence of WCRs on parcel.

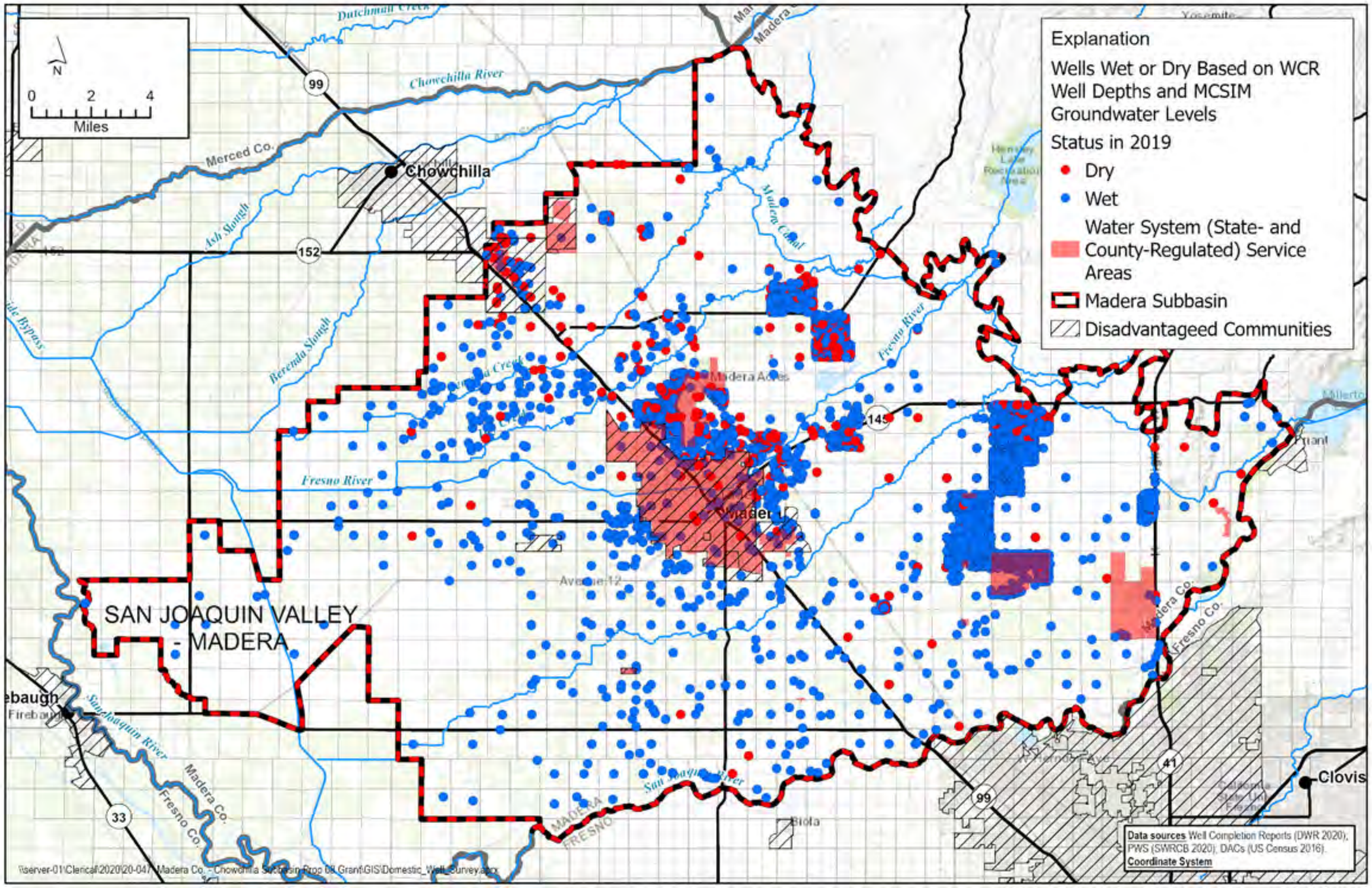


Figure 13a: Status of domestic wells in 2019 - Based on WCR well depths and locations compared to MCSIM groundwater depths.

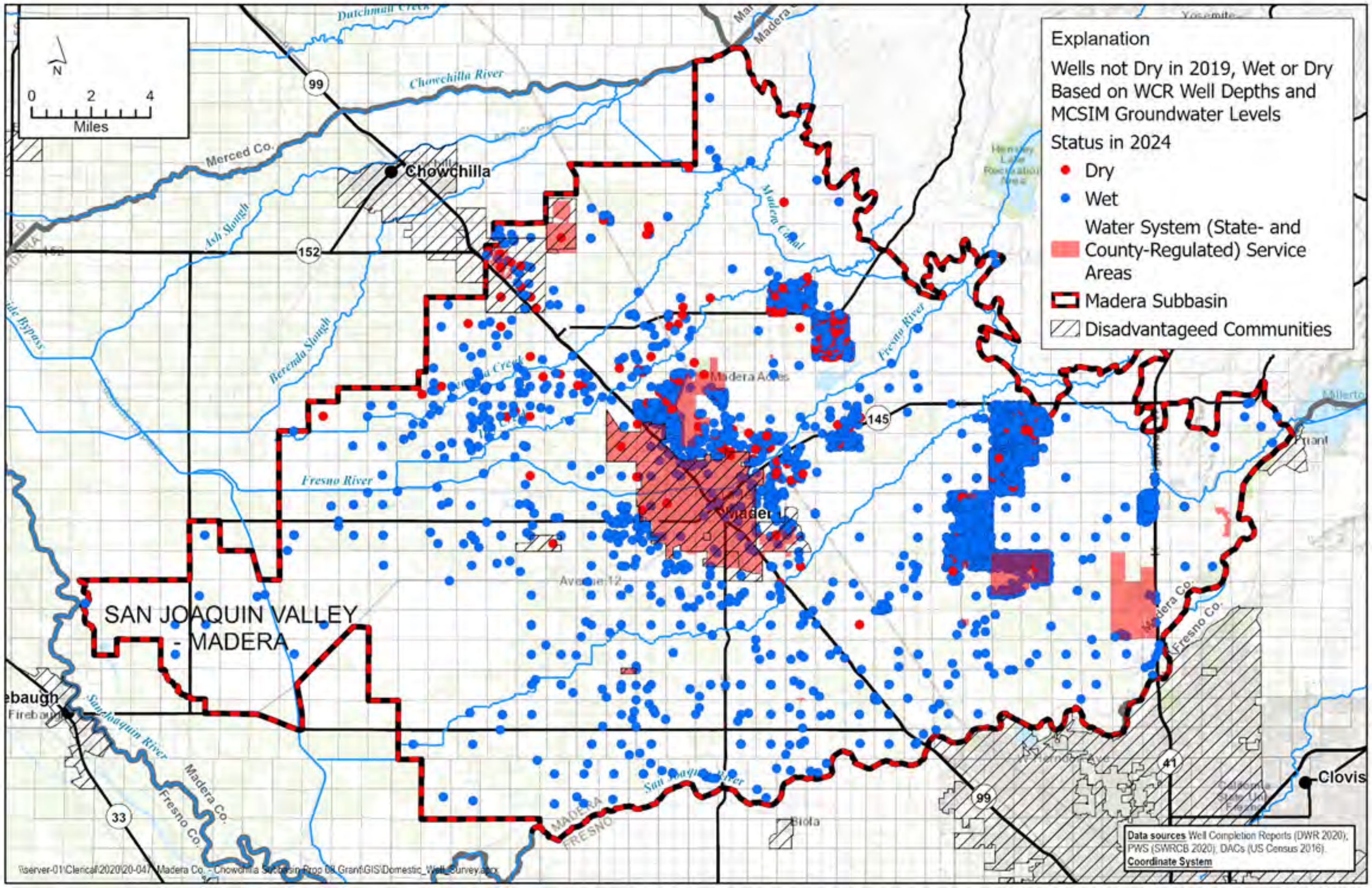


Figure 13b: Status of Wells in 2024 - Based on WCR Well Depths and Locations Compared to MCSIM Groundwater Depths.

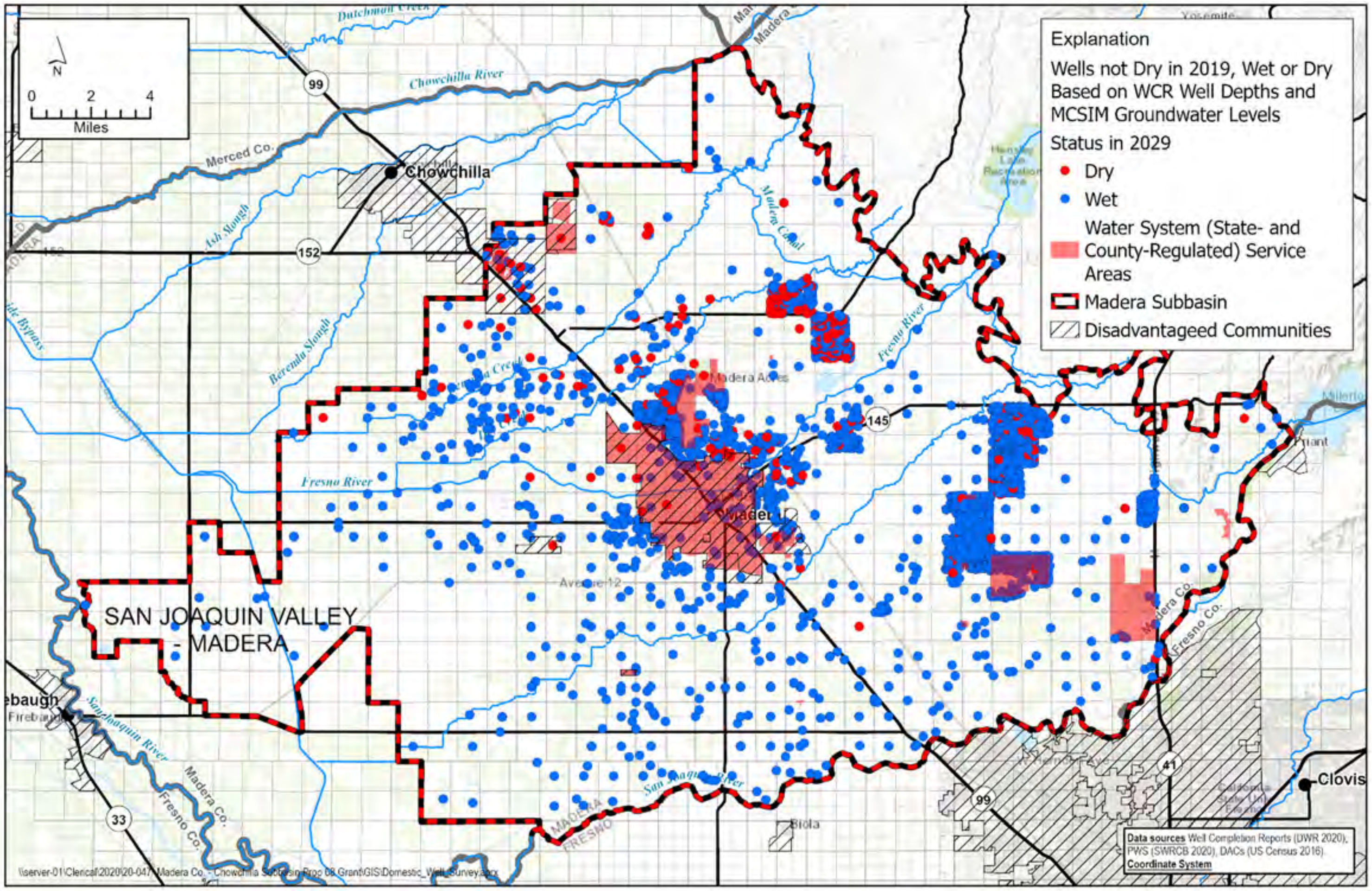


Figure 13c: Status of Wells in 2029 - Based on WCR Well Depths and Locations Compared to MCSIM Groundwater Depths.

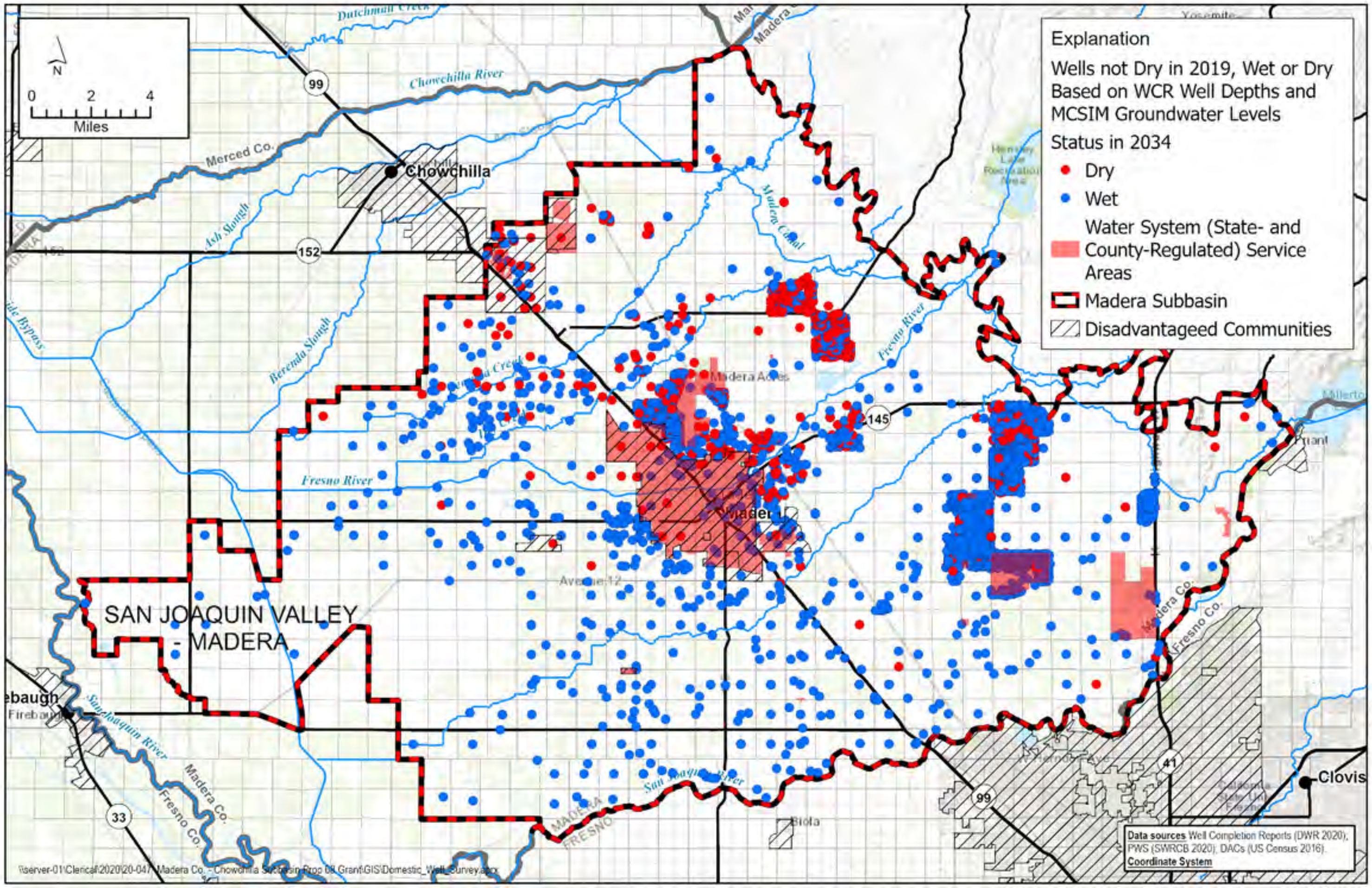


Figure 13d: Status of Wells in 2034 - Based on WCR Well Depths and Locations Compared to MCSIM Groundwater Depths.

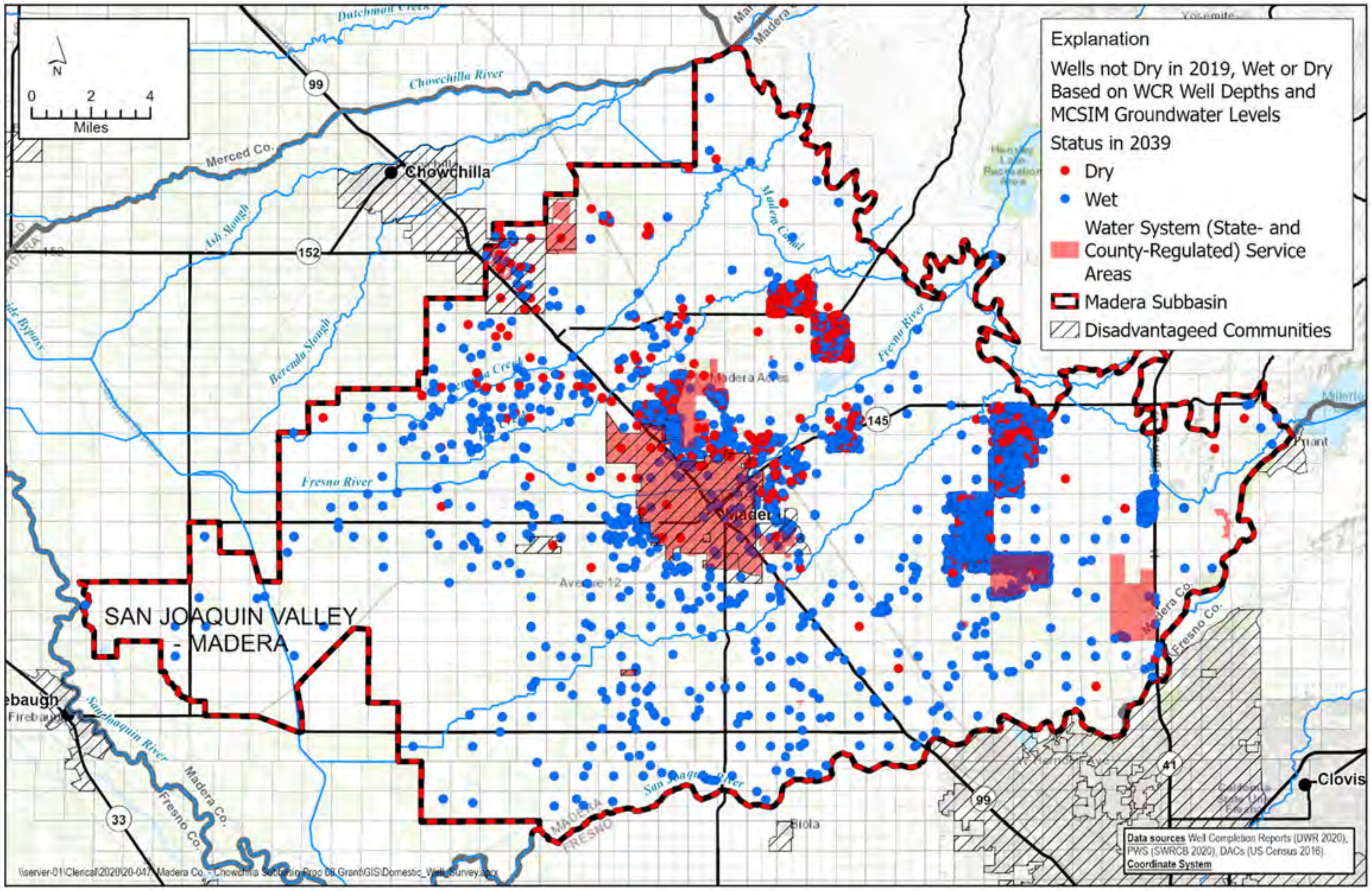


Figure 13e: Status of Wells in 2039 - Based on WCR Well Depths and Locations Compared to MCSIM Groundwater Depths.

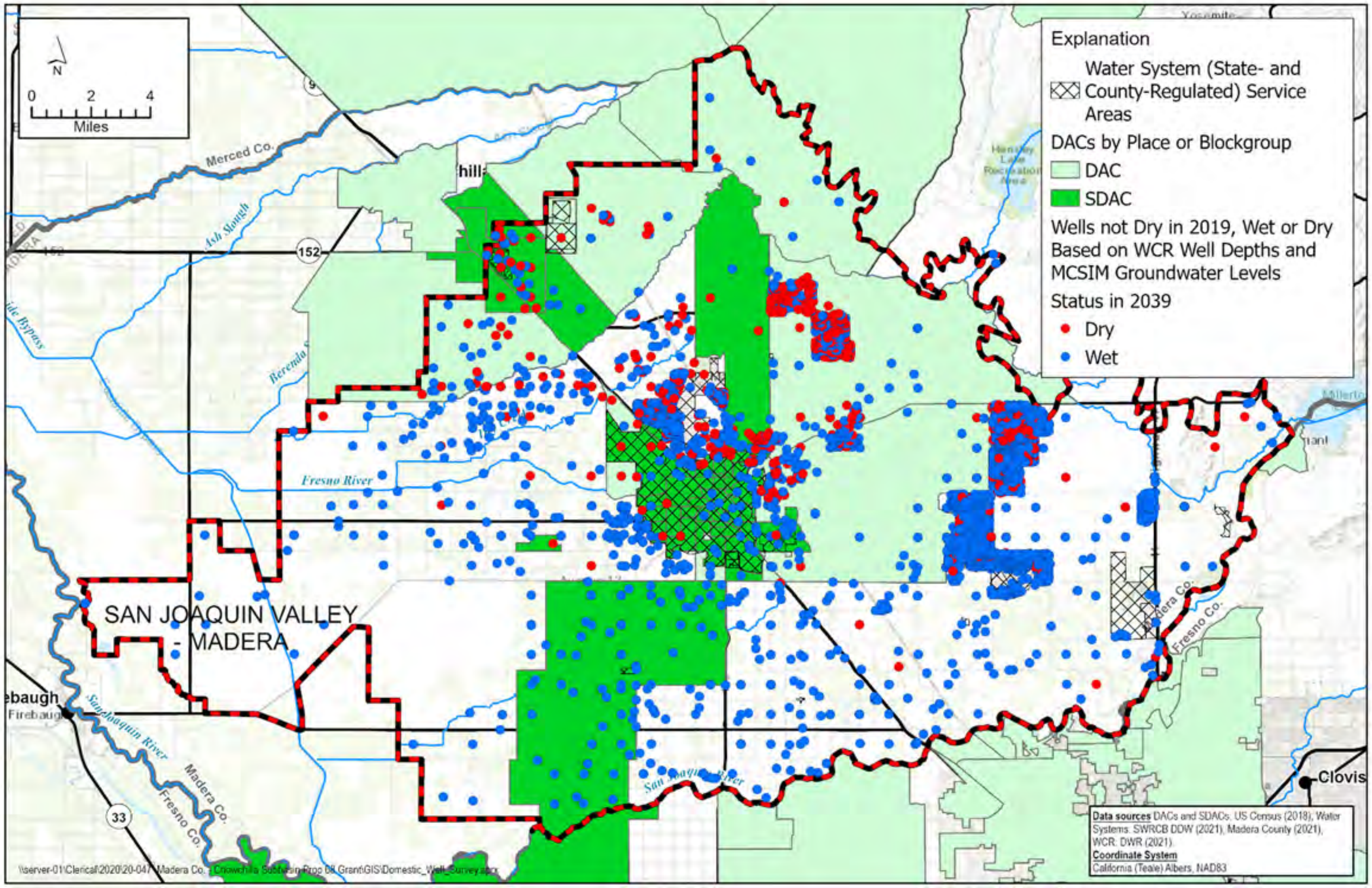


Figure 13f: DACs and SDACs with WCR-Based Wells and Predicted 2039 Status.

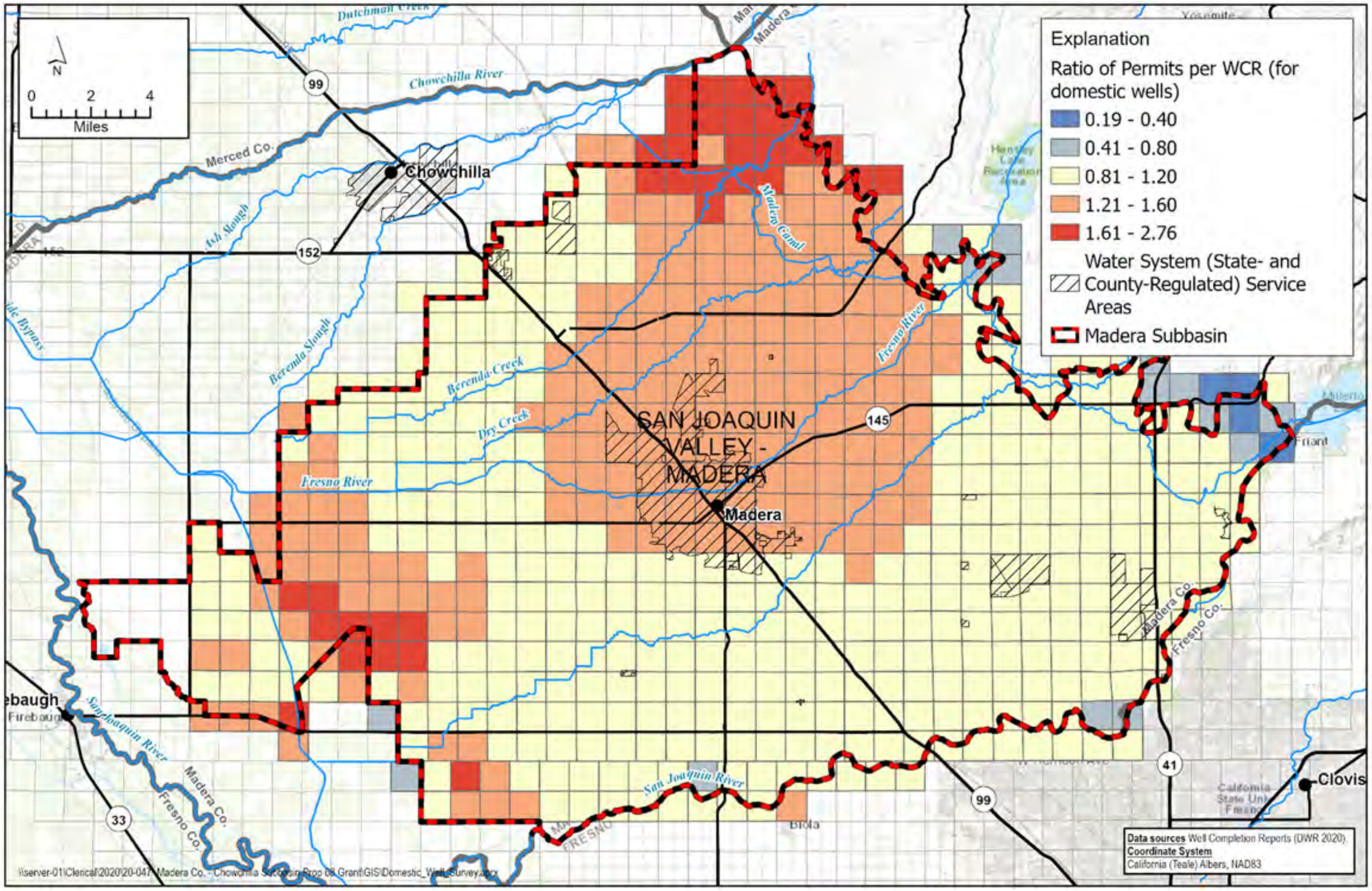


Figure 14: Map of domestic well Permits compared to domestic well WCR (from 1990 and later) locations.

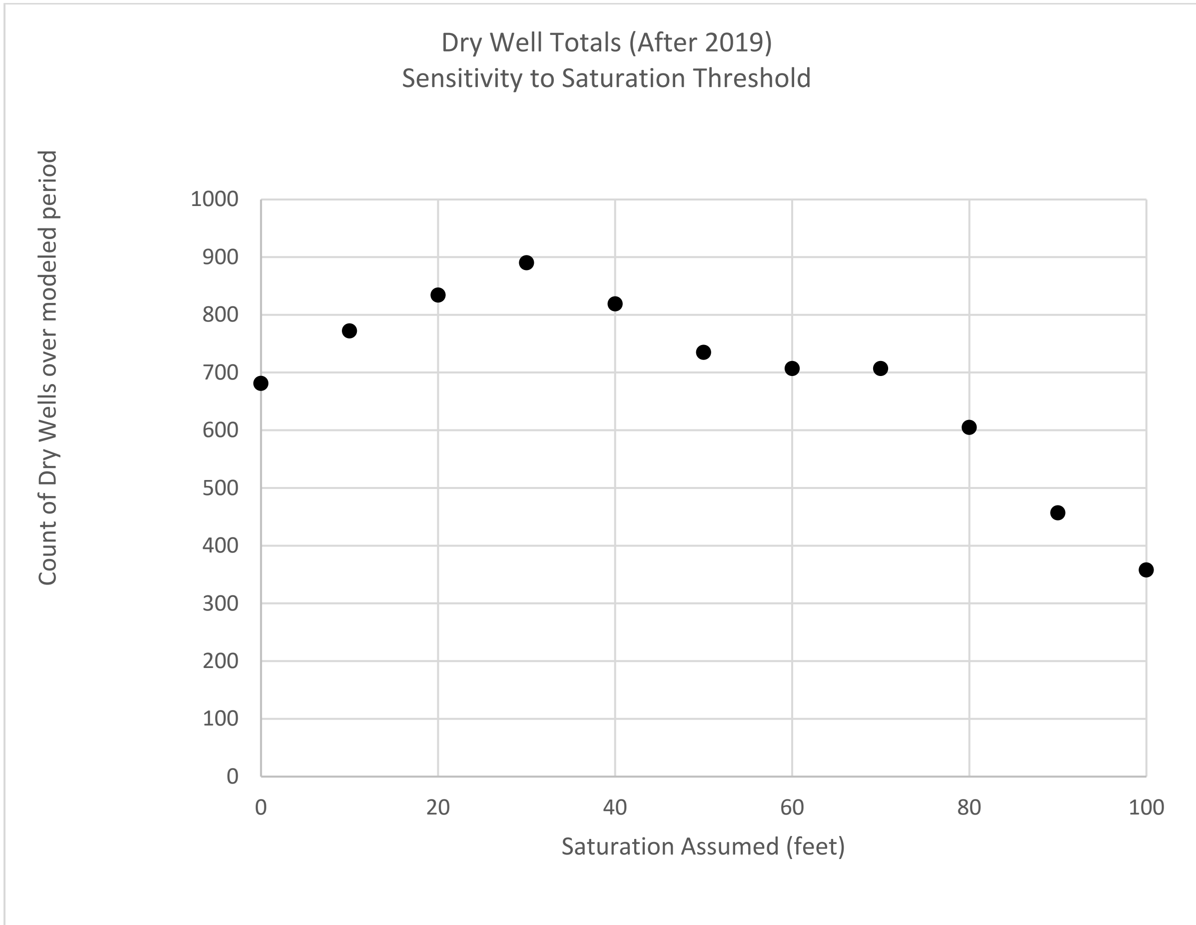


Figure 15: Counts of Dry Wells after 2019 as a Function of Minimum Saturation Threshold.

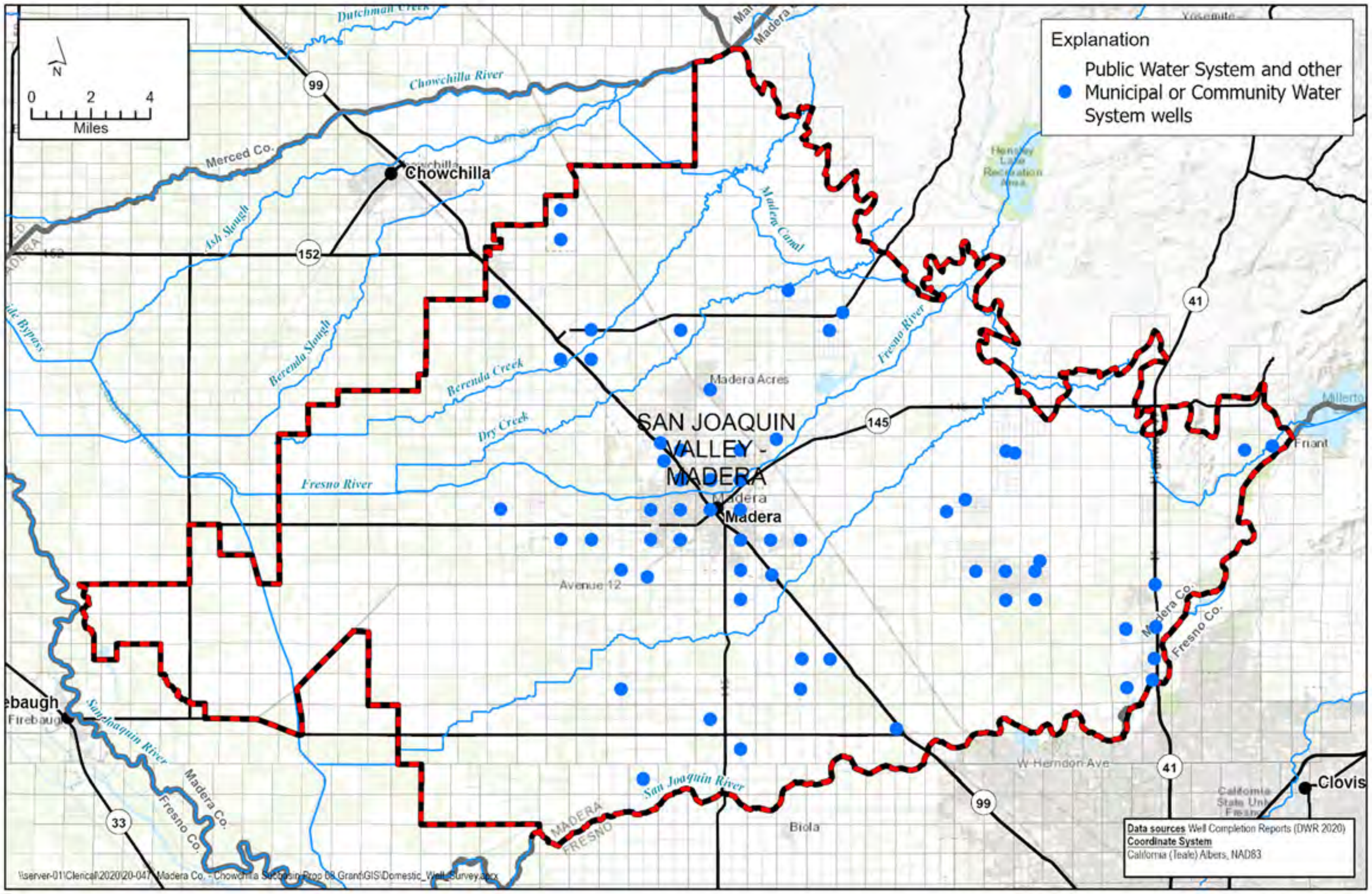


Figure 16: Public Water System and other Municipal or Community Water System wells. Based on WCR data.

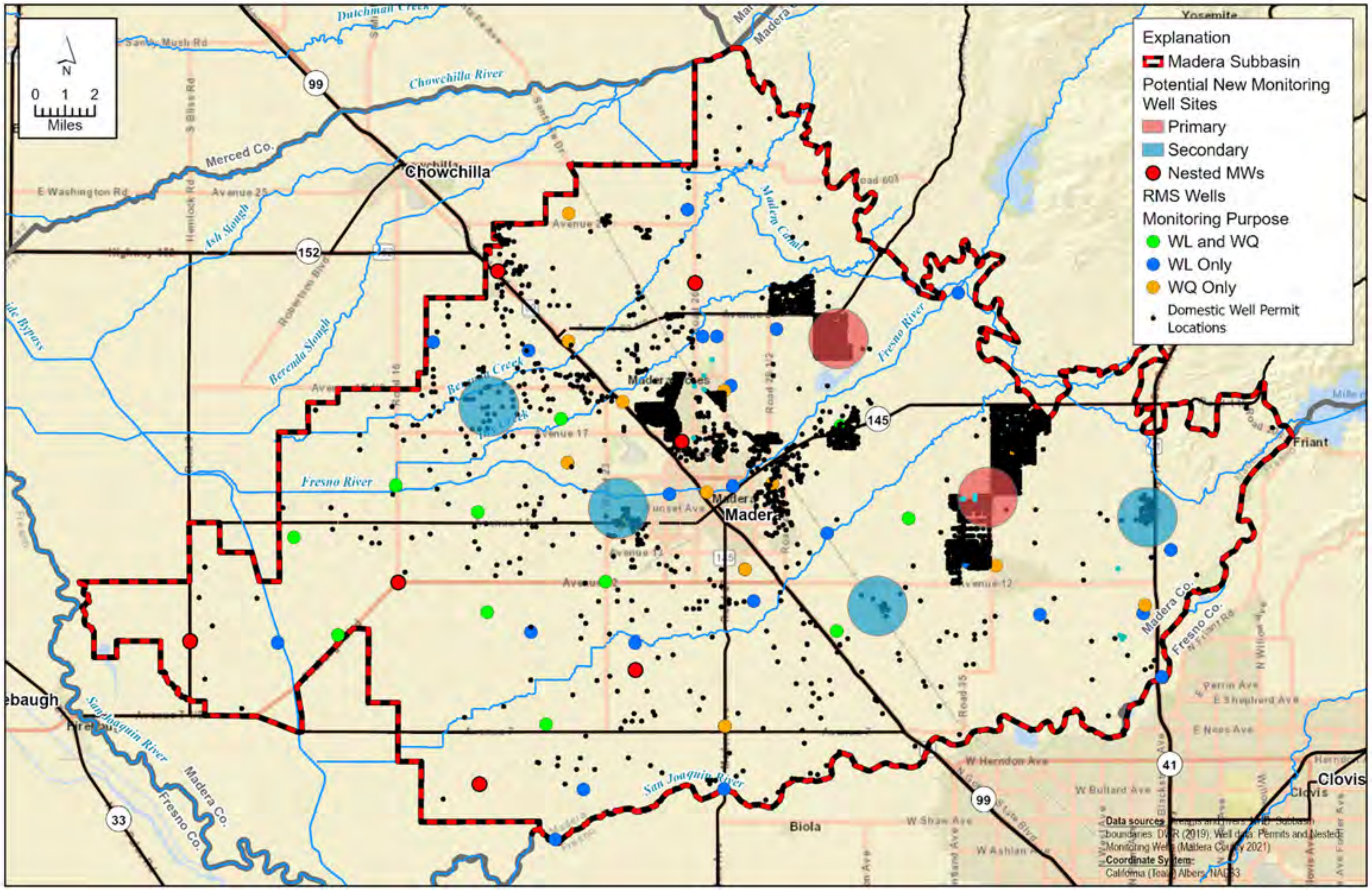


Figure 17: Map of Proposed New Monitoring Well Sites.

ATTACHMENT 1

Domestic Well Replacement Economic Analysis – Madera Subbasin Update

ERA Economics
1111 Kennedy Place, Suite #4
Davis, CA 95616

Technical Memorandum

Subject: Domestic Well Replacement Economic Analysis – Madera Subbasin Update

By: ERA Economics

To: LSCE and the Madera County GSA

Date: January 10, 2022

Purpose and Background

In June 2019 ERA provided a technical memorandum (TM) estimating the cost and benefit of more rapid implementation of demand management under the Madera Subbasin Joint GSP. The economic analysis was included as Appendix 3D to the Madera Subbasin Joint GSP. The analysis was prepared with the best available data and information at that time. After finalizing the GSP, the LSCE and DE consultant teams have continued to assist the Madera Subbasin GSAs with GSP implementation and annual GSP reporting. LSCE was engaged by the Madera County GSA to prepare an updated domestic well inventory for the subbasin.

The economic analysis included as Appendix 3D to the Madera Subbasin Joint GSP estimated the total cost of replacing domestic wells potentially impacted by declining groundwater levels under baseline conditions without SGMA and under the draft proposed GSP implementation plan (so-called "with-SGMA" scenario).

This technical memorandum (TM) serves as an update to those estimates by: (i) updating the project and demand management schedule to reflect the adopted allocation in the Madera Subbasin, (ii) incorporating updated data and analysis on potentially impacted wells from the domestic well inventory, (iii) updating all costs and benefits to current dollars (e.g., well replacement costs), and (iv) refining the economic analysis to compare the cost and benefit of accelerating demand management specified in the GSP. That is, the 2019 analysis compared the draft proposed GSP implementation to baseline conditions without SGMA, whereas this analysis compares the proposed plan with phased implementation of projects and management actions (PMAs) to an accelerated, immediate implementation of PMAs, notably with immediate, full demand management to avoid further domestic well impacts.[1]

These updates to the data affect the resulting economic analysis and results. The 2019 estimate of domestic wells needing to be replaced without increased demand management was 228 wells, which at that time was doubled to account for potential under-reporting. In addition, a sensitivity calculation as

[1] Whereas the cost of immediate demand management implementation has been included, the effect on cost of accelerating recharge and supply projects has not yet been estimated. A full cost estimate of projects for all GSAs in the subbasin is still under development. If this additional cost were included, it would strengthen the conclusion of this analysis.

part of the earlier analysis verified that the conclusions would have held even if the number of affected wells were substantially larger. The updated domestic well inventory puts the number of domestic wells potentially needing replacement between 1,260 and 1,578 over the 20-year GSP implementation period. This TM briefly summarizes the updated analysis, results, and summary conclusions.

Summary Conclusions

Results of this updated analysis comparing the cost of accelerated PMA implementation to the benefit of avoided domestic well replacement costs support the general conclusion of the 2019 analysis. The loss in agricultural value from more rapid demand management still greatly exceeds domestic well replacement costs even though the estimated number of potentially dewatered domestic wells has increased and the cost of replacement for each domestic well has increased by 20 percent. That is, the results of the economic analysis show that the additional cost of more rapid demand management is substantially greater than the cost of replacing potentially dewatered domestic wells and paying higher pumping costs due to lower water levels. This supports the phased implementation schedule and domestic well mitigation program defined in the GSP.

Updated Assumptions

Assumptions and results below are summarized for each of the cost categories considered. All costs (or savings) are expressed as constant 2021 dollars converted to present value using a 3.5 percent real (inflation-free) discount rate[2]. The two implementation scenarios compared are referred to as *GSP implementation* (the phased implementation as described in the GSP) scenario and the *immediate demand reduction* (full demand reduction to eliminate overdraft from 2021 onward) scenario.

1. **Number of dewatered wells needing replacement**. Revised estimates of dewatered wells are calculated and described in the Technical Memorandum prepared by LSCE for the Madera Subbasin Domestic Well Inventory. For this analysis, a total of 1,578 wells were estimated to be dewatered, spread across four 5-year periods. The cost analysis further assumed that well impacts would be evenly divided by year within each 5-year period[3]. For the comparison scenario with immediate demand reduction, it was assumed that none of those wells would need replacement.
2. **Costs to replace dewatered domestic wells**. The 2019 estimate of an average $25,000 per replaced domestic well is updated to $30,000 per domestic well.
3. **Groundwater pumping depth to water (DTW).** The average DTW for the GSP implementation scenario was provided from groundwater model projections described in the Madera Subbasin Joint GSP. The immediate demand reduction scenario is intended to represent immediate elimination of average annual overdraft. A time series was created that followed the

[2] The current federal discount rate for water projects is 2.25%, but a real rate of 3.5% better reflects borrowing conditions in Madera County. A 1.5% increase or decrease in the real discount rate does not affect the conclusions of the analysis.
[3] The timing of the well replacement within each 5-year period does not affect the conclusions of this analysis.

general hydrologic variation estimated for the GSP implementation scenario but held the DTW the same on average during the 2021-2040 implementation period. The ending (2040) difference in DTW between the two scenarios was then carried forward beyond 2040. These pumping depth differences are the basis for the estimated annual pumping cost savings.

4. **Changes in variable costs to pump groundwater, for both domestic and agricultural users.** Energy prices, estimated using a mix of PG&E's latest electricity rates for agricultural pumping, have increased substantially. The analysis now uses an average of PG&E's 2021 AG-B and AG-C peak and off-peak summer rates, resulting in an estimate of $0.40 per acre-foot per foot of lift for the variable cost to pump groundwater. As a result, more rapid demand management provides greater savings (avoided pumping lift) for domestic and agricultural pumping. All agricultural and domestic groundwater pumping in the basin would receive this avoided lift benefit from faster demand reduction.

5. **Costs of demand management under GSP implementation.** Costs of demand reduction have been revised based on the latest estimates of the net return to agricultural water use developed for planning the SALC program. In addition, pumping volumes have been updated to reflect current conditions and the planned ramp-down adopted in the Madera County GSA groundwater allocation ordinance (applicable to the GSP implementation scenario only). These values do not represent average returns to all lands and crops in the subbasin but rather the lands and crops more likely to participate in a demand reduction program. For purposes of this analysis, the lost net return from demand reduction is valued at $230 per acre-foot[4].

Results

The following discussion compares costs between the GSP implementation scenario and the (alternative) immediate demand management scenario. General observations are:

- Demand management costs are greater in the immediate implementation scenario because demand management would be implemented sooner (immediately) and for more years during the GSP implementation period. Recharge and supply projects' costs have not been included in this analysis, but their present value costs would also increase because they would be implemented sooner.
- Pumping costs are lower in the immediate demand reduction scenario because, by definition, the average annual overdraft is eliminated immediately. The effect (smaller DTW and lower pumping cost) is carried throughout the remaining years of GSP implementation and in perpetuity.
- Well replacement costs occur in the GSP implementation scenario but are not required in the immediate demand reduction scenario.

[4] The value of water depends on future crop market conditions. Note that a higher value (greater than $230 per acre-foot applied in this TM) would further increase the cost of accelerated demand management relative to avoided well replacement and additional pumping costs.

- The net effect of these differences in costs results in the GSP implementation scenario having a substantial cost advantage (by about $120 million in present value, or 27 percent) over the immediate demand reduction scenario. In other words, the Madera Subbasin is better off (i.e., realizes benefits that exceed costs) implementing its phased GSP implementation plan and developing/funding the domestic well mitigation program to replace impacted wells than it is if it were to implement immediate demand reduction to avoid dewatering any domestic wells.

Table 1 summarizes the results of the economic analysis. All values are expressed in present value terms. The first two rows show the number of and cost to replace wells estimated to go dry in each scenario. The next rows present the pumping cost savings of the immediate demand reduction scenario relative to the GSP implementation scenario, broken down by domestic pumping and agricultural pumping. The next row shows the demand management costs. For the GSP implementation scenario, demand management is phased in at two percent per year initially, increasing to 6 percent per year until full demand management is reached by 2040. In contrast, the immediate demand reduction scenario implements the full demand management required in 2020, resulting in substantially higher demand management costs.

Table 1. Costs of GSP Implementation Scenario Compared to Costs of Immediate Demand Reduction Scenario - Summary Results for Madera Subbasin, Present Value ($ in Millions)

	GSP Implementation with Well Replacement	**Immediate Demand Reduction**	**Difference**
Domestic Well Replacement			
Number	1,578	0	1578
Cost, PV	$38.64	$0.0	$38.64
Pumping Cost (Savings), PV			
Domestic	NA	-$6.41	$6.41
Agricultural	NA	-$86.11	$86.11
Demand Mgmt. Cost, PV	$449.76	$701.74	-$251.98
Total Cost, PV*	$488.41	$609.23	-$120.82

* Totals may not add exactly due to rounding.

Discussion

Results indicate that the cost of implementing demand management on a faster trajectory (in this case, in year one of the implementation period) would not be cost effective from a subbasin-wide perspective. The avoided costs (fewer domestic wells requiring replacement) would be small ($39 million) relative to the additional lost agricultural net return[5] from immediate implementation ($252 million) for the Madera Subbasin, even after accounting for pumping cost savings ($93 million). The general conclusions are robust to the assumptions used. That is, results are not sensitive to reasonable ranges in key assumptions,

[5] Note that demand management would result in additional economic impacts to other county businesses and industries. These additional indirect impacts are not considered in this updated analysis but would only further support its conclusions.

including the loss in net return per acre-foot of demand management, the total level of demand management, when demand management begins to scale in, or the cost of replacing a domestic well.

This analysis only compares the cost of well replacement to net costs of immediate demand management implementation; it has not considered the timing of other projects such as new surface water supplies or groundwater recharge. That comparison is not possible with current information, and the GSP implementation schedule already reflects an aggressive timeline for project implementation. The cost (in present value) of accelerating implementation of projects has also not been included here. The additional cost of accelerating a recharge project by, say five years, would be the increased present value of the project's capital and O&M cost stream. Costs of new supply and recharge projects have not been accelerated, so the present value of costs for immediate implementation is underestimated. Simply stated, including these additional costs would further support the conclusions of this analysis.

ATTACHMENT 2

Madera Subbasin – Evaluation of DWR Household Water Supply Shortage Reports and Self-Help Enterprises Tank Water Participants

Luhdorff & Scalmanini
Consulting Engineers

TECHNICAL MEMORANDUM

DATE: February 7, 2022 Project No. 20-2-153

TO: File – Madera Subbasin Domestic Well Inventory

FROM: Pete Leffler, PG, CHG; Nick Watterson, PG; Aaron King

SUBJECT: Madera Subbasin - Evaluation of DWR Household Water Supply Shortage Reports and Self-Help Enterprises Tank Water Participants

INTRODUCTION

To support efforts related to implementing the Madera Subbasin Groundwater Sustainability Plan (GSP), the Subbasin completed a Domestic Well Inventory project that identified potential domestic wells in the Subbasin and analyzed potential impacts to domestic wells caused by lowering of groundwater levels historically and during the 20-year GSP implementation period starting in 2020. The Domestic Well Inventory for the Madera Subbasin compiled information on domestic wells in the Subbasin from Well Completion Reports and County well permit datasets and compared these data to modeled groundwater levels in the Subbasin from the GSP over the period from 2014 through 2040. During development of the GSP, historical and future groundwater levels throughout the Subbasin were modeled based on historical conditions and projected future conditions. This memorandum summarizes a review of records in the Department of Water Resources (DWR) Household Water Supply Shortage Reporting System and also participants in the Self-Help Enterprises (SHE) Tank Water Program and includes a comparison of these two datasets with the results from analyses of domestic well impacts conducted as part of the Madera Subbasin Domestic Well Inventory.

DWR HOUSEHOLD WATER SUPPLY SHORTAGE REPORTING SYSTEM

Overview of the Household Water Supply Shortage Reporting System

The DWR Household Water Supply Shortage Reporting System (https://mydrywell.water.ca.gov/report/) is a site for reporting of problems with private (self-managed, not served by public water system) household water supplies. The site was initially created in 2014 as part of drought emergency response efforts and continues to be used to collect information on household water supply shortages from private well or surface water sources. The data in the reporting system reflect information on water supply shortage issues voluntarily submitted by private, local, state, federal, and non-governmental individuals and organizations. Because the data do not undergo review or quality control by DWR, the reported information is not suggested to be complete in its accounting for all water supply shortages and it is also noted by DWR that there may be errors and omissions in data, duplicate entries, and records for non-household related water supply issues. Furthermore, during review of the data, many incomplete and inconsistent records were noted, with many reports providing very little detail for use in understanding the cause of the issue reported. There are a variety of potential causes for issues related to the quantity or quality of water produced by a well, and this can include issues related to the well pump, water distribution system, or the well structure, without relationship to groundwater conditions in the aquifer.

The submission of information to the Household Water Supply Shortage Reporting System is done through completion of a report submittal form (https://mydrywell.water.ca.gov/report/public/form), which includes questions related to the issue, including required entries on the following:

- Type of shortage: a) Dry well, b) low streamflow, or c) other
- Description of the water issue: a) well is dry (no longer producing water), b) reduction in water pressure/lower flows, c) well pumping sand/muddy water, d) well is catching air (have to wait to be able to pump, e) reduction in water quality, or f) other
- Primary use of the well or creek: a) household, b) agriculture/irrigation, c) combination of household/agriculture, or d) other
- Approximate date problem started
- County

As of January 2022, the reporting system included 3,769 entries across the state of California, with dates when the problem started spanning the period from 2012 through 2021.

Household Water Supply Shortage Records within Madera Subbasin

The Household Water Supply Shortage Reporting System contains a total of 46 reports with locations in the Madera Subbasin. The reports within the Subbasin were grouped into four categories according to the type of water supply issue indicated: 1) dry wells, 2) reduced flow or impaired water quality, 3) collapsed well, and 4) surface water problem or inadequate explanation of issue. Figure 1 presents the number of reported well-related issues by year within the Madera Subbasin. Of the 406 reports within Madera Subbasin, 330 were categorized as a dry well issue, 62 were categorized as reduced flow or impaired water quality issues, and six were surface water problem/inadequate explanation of issue or collapsed well. As illustrated on Figure 1, most water supply issues in the system were reported to have started in 2014, 2015, and 2021, with relatively fewer during other years. The greatest number of reports occurred during 2015 after multiple years of drought conditions in the area. Figure 2 shows the locations of the water supply issue reports in the system. Most water shortage reports in the Subbasin are located in the eastern areas of the Subbasin, mainly northeast of Highway 99 in clustered areas north and east of the City of Madera.

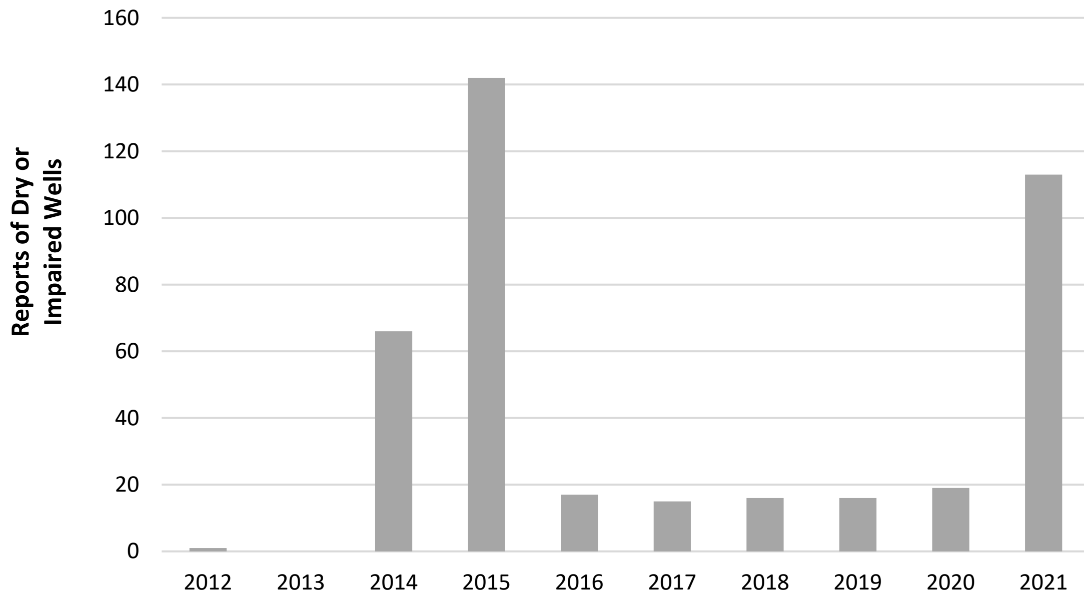
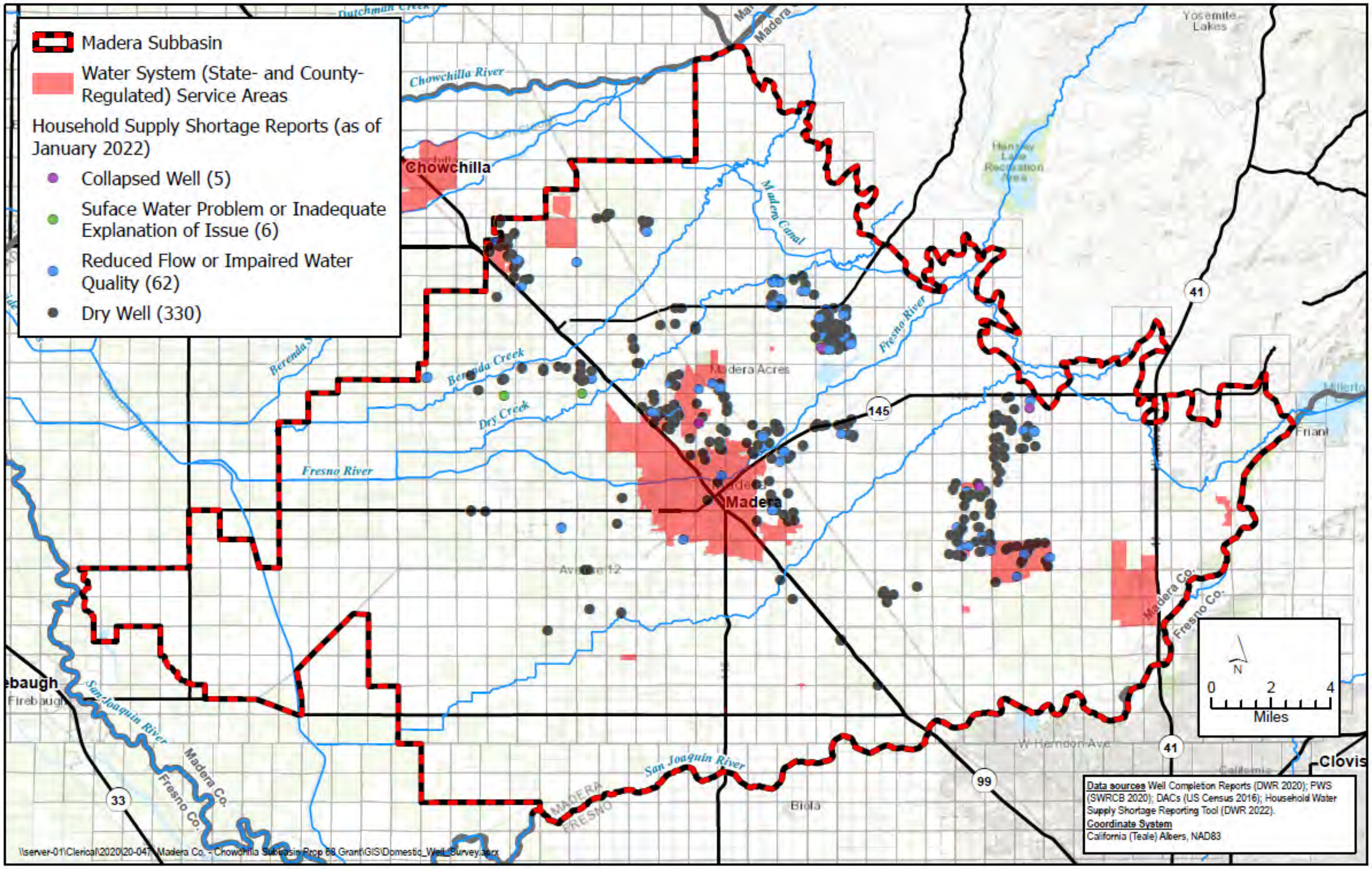


Figure 1. Chart of Household Water Supply Shortage Report Records in Madera Subbasin



Luhdorff & Scalmanini Consulting Engineers

Figure 2
DWR Household Water Supply Shortage Reporting Data

Madera Subbasin
Groundwater Sustainability Planning

SHE TANK WATER PROGRAM PARTICIPANT DATA

Overview of the SHE Tank Water Participant Data

The SHE Tank Water Program provides a temporary water supply solution for households experiencing a well water shortage in eight counties in and adjacent to the San Joaquin Valley: Fresno, Kern, Kings, Madera, Mariposa, Merced, Stanislaus, and Tulare. The SHE Water Tank Program assists households experiencing well water shortages by installing a water tank and hauling water and filling the tank to restore access to water for the home. The SHE Tank Water Program is intended as a short-term solution to provide participants access to water for one year while working towards a long-term solution. Data on participants in the SHE Water Tank Program as of January 2022 were provided by SHE (https://www.arcgis.com/home/webmap/viewer.html?webmap=377849cbc9c54046917d864a635e9674&extent=-120.0525,34.8083,-117.2593,36.0392). As of January 2022, the SHE Tank Water Program includes 769 participants in the eight-county area served by the program. The available Tank Water Program participant data only provide locations for participants without other attributes indicating the date or type of issue necessitating the reliance on tank water. There are a variety of potential causes for issues related to the quantity or quality of water produced by a well, and this can include issues related to the well pump, water distribution system, or the well structure, without relationship to groundwater conditions in the aquifer.

SHE Tank Water Participants within Madera Subbasin

The SHE Tank Water Program covers eight counties within the San Joaquin Valley, along with some areas located outside of the San Joaquin Valley and outside of DWR-designated groundwater basins (e.g., foothill areas). The SHE Tank Water Program includes 239 participants within the Madera Subbasin. Figure 3 presents a map of the Tank Water Program participants within the Madera Subbasin. As illustrated on Figure 3, most of the Tank Water Program participants in the Madera Subbasin are located in clustered areas generally north and east of the City of Madera. Figure 4 is a map comparing the locations of SHE Tank Water participants and dry wells in the DWR Household Water Supply Shortage dataset. The spatial distribution of Tank Water participants and dry wells reported in the DWR dataset are very similar and likely include some of the same wells, although no information is available to evaluate such direct relationships in the two datasets.

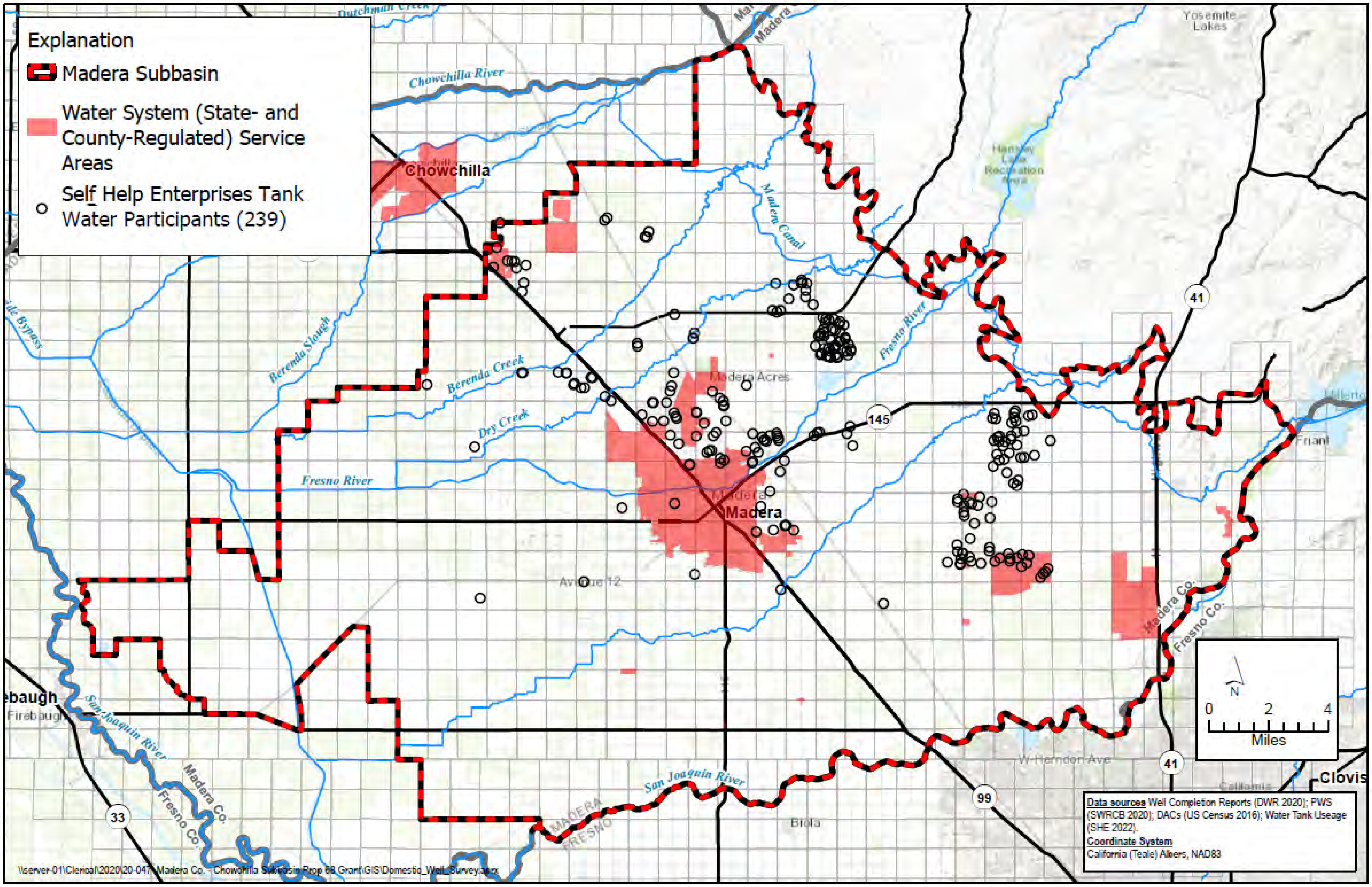


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Figure 3
Locations of Self Help Enterprises Tank Water Participants
Madera Subbasin
Groundwater Sustainability Planning

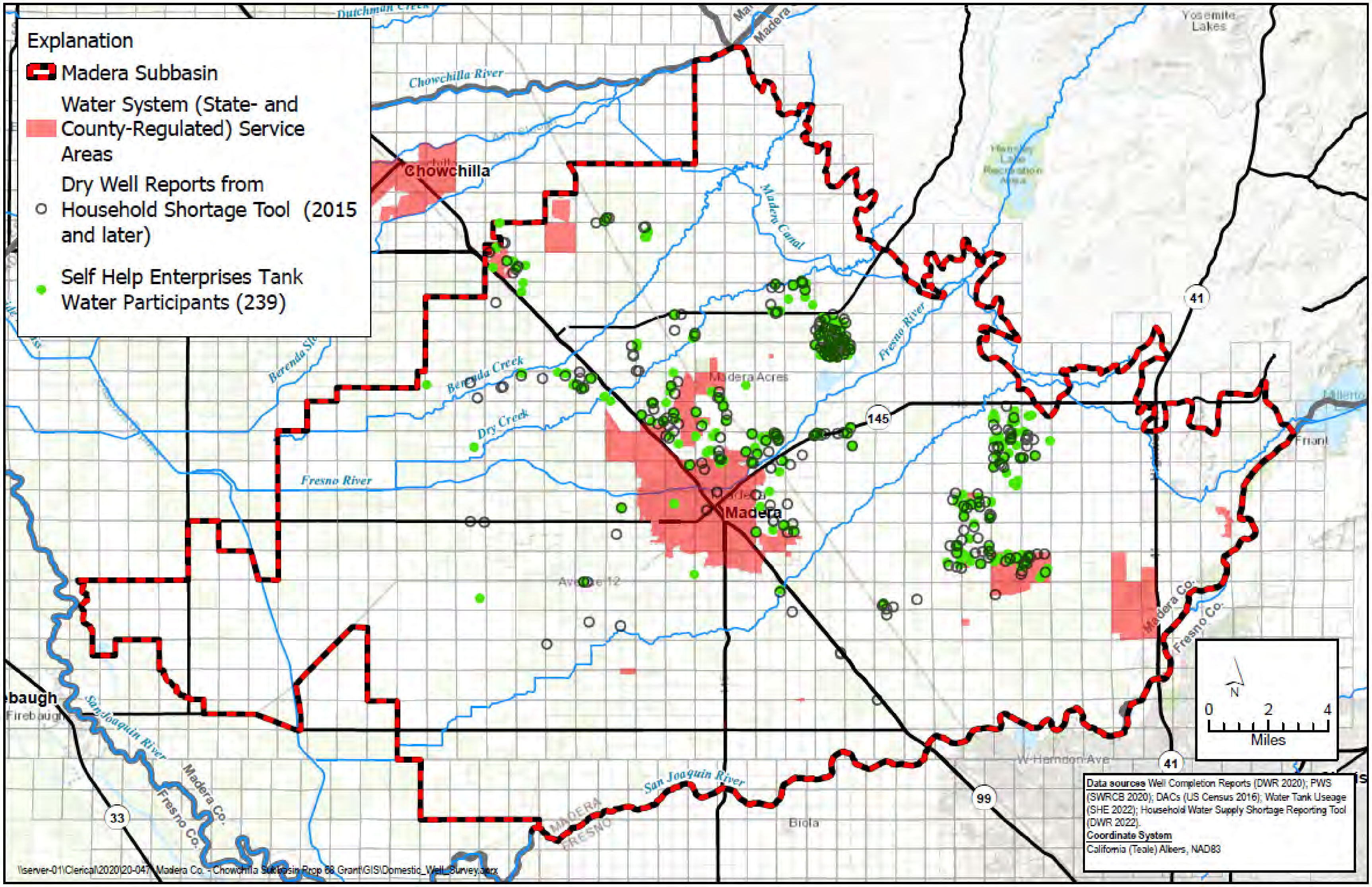

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Figure 4
Comparison of SHE Tank Water Participants and DWR Dry Well Reports
Madera Subbasin
Groundwater Sustainability Planning

COMPARISONS OF DWR DRY WELL RECORDS AND SHE TANK PARTICIPANTS WITH ANALYSES OF DRY WELLS FROM THE DOMESTIC WELL INVENTORY

Analyses of potential domestic well impacts in the Domestic Well Inventory were conducted at five-year intervals based on modeled groundwater levels across the Subbasin. To understand differences between dry wells reported to the Household Water Supply Shortage Reporting System and also SHE Tank Water Program participants in relation to estimates of potential dry wells from the Madera Subbasin Domestic Well Inventory analyses, the spatial distribution of dry wells in the Household Water Supply Shortage Reporting System dataset and Tank Water Participants were compared with modeled dry wells over the period from 2015 through 2024.

The comparisons presented in this TM are intended to provide a general sense for the spatial distribution of the different datasets, recognizing the datasets present different types of information related to domestic well issues. As noted above, there are a variety of potential causes for a well experiencing issues related to the quantity of water produced by a well that may be unrelated to groundwater conditions in the aquifer. Some of these issues may be reflected in the DWR Water Supply Shortage Reports and SHE Tank Water Program participants list. It is also likely that many households with wells that have gone dry have not reported such occurrences to the DWR Household Water Supply Shortage Reporting System and many of these households have also not participated in the SHE Tank Water Program. As described in the technical memorandum summarizing the Madera Subbasin Domestic Well Inventory, analyses of potential dry domestic wells in the Domestic Well Inventory are based only on the relationship between available well construction (e.g., screen depth and total well depth) and simulated groundwater levels at each domestic well location.

Comparison of DWR Dry Well Records with Modeled Dry Wells in the Domestic Well Inventory

Maps comparing dry well records in DWR's Household Water Supply Reporting System with dry wells modeled as part of the Domestic Well Inventory are presented in Figures 5 and 6. Figure 5 presents a comparison of all reported dry wells in DWR's system (2012 through 2021) with modeled dry wells estimated for the period 2015 through 2024 in the Domestic Well Inventory. Figure 6 presents a comparison of reported dry wells during the years 2015 through 2019 in DWR's system with modeled dry wells between 2015 and 2019 in the Domestic Well Inventory. Figure 6 provides a more direct spatial comparison of dry wells in the two datasets over the same five-year period, whereas Figure 5 presents an overview of the spatial relationship between the two datasets spanning a longer timeframe. Although there are considerably more modeled dry wells than reports of dry wells in DWR's system in either comparison, the spatial patterns in the two datasets show many similarities, with most modeled dry wells and reports of dry wells occurring in clustered areas to the north and east of the City of Madera. Some of the differences in locations between the modeled dry wells and reported dry wells in Figures 5 and 6 are likely a result of differing resolutions of locational information available in the two datasets.

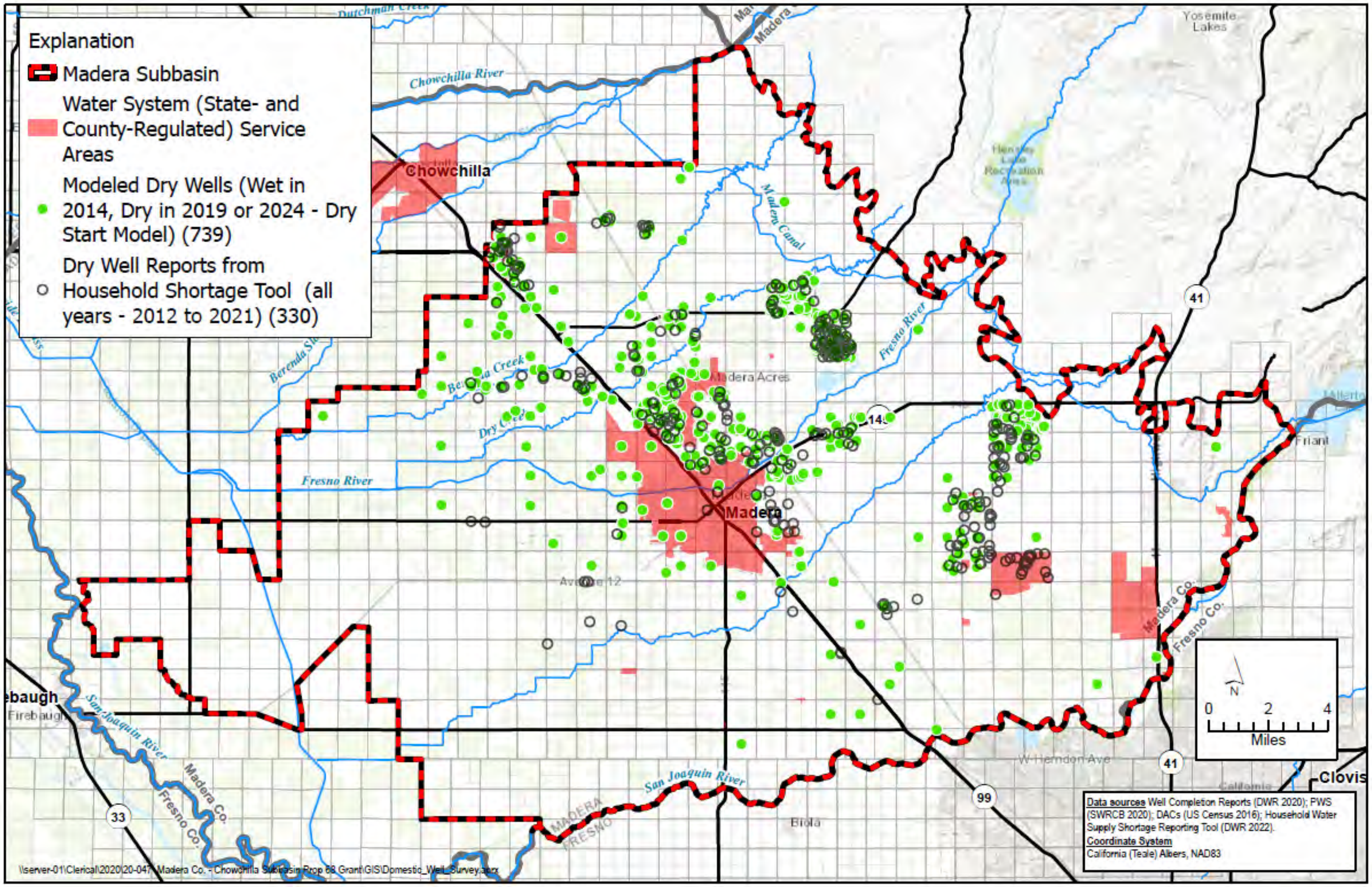

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Figure 5
Comparison of DWR Dry Well Reports with Modeled Dry Wells Between 2015 and 2024

Madera Subbasin
Groundwater Sustainability Planning

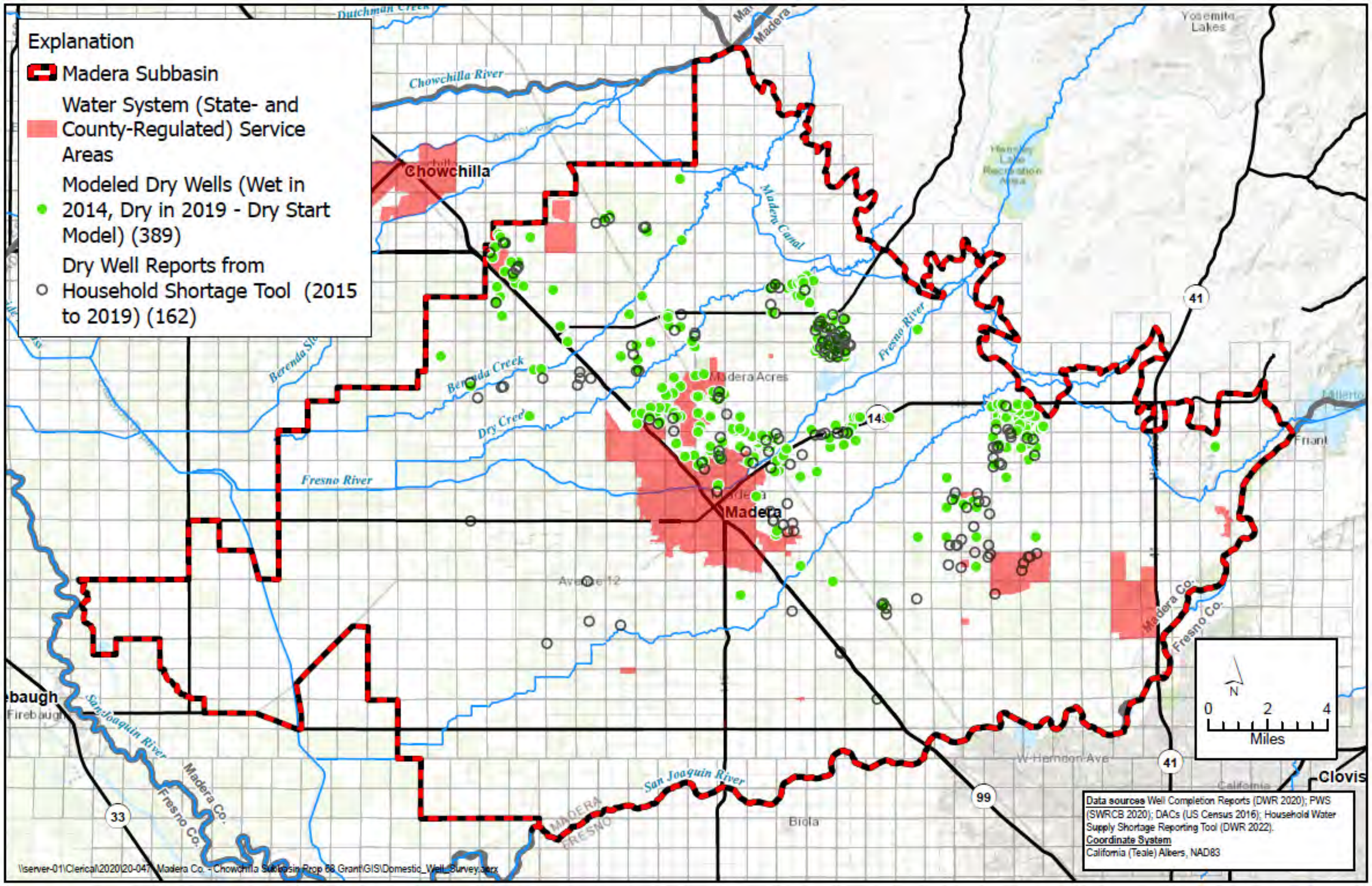

Figure 6
Comparison of DWR Dry Well Reports with Modeled Dry Wells Between 2105 and 2019

Madera Subbasin
Groundwater Sustainability Planning

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Comparison of SHE Tank Water Participants with Modeled Dry Wells in the Domestic Well Inventory

A map comparing SHE Tank Well Participants with dry wells modeled as part of the Madera Subbasin Domestic Well Inventory are presented in Figure 7. Figure 7 presents a comparison of all SHE Tank Water Program participants in the Subbasin as of January 2022 with modeled dry wells estimated for the period 2015 through 2024 in the Domestic Well Inventory. Although there are considerably more modeled dry wells than Tank Water Participants (as is the case with dry well reports in the DWR's Household Water Supply Shortage System), the spatial patterns in the two datasets show many similarities, with most modeled dry wells and SHE Tank Water Participants occurring in areas north and east of the City of Madera.

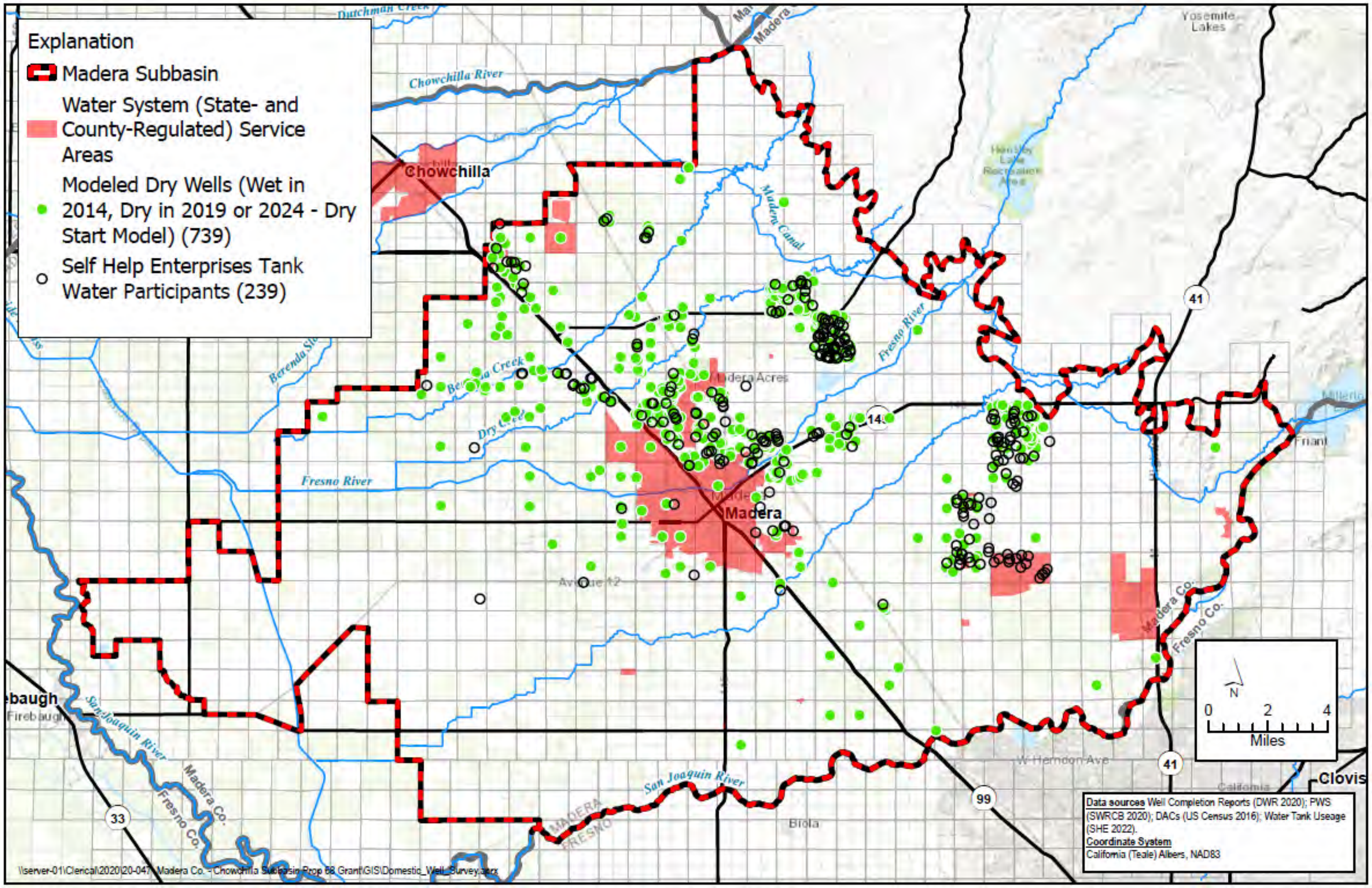

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Figure 7
Comparison of SHE Tank Water Participants with Modeled Dry Wells Between 2015 and 2024
Madera Subbasin
Groundwater Sustainability Planning

FINAL REPORT

Madera County GSA Sustainable Agricultural Lands Conservation (SALC) Land Repurposing Program Planning Report

Prepared for

County of Madera Groundwater Sustainability Agency

March 14, 2022

Prepared by

Davids Engineering, Inc.
ERA Economics
Consensus and Collaboration Program, Sacramento State

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1. Executive Summary

With groundwater overdraft for Madera County estimated at 260,000 acre-feet per year under 2015 cropping and historical hydrologic conditions, the Madera County Subbasins have been referred to as "ground zero" for the Sustainable Groundwater Management Act (SGMA). Madera County includes portions of three groundwater Subbasins (Madera, Chowchilla, and Delta Mendota), with most of the groundwater use occurring within the Madera and Chowchilla Subbasins. Ten Groundwater Sustainability Agencies (GSAs) are working to implement Groundwater Sustainability Plans (GSPs) in the Madera County. The Madera County Groundwater Sustainability Agency (GSA) covers "white area" lands without access to district surface water supplies in the Delta Mendota, Chowchilla, and Madera Subbasins.

The Groundwater Sustainability Plans (GSPs) covering the Madera County GSA in the Chowchilla, Madera, and Delta Mendota Subbasins specified a series of projects and management actions that will be implemented to achieve sustainable groundwater conditions by 2040. The Madera County GSA is developing projects to bring in additional groundwater recharge and new surface water supplies from Sites Reservoir. The initial phases of groundwater recharge projects are currently under development with $8.4 million in funding support from the 2018 Department of Water Resources Sustainable Groundwater Management Grant Program Implementation Round 1. Under Round 1 of the 2021 Sustainable Groundwater Management Grant Program, Madera County initial spending plan submittal was approved, which would bring in another $3.7 million for groundwater recharge project development.

The GSA is also working on demand management actions. GSA demand management options include: (i) a groundwater allocation, (ii) a potential groundwater market that would allow groundwater trading, and (iii) a land repurposing program. Demand management is the amount by which groundwater pumping needs to be reduced to achieve sustainability by 2040, after accounting for new water developed under supply-augmentation projects. Planned demand management specified in the GSP is approximately 90,000 acre-feet per year (AFY) in the Madera Subbasin, 28,000 AFY in the Chowchilla Subbasin, and 2,000 AFY in the Delta Mendota Subbasin portions of the Madera County GSA[1]. At the direction of the Madera County GSA Board, the SALC program is initially developed to achieve approximately 50 percent of the total demand management target in each Subbasin. It may be scaled up (or down) over time, depending on needs and funding availability, as described in subsequent sections of this report.

The land repurposing program incentivizes growers to repurpose irrigated lands to other, non-irrigated uses. Growers that choose to participate in the program are compensated with a financial incentive payment, and the GSA realizes groundwater benefits because pumping is reduced. Depending on program design, the previously irrigated lands can be repurposed to other uses that provide multiple benefits (e.g., habitat corridors, ecosystem services, or energy). In addition, the program can be structured to allow for short-term or longer-term (multi-year) enrollment, providing flexibility for both growers and the GSA.

[1] The GSA groundwater allocation adopted after GSP development considers additional land use change in the county. The total level of demand management at full GSP implementation is approximately 113,000 acre-feet per year in Madera and 63,400 and 2,000 in Chowchilla and Delta Mendota.

This document describes the results of an initial planning study to evaluate the structure, options, and potential fees for the Madera County GSA land repurposing program. It does not implement the land repurposing program. Implementation would be determined in the future by the Madera County GSA Board, with additional stakeholder input for selecting final program options. This planning study was funded by a Department of Conservation Sustainable Agricultural Land Conservation (SALC) program grant. The terms “land repurposing program” and “SALC program” are used interchangeably in this document and in public presentations.

The SALC/land repurposing program development included substantial stakeholder input through a series of public meetings, stakeholder workshops, interviews, and other informal meetings with GSA landowners held over a period of approximately 18 months. This public process has continued throughout the development of this report, with public input resulting in changes to conceptual program design. The first public meeting was held on July 17, 2020. Stakeholders provided initial input on the program development and scope of the work plan. A series of more than a dozen public meetings were held through the end of 2021. Topics at the public meetings and workshops included project updates, summary results for program design, and substantial engagement with stakeholders on all aspects of the program. Meeting venues included GSA advisory committee meetings, public workshops, and presentations to the Madera County GSA Board. In addition, a series of informal one-on-one meetings were held with interested stakeholders. These included representatives from grasslands and various irrigated farming operations in Madera County. The GSA also hosted a series of informal “office hour” workshops to solicit feedback on program development. Technical consultant outreach also included countless spontaneous requests for meetings, responses to emails, and review of stakeholder question and suggestions. All of this input was valuable for shaping the program guidelines described in this report.

An initial step for SALC program development was to inventory existing geospatial data for the Madera County GSA that could be used to evaluate multi-benefit land repurposing opportunities. This included a comprehensive inventory of geospatial map layers/data describing cropping, geopolitical boundaries, land use, infrastructure, water use, habitat, recharge suitability, and other sustainability indicators in the Subbasin. It is anticipated that these data would support future development of incentive structures to encourage land repurposing targeted to specific areas to achieve multiple benefits. For example, land repurposing near sensitive habitat could support habitat corridors. This report describes the mapping data assembled for the project and options for incorporating multi-benefit opportunities into the program.

A fundamental part of the SALC program is to incentivize repurposing of irrigated lands into non-irrigated uses. It could also incentivize currently non-irrigated lands to remain in non-irrigated uses. Enrollment in the program would be voluntary. Landowners would be offered financial incentive payments to participate in the program, which would need to be sufficient to encourage lands to come out of current, irrigated uses. Initial program planning also considered incentive payments to keep certain lands in non-irrigated uses. A series of financial and economic analyses were developed to establish the value of current farming activities under alternative program structures (e.g., different enrollment terms, program scales, and timing of implementation) and considering other GSP projects. This was used to set the SALC program payments that would be required to incentivize growers to repurpose currently irrigated lands into non-irrigated uses.

The value (profitability) of farming activities that determines the program incentive payments varies across the GSA due to a range of factors, including:

- **Farming practices**. The net return to irrigated farming varies by operation depending on a range of factors including crop type, climate, land, age of orchard, and other farm management-specific practices. Farm budgets/financial data specific to the GSA area was applied in the analysis.
- **Scale of the program**. The GSA, like any agricultural region, has a range of agricultural lands varying from highly-profitable orchards on prime ground to less productive orchards and row crops on more marginal lands. As the scale of the SALC program increases, progressively more valuable lands would need to be incentivized to participate. Since the program is voluntary, incentive payments would need to increase accordingly.
- **Transitional Water.** Over time, the availability of groundwater is changing as Transitional Water is phased out under the Madera County GSA Groundwater Allocation Ordinance. This will decrease the net return to farming on a given acre, which, all else equal, will tend to reduce program incentive payments.
- **Program enrollment terms**. Annual, multiple year, and permanent enrollment options affect program incentive payments. Annual enrollment typically results in the greatest incentive payment because the program payment would need to cover the grower's net return over operating costs in addition to return on fixed assets (e.g., equipment). Longer term enrollment options result in lower necessary incentive payments.
- **Crop prices and market conditions**. The net return to farming depends on market conditions that are beyond the control of any individual grower. For example, the current supply glut in almonds has resulted in depressed almond prices. In contrast, processing tomato contract prices are approaching record highs. As crop prices change this affects the net return to farming and required incentive payment for the SALC program. The program is developed with recent historical average prices to reflect expected conditions over time.
- **GSA rate structure**. The GSA is implementing rates to pay for other projects and management actions specified in the GSP. The SALC program incentive payments are set as gross payments that do not consider the payment for other GSA activities. That is, an acre enrolled in SALC would still be required to pay for other projects and management actions. However, if the rates include a volumetric component the SALC program incentive payments would need to be adjusted to account for that cost. Therefore, two sets of incentive payments are shown (one for gross SALC payments, and another for the situation where the GSA implements hybrid rates that include a volumetric component).
- **GSP implementation**. The program incentive payments should be consistent with the cost of other projects and management actions being implemented by the GSA. For example, if program payments are set too high, this would limit the functionality of a potential groundwater market.
- **Other factors**. SALC program enrollment could be structured as a fixed price offering or various bidding approaches (types of auctions) could be used. This report assumes that the program would offer a fixed price for enrollment each year. Other factors, including crop market conditions, cost, and profitability of GSA farming activities, will continue to change over time. It

is anticipated that the GSA would review SALC program terms and enrollment annually, update the calculations for program incentive payments, and periodically update the program parameters.

The SALC program incentive payments were developed based on a series of economic and financial analyses that considered each these factors, jointly and individually, and how they would change over the GSP implementation period. The analyses are specific to each of the three GSA Subbasins (Madera, Chowchilla, and Delta Mendota) because each Subbasin is managed separately. Table ES-1 summarizes the approximate program incentive payments in five-year increments. Payment terms assume annual enrollment with fixed rates (no volumetric charge) for other GSA projects and management actions, and a phased implementation that would achieve approximately 50 percent of planned demand management in each Subbasin by 2040. This corresponds to incentive payments where the GSA has a fixed per acre assessment for GSP implementation (no volumetric rate component).

Table ES-1. SALC Program Irrigated Lands Annual Incentive Payments ($/acre), rounded (fixed per acre assessment option)

GSA	2025	2030	2035	2040
Madera	$725	$640	$620	$630
Chowchilla	$675	$680	$570	$375
Delta Mendota	$715	$670	$530	$435

The final phase of the SALC program study established an initial baseline cost for the program to support the GSA rate study. This was developed under the program scale and implementation timeline recommended by stakeholders, the Madera County GSA Board, and GSA staff. These costs were included in the Rate study that is currently being developed by the GSA. Costs were developed for two options: (i) fixed rates and (ii) hybrid rates (including a fixed and volumetric charge). Table ES-2 summarizes SALC program costs for the fixed rate program.

Table ES-2. SALC Program Costs ($ in millions)

GSA	2025	2030	2035	2040
Admin Cost	$0.5	$0.5	$0.5	$0.5
Incentive Payments				
Madera	$7.9	$11.7	$16.8	$26.7
Chowchilla	$1.9	$3.7	$5.9	$8.8
Delta Mendota	$0.2	$0.4	$0.4	$0.6
Total Cost	**$10.5**	**$16.2**	**$23.6**	**$36.6**

The SALC program should be reviewed and updated over the GSP implementation period. The irrigated lands enrollment and total incentive payments are the bulk of the costs and increase over time. The estimated incentive payments, and costs, are in current dollars (not adjusted for inflation) and reflect current market conditions. As market conditions change over time the incentive payments will need to be adjusted to ensure that sufficient lands are incentivized to enroll and that the program is not overpaying.

The SALC program costs assume that the program would target currently irrigated lands. It is conceivable to prioritize or layer additional payments for multi-benefit repurposing opportunities, such as ecosystem services, floodplain management, and mitigation for other groundwater management objectives in the Subbasin. The program may also consider incentives for never-irrigated lands to remain in unirrigated uses. These options are described in this report and may be further evaluated by the GSA in the future as part of program development and implementation.

2. SALC Program Planning Report Overview

This report describes the initial planning for the Sustainable Agricultural Lands Conservation (SALC) land repurposing program developed for the Madera County GSA. SALC (land repurposing) is a voluntary, financial incentive-driven land repurposing program that would achieve reductions in groundwater pumping (demand management) in the Madera County GSA. Lands that enroll in the SALC program would receive a payment to forgo irrigation on those lands (repurpose to non-irrigated uses) for a specified period set by the program (e.g., annual, multiple years, permanent). The SALC program may also be developed to encourage multiple benefits from lands that are repurposed to non-irrigated uses, such as habitat or broader ecosystem services. Initial program planning also considered incentive payments for never-irrigated lands to remain in non-irrigated uses. The SALC program is developed to be a flexible demand management program that can be scaled up or down to meet the demand management needs of the Madera County GSA as the GSA moves forward with GSP implementation.

The SALC program outline described in this report was developed between July 2020 and early 2022. It included extensive stakeholder input through interviews, surveys, other informal meetings, and a series of public workshops and GSA Board presentations. SALC program technical details were developed based on a review of other similar programs, detailed financial and economic analysis, and a geospatial analysis of compiled county map layers. Outreach also included coordination with other programs and entities that work within Madera County to preserve agricultural lands, incentivize certain farming practices, and keep some lands in perpetual easements for various purposes. The SALC program is intended to work in parallel with these existing programs, and there may be synergies between these entities that could be explored in the future.

The SALC program would work in coordination with other planned GSA projects and management actions. These include recharge and imported surface water (Sites Reservoir) supply-augmentation projects. The SALC program is intended to support the planned demand management in the Madera County GSA. Demand management is the amount by which groundwater pumping needs to be reduced to achieve sustainability by 2040, after accounting for new water developed under supply-augmentation projects. Planned demand management is approximately 90,000 acre-feet per year (AFY) in the Madera Subbasin, 28,000 AFY in the Chowchilla Subbasin, and 2,000 AFY in the Delta Mendota Subbasin portions of the Madera County GSA[2]. At the direction of the Madera County GSA Board, the SALC program was initially developed to achieve approximately 50 percent of the total demand management target in each Subbasin. It may be scaled up (or down) over time, depending on needs and funding availability, as described in subsequent sections of this report.

SALC is a voluntary program. It would incentivize enrollment by offering payments for currently irrigated lands to enter into an agreement to stop irrigating and repurpose those lands into other non-irrigated uses. The terms of the agreements could be annual, multi-year, or permanent. The initial program design and costs shown in this report correspond to annual (1-year) agreements.

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[2] The GSA groundwater allocation adopted after GSP development considers additional land use change in the county. The total level of demand management is approximately 113,000 acre-feet per year in Madera and 63,400 and 2,000 in Chowchilla and Delta Mendota.

The alternative uses for previously irrigated lands are not prescribed for initial program development. However, it is anticipated that these could include repurposing for other multi-benefit uses, and "strategic" land repurposing[3]. Strategic land repurposing would consider additional benefits provided by repurposed lands, including habitat and other ecosystem services, and minimize any negative impacts that could be caused by non-irrigated lands (e.g., increased dust and weed pressure). The GSA is currently pursuing grant funding opportunities[4] to support design and implementation of multi-benefit and strategic repurposing objectives.

This report is structured as follows. The following subsections provide an overview of the SALC program and conditions in the Madera County GSA. Section 3 describes stakeholder outreach and feedback that was used to guide program development. Section 4 describes other land repurposing programs and provides insights for program design in the Madera County GSA. Section 5 inventories and summarizes the geospatial map layers compiled to support future evaluation of SALC program multi-benefit objectives. Section 6 describes the structure of the SALC program, including options that the GSA may consider as it moves forward with implementation. Sections 7 and 8 summarize the data, methods, and results of the program incentive payments and expected annual costs of the program. The final Section 9 provides a short summary and description of potential next steps for implementation and program development. The report includes supplemental sections with references and appendices documenting supporting program technical details.

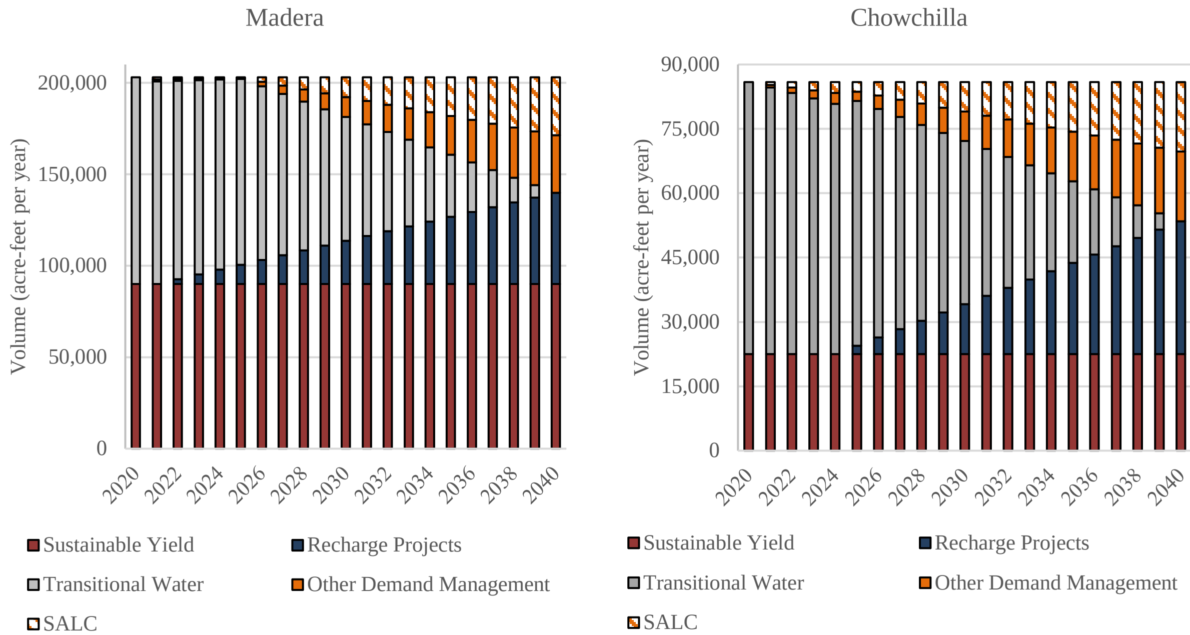
2.1 SALC Program Goals to Support GSP Implementation

The Madera County GSA includes lands in three Subbasins: Delta Mendota, Madera, and Chowchilla. It is implementing GSPs in coordination with the other GSAs in each Subbasin. The GSP implementation plan in each Subbasin includes a mix of projects and management actions to achieve sustainability.

Error! Reference source not found. illustrates the GSP implementation plans for the Madera and Chowchilla Subbasins (Delta Mendota is omitted because the Madera County GSA covers a small land area). The figure illustrates other projects and how the SALC program would work with these other projects to achieve sustainability objectives in each Subbasin. The timing and quantity of water from the recharge projects is approximate, but the figures illustrate the general phased implementation schedule for each Subbasin. The SALC program is included in the figure, illustrating that it will achieve approximately 50 percent of the total planned demand management. The program could be scaled up or down over time to achieve Subbasin sustainability objectives.

[3] See descriptions of strategic land repurposing in:
Environmental Defense Fund. White Paper. Advancing strategic land repurposing and groundwater sustainability in California
The Nature Conservancy. Rewilding Agricultural Landscapes.
[4] For example, this includes the Department of Conservation Multibenefit Land Repurposing grant program.

Figure 1: Madera County GSA GSP Implementation Plan Example: Madera and Chowchilla



2.2 SALC Incentive Structure Overview

SALC would be a voluntary program that landowners could enter to repurpose irrigated lands to other non-irrigated uses. Initial program planning also considered incentives to keep certain lands in non-irrigated uses. To incentivize participation in the program, the program would offer financial incentives (payments). In exchange for the incentive payment, the program would receive the Sustainable Yield (SY) and Transitional Water (TW) allocation for each acre that enrolls in the program.

The incentive payment would need to be sufficient to encourage lands to come out of current irrigated uses, forgoing use of SY and TW. This means that the payments would need to be no less than the current returns to farming different crops in the basin. These incentive payments account for multiple factors that affect returns to farming: water availability under GSP implementation, GSP implementation costs, crop market conditions, length of enrollment in the program, and loss of productive assets (e.g., established orchards). Section 8 provides a detailed technical overview of the program, incentive payments, and how incentive payments were calculated.

2.3 Options for SALC Program Development and Implementation

This report described general land repurposing program parameters and costs but does not implement the program. The program is developed to be flexible and adaptable over time as the GSA moves forward with GSP implementation. This includes working in concert with other GSA projects and management actions specified in the GSPs, as well as other potential grant funding opportunities to support achieving multi-benefit objectives.

The primary options in the SALC program include:

- **Types of lands enrolled in the program**. The program is developed to incentivize certain types of lands to enroll. These include:

  - Irrigated lands that could become unirrigated.
  - Irrigated lands that could be restored to rangeland.
  - Unirrigated lands that could be incentivized to remain as such.
  - Irrigated lands that would remain in irrigated farmland.
  - Agricultural lands that are at risk of being lost to urban development or other uses.
- **Length of easements**. SALC program enrollment terms could be short-term (e.g., annual or several years), longer-term (e.g., 5+ years), or permanent. These different program options affect required incentive payments, and therefore program costs.
- **Non-irrigated lands**. As noted above, non-irrigated lands could be incentivized to remain in non-irrigated uses. This could include rangelands as well as lands on the valley floor that are currently not irrigated.
- **Other multi-benefits**. The program could be developed to achieve additional multi-benefit outcomes. A series of map layers were developed to support future planning efforts by the GSA, which are described in Section 6.3. Options for other multi-benefits may include ecosystem services, flood control, or other land repurposing benefits. These are also described in Section 6.3.

The SALC program is initially developed to be a short-term, annual, flexible program. Costs for other program alternatives (e.g., other enrollment durations) are described in subsequent sections of the report. It is anticipated that the Madera County GSA will periodically review and update the program guidelines in response to stakeholder feedback and input and monitoring of groundwater conditions in the Subbasins.

2.4 SALC Implementation

The purpose of this document is to describe preliminary program options, design, payments, and costs. The Madera County GSA would consider implementation of the SALC program under future public processes. If it is implemented, it would be done in a public, transparent process, and would ultimately require GSA Board adoption and approval.

The SALC program is included in the Madera County GSA rate study. This would develop funding to support program development and implementation.

3. Stakeholder Outreach, Engagement, and Meetings

The SALC program development included substantial stakeholder input through a series of public meetings, stakeholder workshops, interviews, and other informal meetings with GSA landowners held over a period of approximately 18 months. This process has continued throughout the development of this report. A series of more than a dozen public meetings were held through the end of 2021 where project updates were provided, results were presented, and stakeholders provided questions and input on program development. Venues included advisory committee meetings, public workshops, and presentations to the GSA Board.

Due to the restrictions of COVID-19, many of the meetings, workshops, and other engagement efforts were held virtually through video conferencing and phone calls.

3.1 Outreach Methods

The County utilized many tools to inform, reach out to, and engage the public around the SALC program, listed below.

- Stakeholder Assessment Interviews
    - After identifying key stakeholders, a series of assessment interviews were conducted in late summer and early fall 2020 to gather initial input on central issues of SALC program development. See below for more details.
- County Newsletter and Website
    - Madera County has a page on the SALC study on their website. This page includes a downloadable fact sheet (Appendix A) and information from past technical workshops (see below).
- Technical Workshops
    - The County held three public workshops where SALC was a focus, including one standalone SALC meeting and two where SALC was one of multiple GSP-related projects under discussion. All meetings provided opportunities for remote participation, and someprovided in-person opportunities as well. See milestones below for further information. Meeting agendas, presentations slides, and, when available, recordings are located on the SALC webpage.
- Presentations to Groups
    - The County made presentations on the SALC study to the County of Madera Groundwater Sustainability Agencies' Advisory Committee (a meeting that is also open to the public).
- Madera GSA Board Meetings
    - The SALC program was also discussed at multiple Madera County Board meetings, listed below in Key Meeting Milestones. .
- "Office Hours"

  - Beginning April 8, 2021, Madera County held regular "office hours" once or twice a month. This informal virtual format allowed people to bring up SGMA-related topics of their own choosing and engage in conversation with County staff and consultants. SALC was often a topic of discussion at the office hours.
- One-on-One Conversations with Members of the Public
  - In addition to all the other methods of outreach and engagement, Madera County staff members make themselves available by phone for individual members of the public to ask questions and provide input about water-related topics. It is estimated that on average County staff engage in 1-2 hours of phone calls, with 2-4 members of the public, per day.

3.2 Purpose of Outreach and Engagement

As reflected in the County's Sustainable Agricultural Lands Conservation Program, Agricultural Land Conservation Planning Grant Application (Grant Application), the concept for this project came from ideas expressed during Madera County GSA Advisory Committee meetings during GSP development and implementation. As illustrated in the Grant Application, the ideas to be pursued in this project are informed by a diverse range of existing federal, State, and local policies, guidelines, and regulations. Similarly, these ideas have been and will be informed by opinions of affected landowners; sentiments which at times may be conflicting based on anticipated impacts of future land and water use decisions. A key challenge for the county has always been to identify any goals common to many or all stakeholders and to reconcile potential differences (when feasible).

The extensive stakeholder outreach for this project (public workshops, informal meetings, office hours, GSA Board presentations) reflects the GSA's commitment to GSP implementation that works for local stakeholders.

3.3 Key Stakeholders

The main goal of outreach and engagement was to engage with stakeholders most affected by this project. This includes: (1) landowners who might participate in the SALC program; (2) community members who might be affected by the lands that are retired due to the SALC program, either because of their proximity or lack of proximity; and (3) all community members, including landowners, who are affected by the water use in the region that may be ultimately affected by the SALC program. Further, state, federal, and nonprofit organizations already involved in conservation easements were included in outreach efforts, such as the California Farmland Trust, the U.S. Department of Agriculture, American Farmland Trust, Sierra Foothill Conservancy, The Nature Conservancy, and the California Strategic Growth Council.

3.4 Initial Inquiry – Stakeholder Conversations

To initiate the outreach and to gather information about various points of view, third-party neutral consultants conducted a series of interviews in early fall 2020. These confidential interviews allowed representative and affected stakeholders the opportunity to express input about interests, opportunities and concerns regarding the proposed program. These interviews also allowed consulting staff to more fully engage with stakeholders beyond technical workshops (described below) and ongoing GSA meetings.

Following are some of the issues that were discussed during the stakeholder interviews:

- Program structure: certainty vs. flexibility
- Length of contract commitments
- Key factors in landowner decision-making
- Economics of the program
- Incentives
- Setting priority areas
- Land uses and restrictions
- Third-party impacts

Participating organizations in the initial stakeholder outreach meetings included the California Milk Producers Council, Madera County Cattlemen's Association, Leadership Counsel for Justice and Accountability, Self-Help Enterprises, Madera County Farm Bureau, and the Madera Ag Water Association (MAWA). The confidential input was aggregated and summarized by the neutral consultants into a report (see Appendix B).

Key meeting milestones included:

- **July 17, 2020.** Project kickoff meeting. The project kickoff workshop was held via Zoom and presented a high-level overview of the planned project and work plan. Preliminary input on demand management concepts and general program structure.
- **August 6, 2020**. GSA Advisory Committee Meeting. The project team met with the GSA Advisory Committee via Zoom to discuss categories of eligible lands for the SALC program, review preliminary map layers, and discuss planned stakeholder outreach and engagement. See Appendix C for a summary of this meeting.
- **December 18, 2020**. Internal meeting to discuss program design elements, third-party funders, and fairness and equity considerations.
- **January 14, 2021**. Stakeholder meeting (virtual). The stakeholder meeting gave an overview of the SALC program, reviewed programs similar to the SALC program, and discussed SALC program design elements with interactive feedback. See Appendix D for a summary of this meeting.
- **February 25, 2021**. Internal meeting to discuss project outreach, project development, and the interface with the recharge project.
- **March 23, 2021**. Madera County GSA Public Workshop with Stakeholders (virtual). The stakeholder meeting gave an overview of the GSP; the SALC program study, feedback, incentive payments, and program costs; and the recharge program. The meeting also provided opportunities for stakeholder feedback and input. See Appendix E for a summary of this meeting.
- **April 13, 2021**. Presentation to the GSA Board. Progress update on the SALC program to the GSA Board.

- **May 26, 2021**. Presentation to the GSA Board. Progress update on the SALC program to the GSA Board.
- **June 8, 2021**. Presentation to stakeholder working group to receive feedback on SALC program incentive structure.
- **June 16, 2021**. Madera County GSA Public Workshop with Stakeholders (hybrid). The stakeholder meeting gave an overview of the GSP; the SALC program; the domestic well inventory; the development of allocations; and the recharge program. The meeting also provided opportunities for stakeholder feedback and input. See Appendix F for a summary of stakeholder questions and comments from this meeting.
- **October 14, 2021**. Madera County GSA Public Workshop with Stakeholders (virtual). The stakeholder meeting gave a detailed overview of the SALC program. The meeting also provided opportunities for stakeholder feedback and input.
- **December 7, 2021**. Presentation to the GSA Board. Progress update on the SALC program to the GSA Board and presentation of SALC program (and other PMA) costs.
- **February 25, 2022**. Stakeholder workshop to provide an overview of the SALC program and costs, covering SALC program and other PMAs. The presentation included an overview of the SALC program objectives, approach, frequently asked questions, and costs. Stakeholders provided feedback and asked questions about program design.
- **March 1, 2022**. Presentation to the GSA Board. Progress update on the SALC program to the GSA Board.
- **March 9, 2022**. Presentation to the GSA Board. Overview of the SALC program objectives, approach, frequently asked questions, and costs. The presentation was part of a broader rate study presentation.

In addition to the key milestone meetings, a series of informal meetings were held with interested stakeholders. This included representatives from various grazing and irrigated farming operations in the county. At least a dozen such meetings were held between the GSA, SALC program consultant team, and interested stakeholders. The Madera County GSA also held a series of informal “office hour” workshops to solicit feedback on SALC program development and allow interested stakeholders to ask questions and receive feedback.

4. Review of Other Land Repurposing Programs

Land repurposing programs, also called land fallowing or idling programs, seek to achieve land and water conservation goals similar to those set by the Madera County SALC program. With these goals in mind, current and historic examples of land repurposing programs within California and neighboring states were reviewed. This section summarizes those land repurposing programs that were reviewed for relevancy to the SALC program development. The programs reviewed offered lessons learned related to outreach and developing interest in the program, as well as eligibility, bidding and pricing processes, and verification.

A common theme of these other programs is to retire land from agricultural use temporarily or permanently in order to mitigate environmental externalities, such as impairment of instream flows, caused by over-appropriation of water. By incentivizing idling or transitions to dryland production, agricultural producers create a surplus of water for other purposes, which could include habitat function, municipal use, or a build-up of storage. For the purposes of the Madera County GSA land repurposing program, this could include securing additional SY and TW on previously irrigated lands for the benefit of subbasin groundwater management objectives specified in the GSPs.

Agreement terms for other programs reviewed range from annual to multi-decadal periods. Other common stipulations include not being able to sell the water conserved to multiple municipalities, a minimum and maximum acreage for individual farmers, and strict land zoning regulations that must remain constant during program dates. The following subsections describe other programs reviewed to support SALC program development.

4.1 USDA Conservation Programs

The United States Department of Agriculture (USDA) administers several types of agricultural land conservation related programs. Programs cover a range of objectives, from specific farming practices to equipment and water conservation. Only some of these programs are applicable to the Madera County GSA SALC program.

The USDA administers a range of programs that are effectively agricultural conservation easements. USDA programs easement programs work with partner agencies to cost-share a portion of an agricultural easement (typically, up to 50%). Therefore, it is not a direct and sole funding source, but would be supported indirectly with a partner agency. These programs are not directly applicable to the Madera County GSA SALC program but could offer funding opportunities for partnerships in the future (e.g., if the SALC program includes specific land use repurposing objectives that align with these USDA programs). Programs include the:

- Conservation Reserve Program (CRP)
- Wetlands Reserve Program (WRP)
- Grassland Reserve Program (GRP)
- Forest Legacy Program (FLP)
- Farm and Ranch Lands Protection Program (FRPP)

The USDA Conservation Reserve Enhancement Program (CREP) is perhaps the most similar to the SALC program. However, the CREP is available on a state-by-state basis and is not currently administered in California. The CREP in other states was reviewed to inform SALC development. The CREP in Idaho is implemented to reduce groundwater pumping in and around the Snake River Aquifer. The Idaho CREP enrolls currently irrigated lands to stop pumping (and restore to other vegetation). Current payments are around $300 per acre in some counties, with a total program target of 100,000 acres (current enrollment as of 2021 was 18,500 acres). It is noted that payments include compensation for forgoing irrigation (similar to the SALC program incentive payments) in addition to the cost of repurposing the land to native vegetation (or other similar uses). In contrast to Madera County GSA, the crop mix in the Idaho Snake River area is predominately annual row and field crops, including forage for the local dairy industry. Therefore, payment terms are lower than what would be expected in other areas with a mix of higher-value permanent crop plantings.

4.2 Kern 7th Standard Land Idling Program

The 7th Standard Annex is "white area" (non-district) lands included in the Kern Groundwater Authority (KGA) Umbrella Groundwater Sustainability Plan (GSP). The Kern Subbasin is critically overdrafted. Demand management is included as a groundwater management objective in certain parts of the county.

In 2020, the Shafter Wasco Irrigation District (SWID) created a land idling program for the 7th Standard Annex with the intent to idle and repurpose around 200 acres in the area. The program was structured to offer bids for enrollment (incentive payments for landowners to participate in the program). The payments were offered as fixed annual payments.

At their first offering, the district offered a fixed price of $300 per acre for program enrollment. This did not garner any interest from landowners. In their second round the offer was increased to $600 per acre. Ultimately, 230 acres were enrolled for a total year-one project cost of $140,000.

The 7th Standard program is similar to the Madera County GSA SALC program. It would pay lands that are currently irrigated to forgo irrigation and be repurposed to other uses. The other uses for previously irrigated lands are not specified as part of the initial program development (as of the date it was reviewed for this report). The program is for annual enrollment and its purpose is to reduce groundwater pumping to meet demand management objectives specified in the GSP. The crop mix in the area is similar to Madera County but includes fewer established nut orchards.

4.3 Deschutes River Water Leasing Program

The Deschutes River Conservancy (DRC) runs a water rights leasing program to achieve additional flow benefits on the Deschutes River. Program options include entering into a split-season lease, a full-season or one-year lease, or a five-year opt-out lease. The flexibility of lease options is unique to this program compared to others reviewed. Leases are used for instream flow purposes to improve habitat. Therefore, the program is implemented to achieve benefits that accrue to individual landowners and society more broadly (other water users and individuals benefit from additional environmental flows).

The DRC water leasing program is financially supported by public and private entities, including a brewery, the National Fish and Wildlife Program, and the Bonneville Environmental Foundation. Half of the water rights leased are donated. Those that are paid receive $7 per acre-foot. The program is different than the SALC program because it is largely funded by third parties and targets environmental rather than direct groundwater supply benefits. It is useful because it illustrates how the SALC program could be expanded in the future to encourage enrollment of additional (or specific lands) to achieve multiple benefits (e.g., protection of domestic wells or habitat benefits). This would require additional incentive payments that may be funded by public sources, NGOs, or other contributions.

4.4 Imperial Irrigation District Fallowing Program

Imperial Irrigation District's (IID) fallowing program was designed to meet annual water transfers to San Diego County Water Authority and Salton Sea mitigation obligations. The program pays landowners to forgo irrigation on specific fields. The amount of water "saved" by the program is defined by and calculated according to the program rules. The IID program rules and example landowner agreements were reviewed to inform SALC program design.

IID program participation is limited to three times out of every five years to prevent concentrated land idling in specific areas. The IID Board of Directors sets the incentive payment price annually. As of the 2016/17 season, the effective payment was $175 per acre-foot. IID sends a solicitation to all farm units in IID. It specifies the desired program volume and selects lands that are most suitable up to the desired volume, considering environmental, operations and maintenance costs, verification and eligibility, and any other constraints specified in the program rules. Between 2003-2017, more than $160 million was paid for the fallowing of nearly 300,000 acres, translating to approximately 1.6 million acre-feet of water.

4.5 Klamath Basin Water User Mitigation Program

The Klamath Basin is an agricultural region located on the boarder of California and Oregon. Water management issues in the area include drought and balancing irrigation water uses with flows into, and levels at, Klamath Lake to protect endangered species.

The Klamath Basin administered various programs to achieve reductions in agricultural water use in specific years. Between 2001-2010 a water banking/idling program was administered in the Klamath Basin. The first of these programs was the "Pilot Irrigation Demand Reduction Program" and the "Groundwater Acquisition Program," both of which were administered by the US Bureau of Reclamation. These programs focused on idling land and substituting groundwater for surface water, respectively. The programs were the basis of what was called the "Klamath Basin Pilot Water Bank" beginning in 2003 (there was no program in 2002). The Klamath Water and Power Agency (KWAPA) managed the program starting in 2010, which was called the Water User Mitigation Program (WUMP).

The purpose of the WUMP was to incentivize reducing water use for the benefit of instream flows and fish habitat at Klamath Lake during drought conditions in the Klamath Basin. The program water bank included two options. It accepted bids that individual irrigators offered idle land. In addition, the program included a groundwater substitution program (i.e., forgo surface water irrigation and pump groundwater to replace the same volume of water). The U.S. Bureau of Reclamation funded these water bank activities.

The Klamath water bank went through several iterations, including transitioning from a fixed price to an auction-based approach. The program also changed to allow dryland farming of enrolled acres to make it more financially attractive to potential participants. Finally, the inclusion of storage and retiming of instream flows was added in 2005. The WUMP cost-effectiveness and the legality of its implementation were causes for concern. KWAPA was ultimately dissolved after Reclamation raised concerns about the implementation and administration of the WUMP.

Total quantities of water made available through these programs since 2003 have ranged from approximately 100,000 acre-feet to nearly 200,000 acre-feet (in 2010). Agreement terms for idling, groundwater substitution, and surface storage water have also varied. The most recent WUMP program solicited bids from growers for land idling and accepted bids in order of increasing cost per acre-foot until the target volume was achieved. These bids were typically in the range of $75 to $125 per acre-foot. In contrast, groundwater substitution contracts in 2010 were based on a fixed payment of $10 per acre-foot plus actual pumping costs submitted by participants.

4.6 Palo Verde Irrigation District Fallowing Program

The Palo Verde Irrigation District (PVID) and Metropolitan Water District of Southern California (MWD) have a 35-year fallowing program that, effectively, repurposes agricultural water in PVID to municipal uses in MWD. MWD compensates the participating PVID growers through a signup payment and annual payments for acres fallowed in that year.

The prices for lands enrolled and idled in the program were set in 2004. This includes provisions for annual inflation adjustments. Payments for lands idled were based on a water consumptive use of 3.91 acre-feet per acre. Payments were adjusted over time. For example, as of 2012, the payment was $3,150 per enrolled acre (at signing) plus $715 per acre fallowed, or approximately $180 per acre-foot. The payment terms adjust depending on the frequency (number of years) the field is idled, and the grower is responsible for all weed and dust management on the idled field.

Another short-term fallowing program was developed in 2009-10 following an emergency drought declaration. Growers could enroll up to 15% of their acres with Priority 1 Colorado River water for a payment of $1,665 per acre. Under current drought conditions on the Colorado River, lands were offered $925 per acre (with 2% per year escalation), or around $240 per acre-foot, to forgo irrigation to increase storage at Lake Mead.

The per acre-foot payments under the PVID program have historically been between $150 and $400 per acre-foot. The crop mix is different than Madea County GSA, with PVID growing mostly annual hay and forage crops. PVID program payments include costs for the landowner to manage fields for weeds and dust. Program terms are generally for one year idling agreements, but fields are enrolled for a sequence of years for the option to enroll and be idled as part of the program.

4.7 Walker River Basin Storage Water Leasing Program

Walker River Irrigation District (WRID) is located in the Walker Basin of Nevada. It runs a Storage Water Leasing Program to administer additional flows downstream, improving habitat in Walker Lake. The program was initiated in 2009. It is managed by the National Fish and Wildlife Foundation (NFWF) (private non-profit entity). NFWF uses funds appropriated by congress and other private donors to purchase and lease water rights. Acquisitions total about 6,000 acre-feet, plus an additional 31 cubic feet per second (cfs) of instream flow and are individually negotiated with willing sellers.

The programs have evolved since 2009. Currently, a demonstration water leasing program has been developed in coordination with the Walker Basin Conservancy and Walker River Irrigation District. It is funded under a $25 million grant. It would be a three-year water leasing demonstration program in the Walker River Basin to increase Walker Lake inflows. The program terms are under development (as of the date of this report), but participants would receive around $150 per acre-foot of storage water leased.

4.8 California Land Trusts and Agricultural Conservancies

Currently, there are several agricultural conservancies that administer various types of agricultural easements operating in Madera County (see Section 3 for an overview of the outreach to these programs). Broadly, conservancies work to enroll lands for a use specified in an easement in return for compensation.

Agricultural/land easements typically pay landowners to keep agriculture in production or keep lands in certain uses. The primary focus of the SALC program is to repurpose lands to other, non-irrigated uses. However, the SALC program could achieve multiple objectives for preventing new irrigated farmland development, protecting existing agricultural land, and incentivizing agricultural land retirement for some irrigated farmland.

Existing agricultural conservancies operating in Madera County were reviewed. In addition, other non-profit entities and state agency programs were reviewed. These entities could be potential partners for the SALC program in the future, depending on SALC program design and objectives. Examples in Madera County as well as other state and federal programs include:

1. California Farmland Trust (CFT)
    a. Goals and objectives: Preservation of agricultural lands in California. The California Farmland Trust works with multiple agencies that support farmland conservation. This includes the Central Valley Farmland Trust (CVFT), California Farmland Conservancy Program (CFCP), Agricultural Land Mitigation Program (ALMP), Agricultural Conservation Easement Program (ACEP), California Coastal Conservancy, and Sustainable Agricultural Lands Conservation Program.
2. American Farmland Trust (AFT)
    a. Goals and objectives: AFT mission is to protect and preserve agricultural lands. AFT is supports other land trusts and farmland conservation programs. It would in parallel to support other potential programs but does not appear to be a separate easement/land trust option.
3. Wildlife Heritage Foundation (WHF)
    a. Goals and objectives: Protection of lands suitable for various habitat. They state that their land trust currently preserves over 100,000 acres of "ecologically significant land and water resources and regularly engages and cooperates with land trusts, conservation organizations, public agencies, project proponents and other land stewards that require expertise in the area of the protection of wildlife and open space habitat in perpetuity."
4. Sierra Foothill Conservancy (SFC)
    a. Goals and objectives: The Sierra Foothill Conservancy is primarily a land trust focused on preservation of wildlife and foothill ecosystems.
5. The Nature Conservancy (TNC)

   a. Goals and objectives: Protection of lands suitable for habitat. TNC mission is to conserve the lands and waters on which all life depends. Most easements are habitat conservation easements. TNC also owns fee title land across California.

6. Sierra Nevada Conservancy (SNC)

   a. Goals and objectives: Seeks to “encourage, and support efforts that improve the environmental, economic, and social well-being of the Sierra Nevada Region, its communities, and the citizens of California.” Programs include Sierra Nevada Watershed Improvement Program (WIP) and Tahoe-Central Sierra Initiative (TCSI).

7. California Strategic Growth Council (CSGC)

   a. Goals and objectives: Programs include the SALC (funding this project) with general objective of protecting and encouraging agricultural lands across the state. Funding is through California Cap and Trade program (Climate Investments). CSGC does work with partners, including local land trusts, to support agricultural land conservation.

8. USDA FSA programs

   a. Goals and Objectives: Covers a range of programs.

5. Madera County Map Layers for Prioritization

An initial step for SALC program development was to inventory existing geospatial data for the Madera County GSA that could be used to evaluate multi-benefit land repurposing opportunities. This was used to inform land use considerations for developing the SALC program.

The project developed a comprehensive inventory of map layers describing cropping, land use, infrastructure, habitat, and other sustainability indicators in the Subbasins. These data were compiled to support future development of incentive structures to encourage land repurposing targeted to specific areas. For example, land repurposing near existing water ways, sensitive habitat, or domestic drinking well sources. The following types of mapping layers were assembled into a geospatial database for SALC:

- **Boundaries**: Jurisdictional boundaries of Madera County, water district service areas, GSAs, subbasins, and spatial coverages of Disadvantaged Communities, Severely Disadvantaged Communities, and Economically Distressed Areas.
- **Environmental**: Spatial indexes of habitat and solar suitability and spatial coverage of wetlands, vegetation, and suitable habitat.
- **Land use**: Spatial coverage of cropping, pesticide use, CAFOs, and zoning.
- **Roads**: State and county roads.
- **Soils**: Soil types.
- **Urban**: City limits, planning areas, and spheres of influence.
- **Water**: Groundwater elevations, land subsidence, waterways, water bodies, drainage, and conveyance infrastructure, as well as weather stations, precipitation, and evapotranspiration.

In order to support development of the SALC program, a spatial data inventory was developed in a Geographic Information System (GIS) shapefile format. This included a coverage of "ParcelFields" and assembly of a ParcelField Database by determining spatial characteristics of ParcelFields relative to the relevant layers within the spatial data inventory.

Collectively, these spatial data files were used to evaluate land uses for the SALC program. The SALC program did not consider ways to "prioritize" specific lands for enrollment in the program under this initial stage of program development due to stakeholder concerns for privacy. However, the geospatial database could be used to inform future program development or support strategic program development when funding is available for targeted lands. For example, this could include achieving multi-benefit habitat objectives for repurposed lands, which may be consistent with the Department of Conservation grant program opportunities. The mapping data was developed to support prioritization that could include, but is not limited to:

- Unirrigated land that is currently in use as grazed rangeland and could be incentivized to remain as such via perpetual conservation easement (that would not permit farming);
- Irrigated land that could become unirrigated and dry land farmed;

- Irrigated land that could be restored to rangeland;
- Irrigated land that the county wants to remain as sustainable irrigated farmland, especially with prime farmland soils;
- Unirrigated or irrigated land that is in danger of being lost to development and urban sprawl; and
- Lands that provide potential co-benefits that may be of interest to potential funding partners.

The ParcelField coverage was created as the union of legal parcel boundaries (from the Madera County Assessor's Office[5]) and 2016 irrigated and urban lands coverage developed by Land IQ and available from the California Department of Water Resources (DWR)[6]. ParcelFields include a unique delineation of the irrigated and urban lands within each parcel and also an aggregation of all remaining areas within each parcel (i.e., undeveloped land or rangeland, semi-agricultural land, nature preserves, etc.). In total, nearly 55,000 ParcelFields were created. Of these, over 29,000 ParcelFields were entirely within urban areas and had urban development, and the more than 25,000 remaining ParcelFields were partially or entirely outside of urban areas. For the more than 25,000 ParcelFields partially or entirely outside of urban areas, a database defining spatial attributes of each ParcelField relative to select spatial data files in the spatial data inventory was created. This ParcelField Database includes 37 unique characteristics for each ParcelField (Appendix G).

The spatial data inventory was developed from July through October 2020, and the creation of ParcelFields and determination of spatial attributes, or ParcelField characteristics, (which resulted in the ParcelField Database) was completed in October 2020. These processes and the resulting inventory and dataset are described in more detail below. The spatial data inventory and ParcelField database were critical for the development of criteria to identify and prioritize lands and the development of incentive structures for the SALC program.

5.1 GIS Data Assembly Methods

The assembly and organization of the inventory of spatial data files in GIS shapefile format was completed through (1) review and download of publicly available files on the internet uploaded and maintained by various entities and (2) coordination with and data requests to various stakeholders, technical consultants, university representatives, and others. These include, but are not limited to, DWR, Madera County, The Nature Conservancy (TNC), United States Department of Agriculture (USDA), UC Davis, UC Santa Barbara, California Natural Resources Agency (CRNA), and the United States Geological Survey (USGS). In total, 62 unique spatial coverages were assembled and organized into the spatial data inventory; the full list of spatial data files is shown in Table 2. Many of these were used in the ParcelField Database to develop a characterization of each ParcelField.

The creation of ParcelFields and development of the ParcelField Database was largely completed using Esri geospatial software (ArcMap 10.8.1), and also included some data manipulation and analysis using

[5] The Madera County Assessor's Office webpage is available at: https://www.maderacounty.com/government/assessor and the Madera County GIS Portal is available at: https://gis.maderacounty.com/portal/home/index.html

[6] The statewide cropping map, which also includes urban areas, is available for download at: https://data.cnra.ca.gov/dataset/statewide-crop-mapping

MS Excel and MS Access. All spatial data layers used the NAD 1983 (2011) California Teale Albers projected coordinate system[7]. As described above, the ParcelField coverage was created as the union of legal parcel boundaries and 2016 irrigated and urban lands coverage developed by Land IQ and available from DWR. This results in ParcelFields being a unique delineation of the irrigated and urban lands within each parcel, and an aggregation of all remaining areas within each parcel (i.e., undeveloped land or rangeland, semi-agricultural land, nature preserves, etc.). For the aggregated remaining areas, the ParcelField coverage does not explicitly define land use, although some of the characteristics in the ParcelField database can provide more information about land use on these ParcelFields. Due to some discrepancies between the spatial extent of parcels and the irrigation and urban lands coverage, some minor modifications to the resulting ParcelField coverage were made to eliminate small areas of intersection or extension in the coverages. The spatial extent of the ParcelField coverage includes all lands within Madera County and the Madera, Chowchilla, and Delta-Mendota Subbasins, and also includes lands within Madera County extending up to three miles east of the eastern subbasin boundaries into the Sierra Nevada foothills.

The first step in development of ParcelField characteristics to include in the ParcelField Database was to review the spatial data inventory and determine which data layers should have characteristics calculated for ParcelFields and thus be added to the ParcelField Database. Those included were determined to have potential importance and influence on prioritization of lands through the SALC program. Following this, various geoprocessing tools were utilized to calculate the characteristics of the relevant spatial data layers as they relate to each ParcelField, and the results were organized into the ParcelField Database.

5.2 Map Inventory Summary

The results of the spatial data inventory and the ParcelField Database were reviewed to develop criteria to identify and prioritize lands in the Subbasins. It was also used to evaluate potential incentive structures for the SALC program.

The list of the 62 spatial data files in the Spatial Data Inventory is available in Table 2, along with classification into a spatial data category and a brief description of each. A table summarizing the number of spatial data files in each category is also provided.

The list of 37 characteristics in the ParcelField Database is available in Appendix G, along with a classification into a characteristic category and a brief description of each characteristic.

A total of 62 spatial data files were assembled from various sources and organized into the spatial data inventory. They were classified into seven GIS Layer Categories, which are shown below in Table 1 along with the count of spatial data files in each. Table 2 shows the full list of spatial data files including the layer name, category, a brief description, and count of files associated with each layer.

[7] if a spatial data layer used a different coordinate system when it was downloaded or received, it was modified through use of the 'Project' geoprocessing tool to use the NAD 1983 (2011) California Teale Albers projected coordinate system prior to being utilized for creation of ParcelFields or for development of the ParcelField database.

- **Boundaries**: To include jurisdictional boundaries of Madera County, water district service areas, GSAs, subbasins, and spatial coverages of Disadvantaged Communities, Severely Disadvantaged Communities, and Economically Distressed Areas.
- **Environmental**: To include spatial indexes of habitat and solar suitability and spatial coverage of wetlands, vegetation, and suitable habitat.
- **Land use**: To include spatial coverage of cropping, pesticide use, CAFOs, and zoning.
- **Roads**: To include state and county roads.
- **Soils**: To evaluate soil types.
- **Urban**: To include city limits, planning areas, and spheres of influence.
- **Water**: To include groundwater elevations, land subsidence, waterways, water bodies, drainage, and conveyance infrastructure, as well as weather stations, precipitation, and evapotranspiration.

Table 1: Spatial Data Inventory Categories and Layer Count

Spatial Data Category	File Count
Boundaries	8
Environmental	13
Land Use	7
Soils	4
Roads	3
Urban	10
Water	17
Totals	**62**

Table 2: GIS Layers in Spatial Data Inventory

GIS Layer	Spatial Data Category	Description	File Count
Madera County Parcels	Boundaries	Assessor's Parcel coverage for Madera County	1
Water Districts and Agencies	Boundaries	Jurisdictional and service area boundaries for water districts and agencies in California	1
GSA Boundaries	Boundaries	Boundaries for Groundwater Sustainability Agencies (GSAs)	1
Groundwater Subbasin Boundaries	Boundaries	Boundaries for Groundwater Subbasins in California	1
County Boundaries	Boundaries	Boundaries for counties in California	1
Disadvantaged Communities (DACs)	Boundaries	Spatial coverage of DACs in California	1
Severely Disadvantaged Communities (SDACs)	Boundaries	Spatial coverage of SDACs in California	1
Economically Distressed Areas (EDAs)	Boundaries	Spatial coverage of EDAs in California	1

GIS Layer	Spatial Data Category	Description	File Count
Conservation Easements	Environmental	Spatial coverage of conservation easements from the National Conservation Easement Database (NCED)	1
TNC Blunt Nosed Lizard Habitat Index	Environmental	Spatial index of habitat suitability	1
TNC Other Habitat Index	Environmental	Spatial index of habitat suitability	1
UCSB Bren Solar Index	Environmental	Spatial index of solar suitability	1
California Bird Habitat Map	Environmental	Spatial coverage of suitability of habitat for various bird species in California	1
USFWS Critical Habitat Maps	Environmental	Spatial coverage of suitability of habitat for various critical species in California	6
NCCAG Vegetation Dataset	Environmental	Spatial coverage of vegetation for Natural Communities Commonly Associated with Groundwater (NCCAG)	1
NCCAG Wetlands Dataset	Environmental	Spatial coverage of wetlands for Natural Communities Commonly Associated with Groundwater (NCCAG)	1
Land IQ 2014 Crop Mapping	Land Use	Irrigated crop mapping for 2014	1
Land IQ 2016 Crop Mapping	Land Use	Irrigated crop mapping for 2016	1
2008-2016 Pesticide Use Reports	Land Use	Spatial coverage of cropping from pesticide use reporting from 2008 to 2016	1
2014 Confined Animal Feeding Operations (CAFO)	Land Use	Spatial CAFO coverage for 2014	1
Madera County General Plan Designations	Land Use	Land use designations according to the Madera County General Plan	1
Madera County General Plan Zoning	Land Use	Zoning according to the Madera County General Plan	1
USDA Cropscape	Land Use	Spatial coverage of cropping available from USDA for 2007-2016	1
Soil Agricultural Groundwater Banking Index (SAGBI)	Water	Spatial coverage of individual criteria and SAGBI index values	1
State Highways	Roads	California State Highways	1
County Roads	Roads	County roads for Madera and Merced Counties	2
Soil Survey Geographic Database (SSURGO)	Soils	SSURGO data for area of interest	2
Farmland Mapping and Monitoring Program (FMMP)	Soils	FMMP Coverage and Farmland Category for Madera and Merced Counties for 2016	2
National Hydrography Dataset (NHD)	Water	Water-related data available through NHD such as delineations of canals, drains, streams, and rivers.	1
Inflow and Outflow Locations	Water	Spatial coverage of surface water inflow and outflow locations for area of interest	1
Internal Flow Recorders and Stream Gaging	Water	Spatial coverage of internal surface water measurement locations for area of interest	1

GIS Layer	Spatial Data Category	Description	File Count
Weather Stations	Water	Spatial coverage of weather stations with available data for the area of interest, including both CIMIS and NOAA stations	2
Precipitation	Water	Spatial coverage of precipitation over time for the area of interest (PRISM)	1
Evapotranspiration	Water	Spatial coverage of evapotranspiration over time for the area of interest	1
Groundwater Elevations	Water	Spatial point coverage of groundwater elevations (DTW, Elevation, Change) over time for the area of interest. Available through SGMA Data Viewer.	3
Groundwater Elevation Contours	Water	Spatial point coverage of groundwater elevations (DTW, Elevation, Change) over time for the area of interest. Available through SGMA Data Viewer.	3
Land Subsidence	Water	Spatial raster coverage of land subsidence over time for the area of interest. Available through SGMA Data Viewer.	1
Rivers	Water	California Rivers	1
Water Bodies	Water	California Water Bodies	1
Cities	Urban	Spatial coverage of current extent of cities	1
Projected 2050 Urban Expansion	Urban	Spatial coverage of projected 2050 urban expansion in California from California Resources Agency Urban Footprint Projections	1
City of Chowchilla - 2040 General Plan - City Limits	Urban	City limits for City of Chowchilla per the 2040 General Plan	1
City of Chowchilla - 2040 General Plan - Planning Area	Urban	Planning area for City of Chowchilla per the 2040 General Plan	1
City of Chowchilla - 2040 General Plan - Secondary Planning Area	Urban	Secondary planning area for City of Chowchilla per the 2040 General Plan	1
City of Chowchilla - 2040 General Plan - Sphere of Influence	Urban	Sphere of influence for City of Chowchilla per the 2040 General Plan	1
City of Madera - 2040 General Plan - City Limits	Urban	City limits for City of Madera per the 2040 General Plan	1
City of Madera - 2040 General Plan - Planning Area	Urban	Planning area for City of Madera per the 2040 General Plan	1
City of Madera - 2040 General Plan - Secondary Planning Area	Urban	Secondary planning area for City of Madera per the 2040 General Plan	1
City of Madera - 2040 General Plan - Sphere of Influence	Urban	Sphere of influence for City of Madera per the 2040 General Plan	1

5.3 Conservation Scoring and Ranking Criteria

The SALC program considered alternative ways of ranking lands based on the prioritization of different categories (e.g., habitat benefits, suitability for other purposes, other socioeconomic goals). Repurposing lands to non-irrigated uses requires consideration of alternative land uses, and alignment with other stakeholder and GSA goals. The primary objective of the SALC program is to realize water supply (groundwater) benefits. Other considerations reviewed as part of this planning study and discussed at stakeholder workshop included:

- **Land management on previously irrigated lands**. Lands need to be managed for weed and dust control, plus general aesthetic considerations. Other land conservation programs reviewed (see Section 4) include provisions and payments for specific land use practices (e.g., conversation to native vegetation).
- **Habitat and wildlife benefits**. Lands may be repurposed to support habitat corridors or otherwise improve broader ecosystem service values.
- **County land use planning**. Land repurposing may include consideration of other Madera County land use planning efforts. For example, housing, schools, other public services, or recreational land use needs could be considered jointly with SALC program development.
- **Other health and environmental objectives**. Stakeholders at several meetings noted the importance of protecting access to drinking water and disadvantaged communities by considering the timing and location of land repurposing. In addition, repurposed lands could consider other environmental co-benefits (multi-benefits) such as reductions in greenhouse gas emissions (GHGs), depending on how the lands are repurposed.

The SALC project team reviewed map layers and presented information to stakeholders at early program planning workshops (see below). It also considered financial and economic incentives that would be required to achieve some of the potential options for strategic land repurposing. After extensive feedback from stakeholders and the GSA, it was decided that the map layers would not be used to identify specific areas for specific types of land repurposing as part of the initial SAC program planning. This was based on the following considerations:

- Showing specific parcels and ranking (either implicitly or explicitly) those lands for different types of repurposing would cause privacy concerns for landowners. For example, if an area was designated as prime habitat for a particular species, this could affect parcels in this area. Since the purpose of this initial study was to develop options and a planning-level study of the SALC program, no land ranking is published as part of this initial SALC program report.
- As described in this section and associated appendices, the land use designation map layers were compiled from various public sources. While the reliability of these sources is not generally in doubt, the GSA and stakeholders expressed concerns with boundary lines between different areas. For example, a species habitat layer may show a boundary that splits multiple parcels, but landowners may not agree that those parcels are suitable for that habitat for that species.
- Stakeholders and the consultant team also noted technical issues with some of the map layers that could affect how they are applied for SALC program land ranking. For example, landowners have

expressed concern about using the Soil-Agricultural Groundwater Banking Index (SAGBI) without additional, field-level refinements and adjustments.

The SALC program presented general conceptual land ranking at initial public scoping meetings for the SALC program planning. These included:

- **January 14, 2021 Workshop**. Presented concepts of targeting multiple-benefit lands and leverage relevant funding options. For example, if entering land into the SALC program also created benefits for habitat, DACs, flood management, ecosystem services, or other strategic land uses, other funding partners could also be included, such as land conservancies or public grant programs.
- **March 23, 2021 Workshop**. Discussed how SALC program design could meet other policy goals, such as keeping high-quality farmland in production, creating environmental benefits, and targeting land near existing development. Differentiating between currently irrigated and currently non-irrigated lands (grass/rangelands) was also discussed at this workshop.

As described above, the SALC program may consider additional land ranking incentives for land repurposing on specific lands under future program design. However, given the importance of developing effective land ranking criteria and building stakeholder trust and support, no specific land ranking was developed as part of initial program planning. It is anticipated that the SALC program implementation can and would leverage the map layers developed for the project to support future implementation. For example, this may include additional analysis to support land repurposing objectives under future grant funding opportunities. To support future SALC program development, Section 6.3 of this report describes the general types of ecosystem values associated with different types of agricultural lands and land uses. This information, combined with additional stakeholder outreach, could form the basis for more nuanced incentive payments that consider the socioeconomic or environmental co-benefits of land repurposing.

6. Madera County SALC Program Structure

In this section, the preliminary SALC program design considerations are described. These include eligibility of irrigated and non-irrigated lands, examples for program rules, multi-benefit land repurposing, and consistency with other GSP projects and management actions (PMAs).

6.1 Program Participation

SALC program design considered the potential for irrigated lands and never-irrigated lands to participate in the program. Based on extensive stakeholder input and a review of program objectives, it was determined that the initial program design would be targeted to currently irrigated lands. This is because these lands provide a direct groundwater benefit to the Subbasin if they enroll in the program and are repurposed to other, non-irrigated uses.

Broader eligibility considerations were developed based on a review of existing land idling programs (see Section 4) and through extensive stakeholder input at public meetings (see Section 3). Program participation guidelines fall under future program design efforts. Therefore, a general overview is presented in this report, but no recommendations or decisions are documented. Key considerations for program participation could include:

- Ensuring that lands are current on taxes and assessments and in compliance with Madera County and GSA rules and regulations.
- The GSA may also consider whether to place a limit on how much of a landowner’s land is enrolled in the program. For example, PVID’s Short-Term Fallowing Program allowed up to 15% of the landowner’s land to be enrolled in that program.
- Other considerations for limiting enrollment may be to place restrictions on the share of lands enrolled in specific areas. This would prevent a concentration of idled lands in specific regions, which may increase weed and dust issues in those locations.
- Feedback received by stakeholders expressed interest in providing the most flexibility through shorter-term agreements and allowing landowners/lessees to enroll and switch parcels in the program over time. Growers noted that this would allow them to select lands that enter in the program based on their specific practices within their farm unit. For example, younger orchards may have been planted on more marginal ground. Therefore, a grower may be interested in enrolling an older orchard that is reaching the end of its economic life, but is planted on better land, for a period of years, and then switching enrollment once the younger orchard reaches the end of its productive life.
- Consistency with other GSA PMAs. For example, lands that participate in the GSA recharge program may receive recharge credits under that program. The SALC program would limit eligibility to ensure that lands are not unfairly receiving double benefits for the same activity. For example, receiving an incentive payment under SALC to forgo use of SY and TW, but also receiving a credit from the recharge program for the same SY and TW. These concerns were raised by stakeholders in program workshops and would be considered as part of SALC program design, in coordination with other PMAs.

SALC program eligibility would be determined as part of the SALC program implementation process. This would include annual noticing and administration of the program. For example, the GSA would need to notify landowners and lessees of the open enrollment or application process. Many programs send out annual mailers, in addition to posting on their websites. The GSA would work to develop these program parameters as part of the next phase of program implementation.

6.1.1 Irrigated Lands

The SALC program would be targeted to currently irrigated lands in the GSA. This is because these lands provide a direct groundwater benefit to the GSA if repurposed to non-irrigated uses, which would directly benefit groundwater management objectives specified in the GSPs.

The SALC program is developed assuming that irrigated lands could enroll their Sustainable Yield (SY) and Transitional Water (TW) into the SALC program. The TW available ramps down over the implementation period of the GSP. Therefore, SALC program incentive payments are adjusted to reflect the amount of water acquired by the program (ST+TW). These incentive payments would be set and adjusted annually by the GSA.

Based on the direction of the Madera County GSA Board, the scale of the SALC program for irrigated lands would be approximately 50 percent of total demand management: 45,000 AFY in Madera; 13,900 AFY in Chowchilla; and 1,000 AFY in Delta Mendota.

Most irrigated lands are enrolled in the Williamson Act, which is a state law that allows land enrolled to be assessed at a substantially lower tax rate for the purpose of restricting its land use to agricultural or open spaces. During interviews, stakeholders asked how SALC enrollment would affect Williamson Act lands. Based on initial consultation with the Madera County Assessor’s Office it is anticipated that land enrolled in SALC under renewable one-year easements would not change the land use or otherwise affect enrollment in the Williamson Act. At the discretion of the landowner, a re-assessment could be requested based on the current land use. The GSA will continue to work with the Assessor’s Office and stakeholders as part of SALC program development and implementation.

6.1.2 Never-Irrigated Lands

A critical SALC program design consideration is whether never-irrigated lands are eligible to enroll in the SALC program. If eligible, these lands would effectively receive a payment to keep the land in non-irrigated uses.

The SALC program cost summary described in Section 8 assumes that never-irrigated lands are not eligible to participate in SALC. This was based on feedback from stakeholders and direction from the Madera County GSA Board. However, a preliminary analysis was developed that illustrated the options for including never-irrigated lands in the SALC program. This section describes how those lands could be included in the program.

If never-irrigated lands are eligible for the SALC program in the future, the program would be set consistent with other GSA programs policies, including Resolution No: 2020-166 specifying the approach to allocating groundwater. The Madera County GSA developed two resolutions in May 2021 that would affect SALC program costs for never-irrigated lands: “Resolution Adopting Never-Irrigated Lands Farm-Unit Participation Policy for Groundwater Allocation Approach” and “Resolution Establishing

Groundwater Allocation Amounts for 2021 through 2025 and Farm Unit Documentation." Never irrigated lands are only eligible to opt-in, pay GSA fees, and receive the Sustainable Yield component of the allocation. Other lands are eligible for both Sustainable Yield (SY) and Transitional Water (TW) components of the allocation.

Potential SALC program payments for the SALC-eligible never-irrigated lands in the GSA could be based on the value of the Base SY that would not be used. Alternatively, the value of these lands could be based on broader ecosystem service value provided by these lands. Ecosystem service values are described under Section 6.3, below.

6.2 Rules for Acres that Enroll in the SALC Program

As the GSA considers potential implementation of the SALC program, it will need to work closely with legal counsel to develop standard agreements between the GSA and the landowner/lessee that describe the terms and conditions, such as performance period, verification, funds disbursement, and any penalties for breach of contract. Any other easements, third-party consents, and legal and financial processes would also need to be specified. This section describes general rules for program participants.

Verifying that the landowner/lessee meets the performance terms of the contract will be important for ensuring that the program's efficacy. The measurement verification method should be consistent with the methodology for calculations and enforcement of allocations. For example, the GSA currently uses IrriWatch on the basis of ETAW; the County should use the same tool for monitoring and enforcement of its SALC program.

Incentive payments for irrigated lands would be set to encourage participation in the SALC program. The preliminary ranges are described in the cost summary in Section 8. Payments reflect annual per acre amounts. Incentive payments should reflect then-current crop market conditions, which will change over time. Therefore, it is anticipated that the GSA would need to review and periodically (annually) adjust the program incentive payments to ensure that payments are not too low to encourage participation in the program. Payments for non-irrigated lands are set using the same method as the irrigated lands. Non-irrigated land payments are the same under all SALC program scale options. The cost summary is described in detail in Section 8.

The GSA may structure incentive payments and enrollment in different ways. For example, the Klamath Basin accepted bids for its annual idling program, whereas the Deschutes program offers a fixed payment. Options for structuring the enrollment process include:

- **Fixed annual payment**. The GSA offers a fixed amount for acres to enroll in each year. All acres enrolled in the program receive the same amount. If the GSA does not receive sufficient interest in the program, it would need to increase the payment. Similarly, if there was too much interest (more acres than the program had funds to pay in a given year), it could lower the incentive payment and/or develop a process for selecting acres. The GSA would prepare an analysis (similar to that described in this report) every year and update the SALC program payment. SALC program payments summarized in this report are currently set under this fixed annual payment option.

- **Bidding**. The GSA could solicit bids from interested landowners. The bid could specify, for example, the price and current crop type. The GSA could then calculate the effective cost per acre (or per acre-foot) and rank bids, selecting the lowest cost bids up to the target program enrollment. The GSA could then offer the highest cost bid to all acres, or pay each acre based on its bid price.
- **Other auction approaches**. Other bidding approaches include reverse auctions and standard auctions. These types of bidding structures are used to reduce the cost of the program.
- **Other land goals**. The GSA may want to target lands in specific areas based on prioritization, such as considering the social, economic, or environmental multiple-benefits of that land's enrollment. These objectives would likely be defined by the GSA, depending on grant funding opportunities available to support these program objectives.

Other program rules may specify acceptable non-irrigated practices on the previously irrigated lands. For example, repurposing to native vegetation, habitat, or other land cover would prevent dust and weed pressure. Other economically viable activities may be considered, including, potentially, dryland farming.

The fundamental requirement for acres that enroll in SALC is that those acres forgo use of the SY and TW allocation. The SALC incentive payments are set based on this quantity of water (and how TW changes over time). Therefore, there would be no SY and TW allocation for use within the farm unit for acres that are enrolled in SALC.

6.3 Multi-Benefit Repurposing and Ecosystem Services

Multi-benefit water projects refer to activities that generate one or more benefits in addition to the primary water supply benefit. For example, flood control, protecting domestic drinking water supply, or preventing land subsidence. Multi-benefit projects can also include other environmental benefits, which are sometimes generically referred to as ecosystem services. Ecosystem services can be broadly defined as the amenities provided by resources and natural systems. Examples of ecosystem services associated with agricultural lands include protecting endangered species habitat, habitat corridors, air quality, water quality, and protecting open space.

The SALC program would need to establish the types of ecosystem services provided by irrigated and never-irrigated lands, and then establish a value for each ecosystem services. This would be used to set potential incentive payments for provision of such ecosystem services. This section describes the general types and value of ecosystem services associated with agricultural lands. It can be used to support program implementation if the GSA secures grant funding to support such payments.

A primary valuation of ecosystem services attributable to agricultural lands in the Madera County GSA is beyond the scope of this initial SALC program planning study. A defining feature of ecosystem services is that they provide value but there is no market where they can be directly bought and sold. Therefore, the value of ecosystem services is established using alternative methods. For example, open space is not sold, but it is common knowledge that houses with a good view will sell for a higher price, so the value of open space can be inferred by comparing houses near open space (with a view) to those that are otherwise similar. General approaches to establishing the value of ecosystem services include direction valuation, which would involve developing a contingent valuation study or similar method, or developing a benefit-transfer analysis that would leverage the results of other primary valuation studies, and then adjust and apply them to conditions in Madera County.

A literature review was conducted to describe the general value of different types of ecosystem services. The values presented in this report represent the gross value for example types of ecosystem services. The SALC program for the Madera County GSA would need to consider the net value of ecosystem service for setting potential SALC program payments. The net value of an ecosystem service considers the value in the current land use relative to its potential alternative to avoid over-estimating the value provided by a specific parcel/land use type.

The following types of ecosystem services were considered for illustrative purposes in this initial assessment.

- **Habitat**. Conversion to native vegetation from irrigated agriculture (or preservation of never-irrigated lands) can improve habitat for some species. It can also create habitat corridors. The value of habitat depends on the species that would potentially benefit, and consideration of those habitat benefits under current and potential future uses of the land.
- **Flood control**. Agriculture can provide a natural buffer for variation in seasonal water flows and rainfall. Land management practices upstream and downstream affect runoff, drainage, and the frequency of flood events. In some areas agriculture can be managed for both crop production and as a seasonal floodplain.
- **Groundwater recharge**. Deep percolation from irrigation and precipitation will result from some portion of applied water in excess of consumptive use. This proportion depends on field soil characteristics, slope, crop type, and irrigation practices.
- **Water quality**. Surface runoff and deep percolation of water from irrigation and precipitation on agricultural land can increase or decrease water quality. For example, excessive nitrogen application can leach into the groundwater and affect water quality. Open space or grasslands can, in some instances, provide a natural filter for water.
- **Pollination**. Wild pollinator populations have been declining in California. Agriculture provides natural habitat for pollinators.
- **Biodiversity**. A diverse crop mix and rotation system functions as a natural break for pest and disease cycles. It also provides flexibility for producers to respond to changes in agricultural prices and market conditions.
- **Other Ecosystem Services.** There are several other ecosystem services provided by farms and rangeland. For example, erosion control in coastal counties is estimated to be worth $400-$600 per acre per year on some lands (estimated as an avoided cost of alternative erosion control practices). Air quality and carbon sequestration benefits are also associated with agricultural lands. The California carbon market has placed a value of approximately $12 per ton of CO_2 equivalent sequestered.

It is important to emphasize that a comprehensive review of ecosystem service values was beyond the scope of this planning study. The values shown in this report represent gross values and would need to be reviewed and adjusted for application to the conditions in Madera County before they are applied for the

SALC program. Table 3 summarizes the value of ecosystem services. The methods applied to value the different types of ecosystem services very by location and study; Appendix H provides a reference list for the studies considered. For example, the value of flood control benefits attributable to agricultural land is based on the alternative cost of other flood management investments that would provide the same level of flood protection as using agricultural lands as an active floodplain.

Table 3: Summary Value Range for Example Ecosystem Services Provided by Agriculture

Service	Total Value ($/ac per year)	Summary Notes
Flood Control	$42 – $86	*Flood management is an important concern for the Madera County GSA.*
Groundwater Recharge	$22 – $44	*This value represents the average for direct recharge from irrigation and precipitation. These values vary based on local conditions that affect the value of water.*
Water Quality	$27	*Value represents an average; range varies from positive to negative depending on the crop and management practices.*
Pollination	$19 – $64	*Value of habitat for pollinators based on the market value of pollination services.*
Habitat	Varies	*Estimates are both crop and species-specific. Excluded from this analysis.*
Biodiversity	$31	*None.*
Other example values	$0 – $433	*Estimates are crop-specific and can be negative in some cases.*

6.4 Implementation and Consistency with Other GSP Projects and Management Actions

The SALC program is aligned with existing and upcoming projects and management actions (PMAs) in the GSA, which include domestic well mitigation, recharge, Sites water purchases, and a (potential) groundwater market. If these programs are not consistent with SALC, they can limit the effectiveness of one or more programs. For example, if the SALC program payments are less than the cost of recharge, this would undermine the effectiveness of the recharge program (i.e., it is cheaper to pay for land repurposing than recharge). Conversely, if the SALC program payments are set higher than the going price in a (hypothetical) water market, this would limit any transactions in a water market. The other GSA programs are briefly described for context, followed by a discussion of their interactions.

Domestic well mitigation program will compensate for any impacts of declining groundwater levels on domestic wells in the Madera County GSA. The Madera County GSPs include a phased implementation plan that would gradually transition the Subbasin to sustainable groundwater conditions by 2040. The length of the implementation period means that groundwater levels may continue to decline in some areas during the implementation period. The domestic well mitigation program will compensate domestic well pumpers for specific impacts to their wells during the implementation of the GSP. The domestic well program will develop a fund that will be used to pay for replacing or refurbishing domestic wells that are affected by falling groundwater levels during the GSP implementation period. The specific details of the program, including eligibility, are currently being developed by the Madera County GSA, other GSAs, and stakeholders.

The GSA groundwater recharge program will divert flood flows to dedicated recharge basins, and crop fields, in the Madera County GSA. The recharge program will increase water supply by developing a series of phased recharge projects to divert flood flows to dedicated recharge basins or fields in the Madera County GSA. The amount of recharge achieved will vary from year to year as rainfall fluctuates and flood flows are available.

The GSA also plans to purchase additional surface water supplies for direct use, or recharge, from Sites Reservoir. The project would provide water supply when the project is online (around 2032). The GSA costs for participation include initial planning fees as well as annual costs for water purchases.

A groundwater market program is being considered by the GSA. The groundwater market could allow for the lease or purchase of allocation, subject to specific rules. Groundwater markets are an economically efficient way to meet groundwater reduction goals, as those with lower returns to irrigation can sell part or all of their allocations to those with higher returns, moving that allocation to the highest and best uses. This type of flexibility is partially accomplished by the concept of a farm unit in the GSA allocation approach. The groundwater market would likely include restrictions to ensure that it is consistent with other goals of the GSP and its projects and management actions, such as considering the effect that reallocation via a market would have on third-party uses such as domestic wells.

SALC payments need to be consistent with these programs to achieve the desired social, environmental, and economic outcomes. For example, growers may evaluate whether to participate in SALC, comparing the compensation of the program versus the returns to irrigating and/or acquiring additional water. Acquiring water can occur through a lease or purchase on a groundwater market (if one exists), adjustments within a farm unit, through on-farm recharge, or through purchasing additional surface water supply. Each of these activities has its own costs, which affect the returns of that activity. SALC payments will need to be aligned with other existing GSA programs over time, so that it does not create perverse incentives. For example, if the SALC payments are very high in any given year, then the program may be oversubscribed while participation in other programs, such as a groundwater market, would drop off. On the other hand, if the SALC payments are too low, there may be little to no interest in the program, as has been the experience of many of the land repurposing, fallowing, and retirement programs reviewed. Program participation and other key socioeconomic and environmental indicators should be reviewed regularly to assess program performance and recommend revisions to improve it.

7. Incentive Payment (Fee) Structure

The SALC program is voluntary. It would encourage participation by offering incentive payments to participating lands/growers. The incentive payment would need to be equal to or greater than the returns of using that water (e.g., for irrigation). Therefore, the SALC program incentive payments require: (i) establishing the value of water (net return to irrigated agriculture) in its various uses, and (ii) establishing quantity of water available per acre.

7.1 Methodology for Establishing SALC Incentive Payments

SALC program incentive payments are calculated based on net returns to irrigated agriculture and the quantity of SY and TW. The concept is that incentive payments need to be greater than the returns to continuing farming in order to get voluntary enrollment in the program.

Incentive payments are calculated in a sequential process. The first step establishes the net return to major crops in the region. This is calculated as the net return over operating costs because the program would (initially) be set as an annual program. This gives an approximate per acre payment to make growers indifferent between farming and idling land. The approach attributes the net return above operating costs to the non-priced input, in this case water, to calculate per acre foot water values.

University of California Cooperative Extension (UCCE) baseline crop budgets were applied. Crop acreage is developed from DWR geospatial crop data. The diverse mix of crops are aggregated into individual crop categories, with a representative proxy crop and associated UCCE baseline budget for each. Table 4 summarizes the baseline crop budgets applied for lands in the Madera County GSA.

Table 4: Crop Categories and Acreages

Proxy Crop	DWR Crop Types	Representative UCCE Budget
Hay Alfalfa	Alfalfa and Alfalfa Mixtures	Alfalfa Hay – North San Joaquin 2015
Tomatoes - Processing	Dry Beans, Carrots, Lettuce, Melons, Misc. Truck, Onions and Garlic, Tomatoes	Processing Tomatoes – South San Joaquin 2018
Silage	Corn Sorghum and Sudan	Silage Corn–North San Joaquin 2015
Wheat	Misc. Grain and Hay, Misc. Grasses, Mixed Pasture, Wheat	Wheat – Sacramento Valley 2016
Almond	Almonds, Young Perennials	Almonds – North San Joaquin 2019
Grapes - Wine	Grapes*	Wine Grapes – Colombard, South San Joaquin 2019
Grapes - Raisin	Grapes*	Raisin Grapes–San Joaquin 2016
Grapes - Table	Grapes*	Table Grapes – Flame Seedless, South San Joaquin 2018
Pistachios	Pistachios, Young Perennials	Pistachios–SouthSanJoaquin2015
Prunes	Misc. Deciduous, Misc. Subtropical, Apples, Cherries, Citrus, Dates, Kiwis, Olives, Peaches, Pears, Plums, Prunes, Apricots, Pomegranates	Prunes – Sacramento Valley 2018
Walnuts	Walnuts, Young Perennials	Walnuts – North San Joaquin 2017

*Land IQ groups all grape acreage into one category. Shares of subcategories are estimated using USDA NASS data.

The baseline UCCE budgets were refined as part of initial GSP development for the Madera and Chowchilla Subbasins through grower interviews and with additional data collected for the GSP. For the

SALC program analysis, additional refinements were made to the budgets to standardize pumping, fuel, and other input costs unit values. Other adjustments included updating land costs for current conditions, crop prices, and crop yields, using data from the rural appraisers reports and USDA national Agricultural Statistics Service (USDA NASS). The adjusted crop budget values shown in this report are based on average returns to farming in the GSA. In practice, returns vary by operation, so it is expected that growers will be above or below the average values shown in this report.

A standard economic analysis was developed to establish the value of water in the GSA under current land use and crop market conditions. This approach establishes the value of water based on its use as an input to farming activities, which is referred to as the net return to water. This value represents the price that would make a representative grower indifferent between idling land and continuing to farm in any given year. The analysis is developed for:

- **Crop type**. The returns to farming vary by crop type. The geospatial data applied to the GSP and Rate Study development was used to evaluate the current crop mix in each Subbasin.
- **Options for program terms** (e.g., length of enrollment). The length of the program enrollment affects the payment the incentive payment that would be required because some costs are not variable (called sunk costs) in the near term.
- **The age structure for permanent crops**. Permanent crops require an up-front payment to establish and then provide net returns over a productive economic life (between 25 and 40 years). Therefore, the net return to water for an orchard/vineyard depends on the age of that orchard/vineyard.

An important distinction in calculating the net return to water is the period under consideration. In the short run producers can only control variable costs and fixed costs are considered sunk. For example, it is not possible to quickly sell buildings and equipment – the costs are sunk. Over a longer period (the long-run) both variable and fixed costs can be adjusted. Therefore, the net return to water as an input to farming is greater in the short run. Since the SALC program would offer annual enrollment, a short-run valuation approach is applied. If the SALC program is structured under alternative program terms (e.g., several years or permanent enrollment), an alternative valuation approach would apply that appropriately accounts for (includes) longer-run costs. Table 5 provides examples of typical short-run and long-run costs for farm budgeting. The economic analysis developed for the SALC program included an itemized list of each crop budget line item.

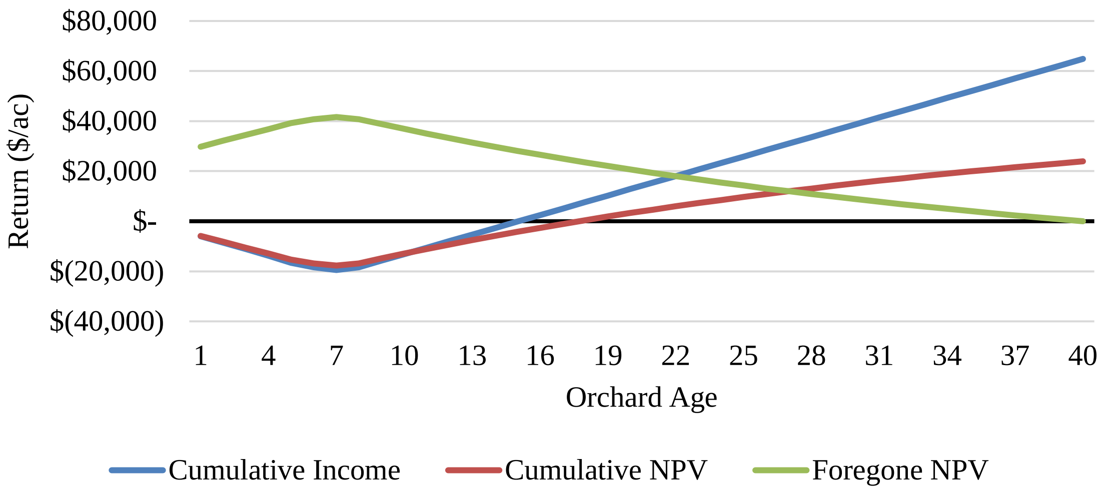
Table 5: Short- and Long-Run Costs Summary

Cost Type	Broad Category	Example
Short Run Costs	Operating Costs	Chemicals, Labor, Custom Services, Machinery Fuel and Repair, Water
Long Run Costs	Cash Overhead Costs	Insurance, Office Expenses, Property Tax, Land Rent, Manager Salary
	Non-Cash Overhead Costs	Land Cost, Establishment Costs, Irrigation System, Buildings

A substantial share of irrigated acreage in Madera County is in permanent crops. Permanent crops require an up-front capital investment to establish the orchard/vineyard and have a typical economic life of more than 20 years. Therefore, the value of a permanent crop must account for the present value of the future income on that investment. This depends on the age of the permanent crop. For example, removing a 15 year old productive orchard (effectively 10 years before the end of its economic life) would cost substantially more than removing a 25 year old orchard.

Figure 2 illustrates the net present value of the income from a representative pistachio orchard, for a single stand (not replanted). It illustrates the present value of the income stream from the orchard over a 40 year productive life. It also shows the net present value cost of removing that orchard over its productive life.

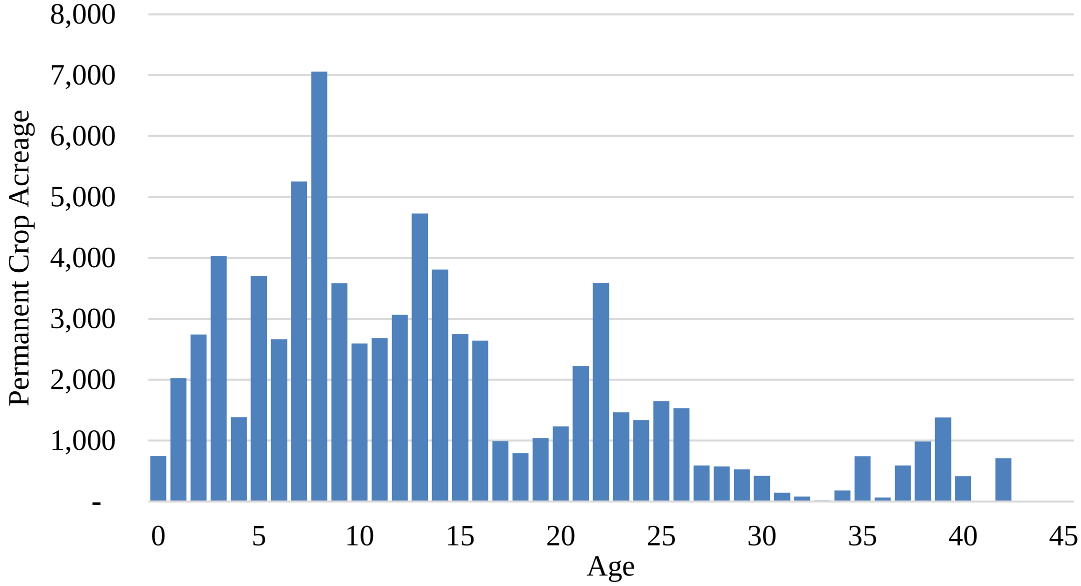
Figure 2: Income and PV of an Example Pistachio Orchard, Per Acre



This analysis of SALC incentive payments considers net present value (NPV) of an orchard in perpetuity (i.e., assuming it is replanted). The NPV of the land depends also on the revenue of future orchards. SALC enrollment would require producers to idle their land for the contract duration (e.g., one year). The value that would make producers indifferent to farming would be the difference between the NPV of their current orchard plus all future orchards and the NPV of future orchards replanted after the contract expires (e.g., one year later). It would be unlikely that any young orchards would enroll in the SALC program because per acre payments would have to be substantially higher than most farming activities in the GSA.

The farm budget analysis for all permanent crops was developed for the stream of income over the life of each orchard/vineyard. The permanent crop age distribution was estimated using available public data for the GSA. The age distribution of perennial crops in the GSA is skewed, with the majority of permanent plantings still early in their productive life. From 2000 – 2010 an average of 2,500 acres of permanent crops were planted per year. From 2010 - 2020 plantings averaged 3,300 acres per year, an increase of 32 percent. Figure 3 illustrates the estimated age distribution that was applied to the SALC program incentive payment analysis.

Figure 3: Permanent Crop Age Distribution, Madera County GSA



7.1.1 Effect of Duration of Agreement on Incentive Payment

Participation in the SALC program can be structured as short-term (annual), long-term (multi-year), or permanent agreements, described in more detail below. Stakeholders expressed more interest in temporary arrangements than permanent ones to provide more flexibility. Based on this stakeholder feedback, the program is structured as an annual agreement with an option for renewal. The agreement could include the option for permanent enrollment in the future. Stakeholders also noted that the SALC program should be flexible to allow landowners to switch parcels enrolled in the program over time, particularly to accommodate the ages of different perennial crops on prime or more marginal ground.

As described in above in Section 7.1, an annual, or short-term, agreement, incentive payment will be greater than longer-term agreements to account for sunk fixed costs. The incentive payment would decrease with longer term contracts (with permanent representing the lowest effective unit cost).

7.1.2 Multi Benefit Repurposing Opportunities

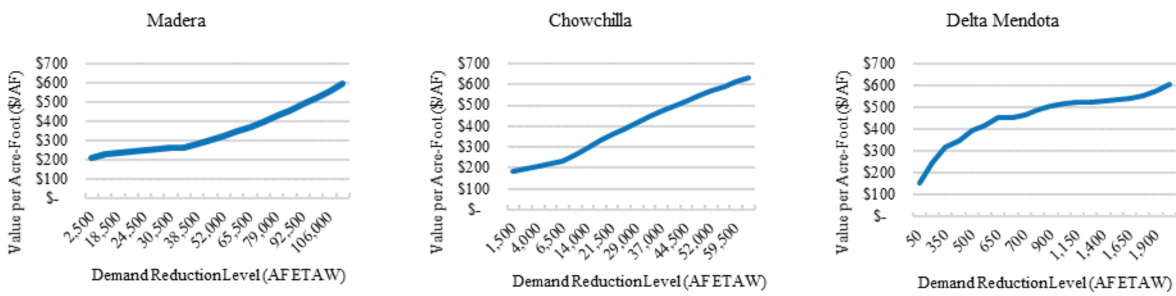
As discussed in Section 6.3, a range of multi-benefit repurposing opportunities exist, such as ecosystem services, floodplain management, and dry well mitigation. The SALC program could also be structured to strategically repurpose selected lands consistent with other Madera County land use policies/goals, or other objectives identified in coordination with stakeholders. Some of these benefits could be formally valued to create additional incentives for specific lands in the GSA, or informally prioritized for enrollment. Should the GSA pursue additional payments for multi-benefits, it might consider partnering with funders and organizations with aligned missions.

7.1.1 Unit Value of Water at Different Levels of Demand Management

Using the crop acreage data, GSA ETAW data, current economic data, and the economic analysis approach described under Section 7, the unit value of water (in $ per acre-foot) are estimated and summarized for each GSA. The output of the analysis shows the value of water at each level of reduction in ETAW (demand management) from the current baseline water use.

Figure 4 illustrates the results of the analysis for the Madera, Chowchilla, and Delta Mendota Subbasins. The value per acre-foot of ETAW is the price that would make a representative grower indifferent between continued production and idling land for a single year. The value increases with the level of demand management. This is because increasingly higher net-return crops would need to be included to achieve greater levels of demand management. It is also important to note the differences in value across the GSA Subbasins. This is caused by differences in the crops mix, value of crops, and total water demand (ETAW) in each Subbasin.

Figure 4: Value of Water ($/AF) for the Madera County GSA in each Subbasin



The value of water is used as an initial starting point for the SALC program incentive payments. That value represents the minimum willingness to accept because it is the value that would make a grower indifferent between continuing to irrigate and enrolling acreage in the SALC program. Since the program is encouraging voluntary enrollment it is necessary to include a premium over the minimum value of water to ensure participation in the program. In addition, based on interviews with stakeholders and feedback at public meetings it was determined that the additional premium should account for an initial "learning curve" for program participants as growers adjust to GSP implementation in the GSA.

A cursory review of other water leasing and Idling programs was conducted. Premiums for those programs range from less than 20% to over 40%. An initial premium of around 40 percent was applied for each Subbasin. This premium is then gradually decreased over the GSP implementation period.

The net return to water was integrated into an economic/financial analysis that was used to evaluate the SALC program incentive payments and costs under alternative program options. A nonlinear regression was applied to the value of water in each Subbasin (see Figure 4) and included in the SALC program analysis as a third-order polynomial function. This function relates the value per acre-foot of ETAW to the level of demand management (in ETAW) in each Subbasin. It was used to evaluate the SALC program outcomes for different program structures that were considered by the GSA, proposed by stakeholders, or considered for the Madera County Rate Study.

The outputs of the SALC program analysis includes the cost of administering the program, incentive payments, and total program cost over the implementation period. Incentive payments are defined as the net return to water, which is then multiplied by the total per allocation (TW and SY) available in that year to calculate the SALC program incentive payment per acre. The total program cost is the incentive payment per acre multiplied by the number of acres that would need to be enrolled in the program to achieve the desired scale of the program in each year.

The economic/financial analysis of the SALC program options evaluates important program parameters that are changing over time the GSP is implemented. First, as the program scale increases, the value of water (in $ per acre-foot) increases, which increases the SALC program incentive payments. However, as TW decreases over the GSP implementation, the amount of water paid for (in acre-feet per acre) declines, which decreases the SALC program incentive payments. The net result of these two counteracting effects can result in the SALC program incentive payments per acre increasing or decreasing depending on circumstances in each Subbasin over time.

Section 8 summarizes the SALC program incentive payments, terms, and estimated cost of the program.

8. SALC Program Costs

There are no up-front capital costs for the SALC program because it does not require building any infrastructure. Annual SALC program costs for achieving the specified demand management targets for each Subbasin will vary based on final program design. SALC program costs fall under two general categories:

1. **Program administration**. This is the cost of County staff time to develop, implement, and review the SALC program. General tasks would include reviewing and approving applications, updating program incentive payments, outreach, and other legal, administration, and accounting support.
2. **Program incentive payments**. Incentive payments are the payments to individual landowners that choose to enroll in the SALC program. This is the largest share of SALC program costs. The program incentive payments are based on returns to irrigated agriculture in the region (see Section 7). The incentive payments are set to be above the returns to irrigated agriculture in order to incentivize participation. Payments adjust over time with the scale of the program, eligibility, and other program rules to be determined by the GSA. Program incentive payments are developed for irrigated lands that would be eligible for the SALC program. Never-irrigated lands are not currently eligible for SALC program enrollment.

The cost of the SALC program depends on the scale of the program, rules for non-irrigated land eligibility, and other program options that are still being considered by the GSA and its stakeholders. It is anticipated that these costs will be refined as the GSA considers development and implementation of the program.

8.1 SALC Program Administration Cost (GSA Costs)

It is estimated that the SALC program could be managed with full-time-equivalent (FTE) County staff, plus staff management and additional technical support. Staff would include an analyst (i.e., Water Resources Specialist III) plus a mix of accounting, administration, and legal support totaling an additional 50 percent time.

It is anticipated that the program would have peak workloads that would exceed existing full time staff capacity. For example, reviewing and approving applications and updating program incentive payments, which would be annual program activities. These tasks would be accomplished with a planned budget for external technical support. County staff time to manage the external support and associated RFP process would also be required.

General duties for County staff to administer the SALC program include:

- General administration and program management.
- Respond to requests, emails, conduct periodic workshops, and meet with stakeholders as needed.
- Develop annual updates/reporting for program finances; coordinate with GSP consultants for annual and 5-year reports; assist with data requests for GSP implementation.

- Manage lands enrolled in the program, including data entry, tracking, and ensuring that lands comply with program requirements.
- Support required across other positions (totaling 0.25 FTE) would include:
  - Accounting: development, processing, and approval of payments.
  - Legal: development and review of terms of SALC program agreements.
  - Other administration: Responding to internal requests, website management, data management, and program reporting.

Annual review of applications, updating program incentive payments, and responding to specific technical requests would exceed staff capacity and require outside technical support. This would include:

- Assistance with review of SALC program applications.
- Annual/periodic update of program incentive payments to ensure enrollment in the program; revising/modifying program incentive payments in response to change in policy or funding sources (e.g., grant program eligibility); updates to program guidelines to meet GSA sustainability objectives.
- Assistance with set up and review of easements/agreements for the SALC program.

Table 6 summarizes estimated program staff and external costs. Staff costs are based on the current published Madera County salary schedule and are subject to revision. Costs include one full time equivalent (FTE) Water Resources Specialist III position. Staff support activities are set at 50 percent of the Water Resources Specialist 1. Management time is set at 10 percent of the Deputy Director of Water and Natural Resources. A standard fringe benefit rate of 35 percent is applied to all base salaries. All costs are in current dollars (no adjustment for inflation) and rounded to the nearest hundred. External technical support budget is $50,000 annually.

Table 6: Estimated SALC Program Administration Summary, Fixed Rates

	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
Water Resources Specialist III	$122,000	$122,000	$122,000	$122,000	$122,000
Support Staff (0.5 FTE)	$61,000	$61,000	$61,000	$61,000	$61,000
Management (Director 0.1 FTE)	$18,600	$18,600	$18,600	$18,600	$18,600
External Technical Support	$50,000	$50,000	$50,000	$50,000	$50,000
Total	**$251,600**	**$251,600**	**$251,600**	**$251,600**	**$251,600**

SALC program staff requirements may be initially higher and then decrease over time as the program scale increases. This is not shown in the staffing costs presented in 6. Staff costs assume full program implementation. SALC program administrative costs would increase if the GSA adopts a hybrid rate structure (fixed plus volumetric) because the GSA would need to track, administer, and enforce water use for the volumetric rate component. These were estimated to be approximately double the fixed rate costs (totaling $506,200 per year).

8.2 SALC Program Incentive Payments and Costs

Incentive payments for the SALC program represent the largest share of the program cost. These are payments to incentivize willing landowners to participate in the SALC program. Payments would be offered as a fixed amount per acre enrolled in the program, although the amount offered would change over time to reflect the ramp-up of the program, to incentivize higher-valued irrigation uses to enroll, as well as changes in market conditions. SALC program incentive payments were summarized in Section 7.

Incentive payments could consider different types of benefits provided by lands that enroll in the SALC program (multi-benefits). For the purposes of SALC program costs, the incentive payments are set to encourage currently irrigated lands to become unirrigated. That is, there is no additional premium paid to lands that may provide other public benefits (e.g., flood risk reduction, ecosystem services, or other habitat value). It is anticipated that the GSA would continue to pursue funding opportunities for these benefits in the future and may add them to the program.

The SALC program payments are designed to incentivize lands to enter the program. The total amount (cost) of the incentive payments program depends on several factors, including:

- **Scale of the program**. Incentive payments increase with the scale of the SALC program. This is because lands that generate a greater return per unit water (e.g., productive orchards and vineyards) would need greater incentive payments to enroll in the program.
- **Transitional Water**. The SALC program would acquire both Transitional Water and Sustainable Yield from irrigated parcels that enroll. The quantity of Transitional Water is planned to decrease over time. Therefore, SALC program incentive payments would be adjusted to account for this change.
- **Payment Premiums**. As described in Section 7, the program has included an additional payment premium to induce sufficient participation. The premium will start at 40 percent while growers become familiar with the program, but decline over time to 20 percent.
- **Other changes over time**. SALC program incentive payments are based on the returns to farming. These returns change over time as the market for Madera County crops changes. This is a result of price fluctuations driven by other market forces (e.g., trade agreements, consumer preferences, other macroeconomic changes) and local costs (e.g., the cost of water).

A critical SALC program design consideration is whether non-irrigated lands are eligible to enroll in the SALC program. As described in Section 6.1, if eligible, these lands would effectively receive a payment to keep the land in non-irrigated uses. The SALC program cost summary described in this report assumes that never-irrigated lands are not eligible to participate in the SALC program.

8.3 Scale of the Program

As previously discussed, the scale of the SALC program is the major determinant of its cost. There are two forms of program scale: the total demand reduction that the program will achieve, and over what time period it will do so.

Three options were evaluated for the total demand reduction levels in each GSP: Option 1 would set a program demand target equal to 25 percent of the planned demand management shown in each GSP;

Option 2 would set the target equal to 50 percent; and Option 3 would set the target equal to 100 percent. These levels are summarized in the table below.

Table 7: Options for SALC Program Scale, as Percent of Total Demand Reduction

Demand Reduction Level (in acre-feet per year, AFY)	Madera Subbasin	Chowchilla Subbasin	Delta Mendota Subbasin
Option 1, 25 percent	22,500 AFY	6,900 AFY	450 AFY
Option 2, 50 percent	45,000 AFY	13,900 AFY	1,000 AFY
Option 3, 100 percent	90,000 AFY	27,755 AFY	2,000 AFY

Incentive payments for irrigated lands would be set to encourage participation in the SALC program. These payments are based on the returns per acre-foot of water for irrigated agriculture in the respective Subbasins, plus an additional premium. The resulting per-acre-foot costs and total costs are displayed for the Madera, Chowchilla, and Delta Mendota Subbasins.

After extensive conversations with stakeholders and direction from the Madera County GSA Board, Option 2 for 50 percent demand reduction was selected for the SALC program, with an enrollment duration of one year. As described earlier, the terms of enrollment in the SALC program could be longer than one year (e.g., 3–5 years), and this would affect the program costs shown below[8]. Incentive payments reflect current crop market conditions. These will change over time. Therefore, it is anticipated that the GSA would need to review and periodically (annually) adjust the program incentive payments to ensure that payments are not too low to encourage participation in the program.

The irrigated lands portion of the SALC program has a planned phase-in in both enrollment and cost. The irrigated lands enrolled would start in 2022 and ramp up to the 50 percent target by 2040. The GSA can increase or decrease the rate of implementation, depending on funding availability, crop market conditions, and other GSP implementation objectives.

Program costs are in current dollars (no inflation adjustment). Annual increases in total costs over time shown in these tables are driven by increasing amounts of land and water, but also reflect the changes in Transitional Water and the unit value of water. Tables 8, 9, and 10 summarize the SALC program incentive payments at 5-year intervals over the implementation period. This includes the total acre-feet, acres, cost, and incentive payment per acre. The changes in incentive payment over the selected years show how changes in transitional water, unit value of water, and payment premiums interact over time.

Table 8: Irrigated Lands Incentive Payments, Madera Subbasin (selected years)

Year	Units	2020	2025	2030	2035	2040
AF SALC	AF	0	24,500	33,750	39,350	45,000
Acres	acres	0	10,863	18,180	26,996	42,500
Cost	$/yr	0	$7,891,378	$11,676,918	$16,787,036	$26,693,166
Incentive	$/ac	0	$726	$642	$622	$628

[8] Permanent SALC enrollment easements would affect the overall program costs because incentive payments would be lower for permanent irrigated land repurposing.

Table 9: Irrigated Lands Incentive Payments, Chowchilla Subbasin (selected years)

Year	Units	2020	2025	2030	2035	2040
AF SALC	AF	0	5,850	8,600	11,250	13,900
Acres	acres	0	2,794	5,398	10,296	23,476
Cost	$/yr	0	$1,891,726	$3,681,419	$5,875,698	$8,762,060
Incentive	$/ac	0	$677	$682	$571	$373

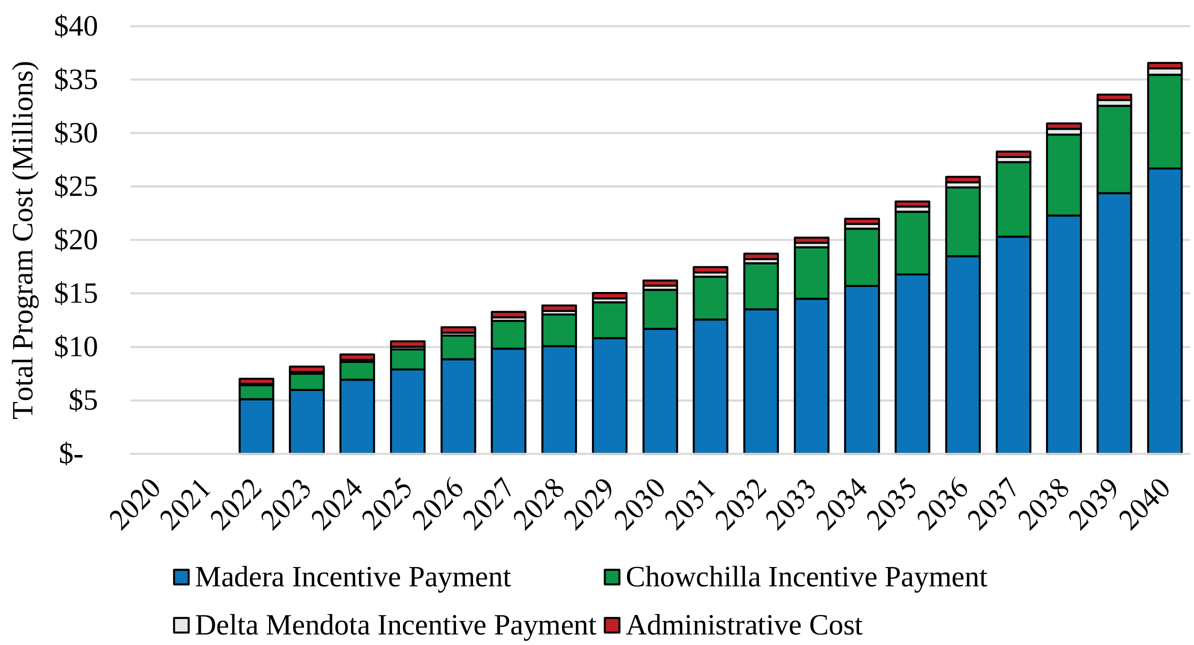
Table 10: Irrigated Lands Incentive Payments, Delta Mendota Subbasin (selected years)

Year	Units	2020	2025	2030	2035	2040
AF SALC	AF	0	500	700	850	1,000
Acres	acres	0	318	544	850	1,400
Cost	$/yr	0	$227,871	$365,141	$449,384	$607,419
Incentive	$/ac	0	$716	$671	$529	$434

8.4 Annual SALC Program Cost Summary

SALC program costs include incentive payment costs for Madera, Chowchilla, and Delta Mendota portions of the Madera County GSA and program administrative costs. Figure 5 below illustrates total program costs by year.

Figure 5: Total SALC Program Cost Summary



The SALC program structure, eligibility, and incentives will be refined as part of final program development, and subsequent implementation. It is emphasized (again) that crop market conditions will change over time. Therefore, program incentive payments described in this report will need to be updated periodically to ensure sufficient enrollment in the SALC program. Put another way, the demand management targets for each SALC program are only targets. The actual level of demand management achieved by the program could (and in fact are expected to) be greater or less than the target for several reasons. Changes in factors that affect supply (the cost to produce a crop) and demand (the price received for a crop) will continue to change over time due to many other factors other than the implementation of the GSP. These types of factors would be considered by the GSA in its annual updates to the program.

8.5 Options for Program Scale and Incentive Payments

The GSA evaluated a range of options for SALC program design. This included evaluating alternative structures for incentive payments, enrollment eligibility, and incentive payment premia. The report summarizes the final, selected program options based on stakeholder feedback and Board direction.

Other options considered for the scale of the SALC program included:

- 25% of total demand management target
- 100% of the total demand management target

Other options considered for the SALC program incentive payments included:

- Never-irrigated lands (based on the value of ecosystem services)
- Permanent enrollment in the SALC program (based on the capitalized value of water, net of fixed farming costs), which was between $10,000 and $13,000 per acre.
- Keeping lands in irrigated uses (not considered as part of program design because it would be inconsistent with GSP objectives)

The final option for SALC program implementation considered a hybrid rate structure. This is if the GSA decided to adopt a per acre assessment in addition to a per acre-foot (volumetric) charge. The component of the volumetric charge to cover GSA implementation would need to be adjusted in the SALC program incentive payments. As described in Section 6 and 7, there are several steps involved to calculate the SALC program payment. Therefore, a second alternative was developed for the GSA based on the estimated per acre-foot volumetric charges (as presented at the March 4, 2022 GSA Board public meeting).

Table 11: Irrigated Lands Incentive Payments, Hybrid Rates, Madera Subbasin (selected years)

Year	Units	2020	2025	2030	2035	2040
AF SALC	AF	0	24,500	33,750	39,350	45,000
Acres	acres	0	10,863	18,180	26,996	42,500
Cost	$/yr	0	$7,891,378	$11,676,918	$16,787,036	$26,693,166
Incentive	$/ac	0	$631	$494	$539	$565

Table 12: Irrigated Lands Incentive Payments, Hybrid Rates, Chowchilla Subbasin (selected years)

Year	Units	2020	2025	2030	2035	2040
AF SALC	AF	0	5,850	8,600	11,250	13,900
Acres	acres	0	2,794	5,398	10,296	23,476
Cost	$/yr	0	$1,891,726	$3,681,419	$5,875,698	$8,762,060
Incentive	$/ac	0	$576	$579	$504	$344

Table 13: Irrigated Lands Incentive Payments, Hybrid Rates, Delta Mendota Subbasin (selected years)

Year	Units	2020	2025	2030	2035	2040
AF SALC	AF	0	500	700	850	1,000
Acres	acres	0	318	544	850	1,400
Cost	$/yr	0	$227,871	$365,141	$449,384	$607,419
Incentive	$/ac	0	$716	$671	$529	$434

The incentive payments for the SALC program must be adjusted for consistency with the rate design approach. If they are not adjusted, this can push costs (unfairly) onto a subset of irrigators. For example, if the volumetric charge was not deducted from the SALC program incentive payment structure this effectively assumes that the lands that enroll in the SALC program would not have to pay the volumetric rate if they instead continued to irrigated. Clearly, such a situation is not fair because any land that continues to irrigate would have to pay the volumetric charge in order to realize the net return on that land.

It is not possible to develop every possible case for SALC program incentive payments as part of initial program planning as summarized in this report. Therefore, it is anticipated that the GSA will revisit some of these options as part of future program design and refinements. The parameters described in this report reflect final direction and input from stakeholders, GSA staff, and the Board.

9. Summary and Discussion

The objective of the SALC program is to develop strategic land repurposing that is aligned with GSP and GSA goals. In particular, the SALC program is intended to incentivize the resting, retiring, restoring, or (potentially) protecting of agricultural lands via alternative water-centric conservation easements and land retirements. In doing so, the program should ideally maximize the potential for multi-benefit land repurposing, including but not limited to ecosystem services, habitat function, and domestic well recovery. The initial program is developed to achieve the benefit that is most critical for the GSA and its stakeholders: groundwater.

The SALC program would acquire water from lands that voluntarily enroll, and the landowner/lessee would receive an incentive payment. That incentive payment would be set by the Madera County GSA Board, which should be reviewed and revised annually to reflect then-current market conditions. The methodology for the development of incentive payments and the program cost summary are discussed in detail in Sections 7 and 8, respectively. While the incentive payments currently are based upon the value of irrigated agriculture in the Madera, Chowchilla, and Delta Mendota Subbasins, it is conceivable to layer additional incentive payments that would account for parcel-specific multi-benefit repurposing opportunities, such as ecosystem services, floodplain management, or dry well mitigation.

Only irrigated lands are eligible for enrollment in the SALC program. Currently irrigated lands can receive Sustainable Yield of native groundwater (SY) and may opt-in for Transitional Water (TW), which is overdraft that has a planned ramp down over the implementation of the GSP. The SALC program could acquire SY or TW from irrigated lands. Because the quantity of TW will decrease over time, the SALC program incentive payments for the TW would be proportionately adjusted.

Three targets were evaluated for the scale of the SALC program: to achieve 25% of overdraft demand reduction, 50% of overdraft demand reduction, and 100% of overdraft demand reduction. At the direction of the GSA Board, the GSA plans to pursue the 50 percent level at full GSP implementation (not occurring until 2040), or approximately 45,000 acre-feet per year (AFY) reduction in Madera Subbasin; 13,900 AFY in Chowchilla Subbasin; and 1,000 AFY in the Delta Mendota Subbasin. The SALC program has a planned phase-in, in both enrollment and cost, through the implementation of SGMA. Note that the SALC program can be scaled up or down to achieve the desired level of demand reduction.

The SALC program development was informed through a series of extensive public meetings, stakeholder workshops, interviews, and other informal meetings with GSA landowners. This also included countless spontaneous requests for meetings, responses to emails, and review of stakeholder question and suggestions. Stakeholders interviewed stated strong preferences for program flexibility, such as shorter-term agreements and the ability to swap out lands that are enrolled.

Other implementation questions will need to be addressed, such as defining the terms of the easement, contractual obligations of both parties, payment disbursement, verification of contract performance, and penalties for breach of contract. These considerations would be part of SALC program implementation.

Finally, program performance should be monitored for key performance indicators such as participation, compliance rates, and socioeconomic and environmental metrics. These should be reviewed regularly to assess program performance and recommend revisions for improvement.

10. References

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11. Appendices

The following appendices are included:

Appendix A: SALC Program Fact Sheet

Appendix B: SALC Program Interview Summary

Appendix C: August 6, 2020 Meeting Summary

Appendix D: January 14, 2021 Meeting Summary

Appendix E: March 23, 2021 Meeting Summary

Appendix F: June 16, 2021 Meeting Summary

Appendix G: ParcelField Database Summary Characteristics

Appendix H: Ecosystem Service Value Literature Review

Appendix A: SALC Program Fact Sheet

The SALC program fact sheet was prepared and posted to the Madera County GSA website. This was developed to support stakeholder outreach and engagement during the program planning and development.

It is available on the web at: https://www.maderacountywater.com/wp-content/uploads/2020/11/SALC-Fact-Sheet-FINAL.pdf

Figure B-1. SALC Fact Sheet

Madera County Sustainable Agricultural Land Conservation (SALC) Program

Fact Sheet

With overdraft for Madera County as a whole estimated at 260,000 acre-feet per year with the 2015 crop mix, the County has been referred to as "ground zero" for the Sustainable Groundwater Management Act (SGMA). As one of several demand management actions, the County is undertaking a study to develop a Sustainable Agricultural Land Conservation (SALC) program. The program would incentivize setting land aside for dry land farming, or retiring the land for a short or long duration, helping ensure that the SGMA groundwater sustainability goal is met while using existing and future water supplies efficiently and promoting groundwater recharge to maintain a productive agricultural sector for future generations.

One component of the study will develop criteria for different types of agricultural land in the county, and features of that land that may align with program goals. The land criteria will help evaluate the suitability of land for conservation, evaluating elements such as soil suitability, recharge areas, prime farmlands, existing crops, and proximity to water infrastructure. It will also assist in identifying lands that may be beneficial to other planned projects in the GSP or provide co-benefits through temporarily resting (not using as irrigated farmland), permanently retiring, retiring and restoring, or permanently protecting lands.

General land categories identified in the study of the SALC program include:

- Unirrigated land that may remain unirrigated
- Irrigated land that may become unirrigated
- Irrigated farmland that may remain irrigated

Madera County Sustainable Agricultural Land Conservation (SALC) Program

Fact Sheet

The study will also develop a proposed incentive structure for agricultural land conversion or preservation in specific areas based on the land categories identified in the analysis. The program incentive structure will be consistent with other County demand management actions and other GSP projects. The study will also identify potential funding sources for the program. The incentive structure will consider operational, financial, hydrologic, and sustainability criteria for short- and long-term agreements for agricultural land conservation.

In addition to conforming to a diverse range of existing federal, State and local policies, guidelines and regulations, the program will be informed by stakeholder input. Stakeholder outreach will include an education component, focused on keeping the general public apprised of progress on the study, and an input-gathering component. Input will be collected at GSA meetings, through stakeholder interviews, and through a working group. Throughout the study period, interested parties will be able to provide input on the program at GSA meetings. The stakeholder interviews will be conducted with individual interest groups at the outset of the project and will identify areas of agreement and difference in their interests. After analyses of land categories and incentive structures have been conducted, the working group will provide additional input on particular program components that would benefit from a multi-interest stakeholder group discussion.

Appendix B: Assessment Interview Summary Report

As one demand management action related to implementation of the Groundwater Sustainability Plan (GSP) adopted to meet the Sustainable Groundwater Management Act (SGMA) requirements, the Madera County GSA (County) is undertaking a study to develop a Sustainable Agricultural Land Conservation (SALC) program. The program would incentivize setting land aside for dry land farming, or retiring the land for a short or long duration, helping ensure that the SGMA groundwater sustainability goal is met while using existing and future water supplies efficiently and promoting groundwater recharge to maintain a productive agricultural sector for future generations.

One component of the study will develop criteria for different types of agricultural land in the county, and features of that land that may align with program goals. The study will also develop a proposed incentive structure for agricultural land conversion or preservation in specific areas based on the land categories identified in the analysis. In addition to conforming to a diverse range of existing federal, State and local policies, guidelines and regulations, the program will be informed by stakeholder input. Input is being collected through various channels, beginning with stakeholder interviews. Stakeholder interviews were conducted to gather information from a representative cross-section of stakeholders affected by changes in agricultural land use and policies/programs anticipated under the Groundwater Sustainability Plan (GSP). Interviews were conducted with individuals representing the following groups:

- California Milk Producers Council
- Madera County Cattlemen’s Association
- Leadership Counsel for Justice and Accountability
- Self-Help Enterprises
- Madera County Farm Bureau
- Madera Ag Water Association (MAWA)

Input from the interviewees is summarized below. Interview details are confidential, so the summary below describes themes, trends, interests, and differences in stakeholder perspectives but no comments are attributed to a specific participant. Also, the particular set of interviewees, although chosen to represent a variety of interests, present a small sample, so the number of people who subscribe or don’t subscribe to a particular view should not be taken as meaningful. The intent of this report is to lay out different views and highlight some ideas that might be helpful to the County at this point of the process.

SALC Program Structure

A key theme from the interviews is the need to balance certainty and flexibility within the SALC program structure. Interviewees recognized the need for the County and the Subbasin as a whole to ensure that long-term water use aligns with the sustainability goals set forth in the GSP; and that using a structure that prioritizes long-term commitments to keeping land unirrigated will help the County’s planning. For landowners, there is a need for increased certainty about water supply in the near term, however they also need flexibility for the future.

Interviewees said that long-term conservation, in particular in perpetuity, is a hard sell and landowners are likely to be interested in shorter-term commitments. An interviewee emphasized that land is a farmer’s biggest asset, providing equity so that they can take out loans and make investments; a key question for farmers is how they will be able to leverage the value of their land if they participate in a program like this.

Interviewees said that growers want to keep their options viable and maintain all the benefits of the land. Many growers understand that there are few options for augmenting water supply in the County and would be willing to fallow land, however they want to maintain the ability to return that land to farming or a different land use at a later time.

Interviewees said that longer-term commitments would be more viable if the program structure allows changes to the particular land enrolled, allowing realignment based on the value of a crop as well as the agronomic value of the land. For example, a landowner may have a parcel that has a 20-year-old almond orchard in one area where the land has high agronomic capacity and a 10-year-old orchard in another area with lower capacity land. The landowner should be able to temporarily retire the land with the older orchard first, keep the younger orchard through its productive cycle, and then replant the area where the land is better and maintain the other area unirrigated for the remainder of the commitment.

One interviewee suggested a hybrid system in which land enrolled in a ‘diversion’ program, with a specific term of water use restriction, would receive water credits that could be traded between users. These credits could be purchased by other landowners or even a GSA. The parcel of land under the water use restriction would also be changeable, so that both the land earning the credit and the land on which the water credit is applied are flexible. The instrument restricting water use could be an agreement with the GSA or a permanent easement. This system would be something like a partial water market but could be implemented before a full water market to shed light on how the system might function in practice. It would provide a long-term guarantee of the total water use reduction within a given jurisdiction while providing significant flexibility to individual landowners. Another interviewee suggested a similar system in which land removed from production could be brought back into production by buying back water credits.

Another need in terms of flexibility is the ability to ‘repurpose’ land during the period over which a landowner has committed not to irrigate it, while still being able to return it to farming afterwards. Interviewees shared ideas about what might be done with lands during the time they are enrolled in a SALC program; for details, see the section titled Land Uses and Restrictions below.

Timing

Interviewees shared various perspectives related to program timing, including about the length of commitments within the program and about the timing of program implementation. Regarding the former, one interviewee said that people might be interested in making commitments as short as a 90-day growing season. Another suggested using a rolling, evergreen contract with a 10-year base unit, similar to the structure of the Williamson Act. Another suggestion is to use a very long-term contract, between 50-90 years, but to allow the parcel under the contract to be changed. Interviewees also said that many landowners are likely to assume that the program will include easements in perpetuity. An interviewee noted that for the many who grow tree crops, a shorter-term commitment will only make sense when a crop has reached the end of its productive years, as the growers need to secure a return on their investment. For these growers, the program will be incentivizing them to not re-plant rather than to take out land currently in production.

An interviewee said that the fact that land use in the region is constantly changing will affect interest in the SALC program. There may be more interest in participating in the program now, when wells are close to going dry, than in the future.

An interviewee said that decisions growers are making now are colored by uncertainty about demand management actions in the Subbasin; providing increased certainty will allow people to make the decisions that they know are rational. For example, landowners understand that due to water supply limitations, some land will need to be fallowed and replanting at this time is likely not advisable. However, they are concerned that taking land out of irrigation now will put them at a disadvantage later when programs like water allocation are implemented. Knowing how and when the various demand management actions will be implemented will allow landowners to make decisions and commitments that they would otherwise be reluctant to make. The interviewee said that if landowners could enroll in programs now, they would do so in order to have more certainty.

One interviewee identified a potential progression for developing and implementing demand management actions so that they build upon one another. They suggested beginning with a non-transferable water allocation, so that each landowner chooses how to distribute their allocation among their acreage. These allocations could then evolve into transferable water credits, which could then evolve into a complete water market. In this way, the final system can be responsive, and kinks can be worked out at each stage before adding an additional layer of complexity.

Factors in Decision-Making

Interviewees identified potential key factors for decision-making – either by the County or by potential participants in the SALC program, or both. As mentioned above, an interviewee noted that growers are currently making decisions based on incomplete information about how the suite of GSP projects and management actions will be implemented. The specifics of when and how the various programs will be run are key to landowners' decision-making about participation in a SALC program.

Multiple interviewees noted the tension between the interests of an individual farmer and the broader needs and interests in the Subbasin. For example, agricultural interests in the Subbasin would not want to see urban encroachment on prime farmland, but an individual landowner may be interested in the financial return on developing their land into housing. Similarly, a SALC program may find that landowners are interested in enrolling certain sections of their land while keeping others in production, creating a fragmented patchwork of areas that are potentially available for environmental uses. However, from the perspective of the County and for the use and enjoyment of some County residents, it would likely be preferable to have various acreages in the SALC program either next to each other, contiguous to parks, and/or providing buffer zones next to residential areas. One interviewee emphasized the need to balance public policy, taking a broad view of lands that would be advantageous to continue or not continue to farm in the County due to factors like soil quality and environmental values, with the landowners' individual choices, based on the particulars of their operation, land, and values.

Additionally, multiple interviewees said that decisions about whether to participate in a SALC program will ultimately come down to economics – are the incentives offered by the SALC program in line with the current value of water and of what they can produce on the land?[9] However, they also emphasized that the economics are particular to each landowner and will change over time as the value of water and crops fluctuate. For example, the economics of water supply will differ throughout the County, with groundwater pumping costs varying based on factors like low water levels or sand in the groundwater. An interviewee said that there is not a comprehensive dataset about the differential costs of water; well drillers and pumpers are likely to have the most comprehensive understanding of conditions in different areas, however this information would be anecdotal. Additionally, a farmer that recently made a large investment such as drilling a new well would be less likely to choose to stop cultivating their land in the near-term, even if their land is not considered to have a high agronomic value. Similarly, for tree growers, tree age will be a significant factor.

For dairies in particular, since cropping operations are likely to be the most affected by SGMA, and since they can transition to buying feed rather than growing it if need be (at an additional cost and with limits), this might allow them additional flexibility to participate in the SALC program. Though dairies currently use crops to apply nutrient water, a participant said that other solutions could be found for the nutrients.

Additional decision-making factors include the potential value of the land if it becomes unirrigated, for example if it is transitioned to rangeland, solar power production, habitat, etc. (See the section titled Land Uses and Restrictions below for discussion of potential uses of land moved out of irrigated production.) One interviewee also emphasized that personal values and worldview can be an important decision-making factor for some landowners.

Given the variety of reasons stated above, multiple interviewees acknowledged that there are too many factors to measure to be able to accurately determine what economic decision each landowner might make. Instead, they suggested there should be significant flexibility in the program to allow individuals to decide whether and how to participate over time, and, as discussed above, the public policy prioritization should not be overly prescriptive about lands that should or should not participate.

Incentives

As noted above, interviewees said that participation in a SALC program will be a largely economic decision for landowners. One interviewee said that the revenue generated per acre annually is an important starting point for determining the incentives,[10] however since land in the program would not require the same level of investment each year, the incentives would not need to be equal to annual revenue. On the flip side, the incentive needs to account for the maintenance costs that will be required on land taken out of production. (See the section titled Land Uses and Restrictions below for more on maintenance costs.)

An interviewee said that if the program provides flexibility to bring land back into production, growers are more likely to approach participation as a voluntary contribution for a period of time. However, as

[9] The SALC Project Team noted that water and land values will fluctuate with implementation of SGMA. The SALC program will likely need to align with these values as they fluctuate, rather than remaining at a static level set at the outset of the program.

[10] The SALC project team noted that profits (net income) not revenue (gross income) would be an appropriate starting point to determine incentives.

discussed in the timing section above, tree crops cannot generally be fallowed temporarily; given the amount of land dedicated to tree crops, the incentive will need to make the lost investment worthwhile.

An interviewee said that the biggest incentive growers will have for fallowing land is the flexibility of the water allocation. If a grower is able to apply water they would have used on a certain area on a different area, they will voluntarily stop irrigating some of their land. As noted in the previous section, the program should not become overly prescriptive in its attempt to be strategic.

One interviewee suggested considering amplifying the incentive by creating a structure in which money received as a program incentive would be taxed at a lower rate than other income.

Interviewees also shared ideas about the process through which the incentives could be established. One interviewee advocated for a bidding process as a good way to establish value while giving people a sense of control in the process. Two examples were shared:

- The Kern County GSA has a fallowing program that aims to fallow 200 acres to support demand reduction. They initially offered $300 per acre but no landowners chose to participate. They subsequently opened a bidding process through which a rate of $600 per acre plus waiver of the $150 GSA fee was set.
- The Palo Verde Irrigation District has a land fallowing program which provides an up-front payment of $3,000 per acre plus an additional yearly rate for lands fallowed. Landowners must commit to participating in the program for 35 years; during those years, they must fallow between 7-30% of their total acreage each year, and can fallow the maximum amount for up to ten of the 35 years. In addition to the up-front payment, landowners receive $700 per acre fallowed each year. The actual land fallowed can be changed from year to year; the land fallowed can even be owned by a different person, so long as the total amount meets the minimum commitment.

Setting Priority Areas

Interviewees discussed factors that should be considered in setting priority areas for the program, including equity, environmental needs, and types of farmland. As discussed above, some also warned against being overly specific in identifying areas for inclusion in the program; an interviewee said that this can be both inefficient and increase opportunities to “game the system.”

One interviewee suggested identifying preferential areas where incentives would be higher, such as areas farther from the river. An interviewee said that lands currently cultivated in both tree and row crops should be included. Another interviewee suggested focusing the SALC program on land that would be best suited to environmental uses, and allowing the rest to be decided economically. One interviewee said that the land itself is not the most important factor for the program and, as discussed above, it is important to provide flexibility in terms of the particular land kept unirrigated at a given time.

Multiple interviewees discussed the importance of creating accountability for larger farmers to cut back their usage so that small farmers do not go out of business while large farms continue to expand. For example, one interviewee suggested incentivizing or requiring that all growers move to 90% irrigation to ensure that growers of all sizes contribute to the overall reduction. Another interviewee expressed concern that a moderate incentive would appeal only to those farmers in the most precarious financial situation, leading small farms to go out of business. The interviewee advocated for developing an incentive structure that could support sustainable farmers, small farmers, and socially disadvantaged farmers to continue farming.

An interviewee said that the SALC program has the potential to address SGMA goals while also addressing other community needs. They suggested prioritizing and incentivizing land retirement to create a buffer zone around residential areas, particularly disadvantaged communities. This would help address health risks related to water and air quality, such as dust, pesticides, and lowering water tables.

Land Uses and Restrictions

Interviewees said that, in addition to the questions of how to get landowners interested in the program and determining which lands to include, the SALC program will need to clarify what will be done with land that is taken out of irrigation. Multiple interviewees emphasized that fallowed land has the potential to become a problem due to dust emissions, weeds, or other issues. One interviewee said that unirrigated land must still be managed, so the SALC program should provide funding and/or support for that management. Some growers will likely be interested in using fallowed land for recharge, however this option will not be viable in all areas.

Additionally, multiple interviewees said that it is important that landowners be able to get value out of their unirrigated land, whether transitioning to rangeland, seasonal grains, habitat restoration, a blend like rangeland restoration, solar, or other uses. One interviewee said that any land not currently developed should remain rangeland.

Multiple interviewees suggested that the SALC program could provide an opportunity to incentivize multi-benefit projects, such as helping communities access drinking water or providing parks and green spaces adjacent to communities while also taking land out of irrigated production and creating the buffer zones mentioned above. One interviewee said that added incentives could be provided for using community-led processes to make decisions about land-use changes related to the SALC program. Interviewees suggested that projects like community wells, sewers, or recharge basins could be located on land taken out of irrigation.

Third-Party Impacts

Multiple interviewees discussed the impacts that demand reduction programs like SALC will have on communities beyond the landowners participating directly in the program, for example on workers, supporting industries, and tax revenue. One interviewee said that the SALC study should acknowledge these impacts and provide examples of how these impacts have been mitigated in other areas. The interviewee said that the Palo Verde Irrigation District (PVID) fallowing program, discussed above, includes a fund to compensate for community impacts of the program and a community board to direct the funds. The PVID program sells the water from the fallowed lands and some of the revenue from those sales funds the mitigation program. The interviewee acknowledged that funding for mitigation may be challenging in Madera. An interviewee said that the GSA should consider how mitigation of third-party impacts related to a SALC program could be incorporated into efforts such as its community water supply and water quality program.

An interviewee said that job loss is an important impact of SGMA implementation and the SALC program should address how land taken out of production can be leveraged to provide other jobs.

Other Demand Management Actions

The suite of demand management actions and supply augmentation projects included in the GSP are highly interrelated and interviewees shared perspectives on monitoring, allocations, water markets, and recharge projects and how they might all fit together with a SALC program.

An interviewee noted that there is some uncertainty in the Madera Subbasin water budgets, so the first step in GSP implementation should be to monitor and charge for water use. They said that using LandIQ to monitor water use is cheap, at less than one dollar per acre each year, and could be implemented quickly. They said that this information will provide a needed baseline of information to support successful implementation of GSP projects and management actions.

As discussed in the incentives section above, some interviewees believe that the water allocation structure could serve as an important incentive for taking land out of production. One said that an allocation system which allows farmers to use their total allocation anywhere within their parcels would lead to some areas becoming unirrigated without necessitating a dedicated diversion program. An interviewee noted some challenges of an allocation system, including whether to allocate water to all lands or only those currently irrigated, whether to allow for transfer of water between landowners, and how to prevent hoarding of water credits.

An interviewee suggested beginning demand management with a non-transferable water allocation, evolving into a transferable water credit, and then evolving into a full water market. One said that there is enthusiasm about a water market, however it will have complex consequences and should not be implemented before there is robust monitoring and improved management of water use. Another interviewee said that there is a range of reactions to a potential water market. Some landowners are well positioned to purchase water and are looking forward to a water market, others will be unable to buy additional water but are willing to sell water, others who are likely to leave agriculture and are likely to be interested in a SALC program, and others are committed to maintaining agriculture in the Subbasin and will not make decisions from a purely economic angle.

Challenges and Additional Considerations

Participants identified a few additional challenges related to landowners' likely level of interest in a SALC program. One interviewee noted that the program is presented as voluntary, however many landowners may feel they are in a bind that makes participation in a program like this necessary. Another interviewee said that growers may be open to the idea of receiving incentives to take land out of production but may be less amenable to paying for others to receive such incentives. An interviewee said that clarity is critical about what a landowner will be relinquishing in exchange for the incentive. Another interviewee said that existing easements seem to be subject to an endless increase in fees and taxes. Another interviewee said that the SALC program should take a worst-case scenario in terms of the potential supply increase, planning for a need to reduce demand at a high level. Regarding funding the incentive program, an interviewee noted that the Integrated Regional Water Management groups could be a potential source of funding.

Additional Outreach

Finally, interviewees were asked if they had suggestions for others to reach out to. One suggested talking with growers who experienced allocations during the last drought, such as those on the west side of Fresno County, to help identify short- and long-term strategies to help growers through GSP implementation. Another interviewee said it is important to talk with both larger and smaller growers, who have different expertise and concerns. And another interviewee suggested doing in-depth outreach with a handful of growers to understand their perspectives and the context of their d

Appendix C: August 6, 2020 Meeting Summary

Presenters:

Bryan Thoreson, Davids Engineering; Duncan MacEwan, ERA Economics; Malka Kopell, Sacramento State Consensus and Collaboration Program

Meeting Summary:

Bryan Thoreson reviewed how the Sustainable Agricultural Lands Conservation (SALC) program fits within the broader groundwater sustainability strategies in the Madera Subbasin Joint Groundwater Sustainability Plan (GSP), project objectives, and a timeline for the SALC study. The GSP includes demand management (water use reduction) strategies, with possible approaches including allocation, water market, land resting/retirement and easements, and fee structures. The SALC study will present and analyze issues the County may consider to design a program to assist with resting land through easement and fee structures.

The SALC study will

- Assess and develop an agricultural land conservation program with the primary objectives of developing:
  - Criteria for identifying and prioritizing land for its potential to be temporarily rested, permanently retired, or retired and restored and
  - An incentive program structured for resting, retiring, restoring, or protecting land under alternative water-centric conservation easements/land retirement
- Develop program incentives consistent with other GSA demand management program efforts

Mr. Thoreson emphasized that the program, if adopted, would put in place incentives for resting or retiring land, but decisions about whether to participate in the program would be entirely up to individual landowners.

The SALC study project includes the following components; a timeline of the tasks is presented below.

- Collaborative Outreach: meetings with key stakeholders to obtain input
- Maps: land use categories
- Criteria and fee structure
- Collaborative Outreach: Present criteria and fee/incentive structure and gather feedback
- Final plan: Land use categories, criteria, and fee/incentive structure
-

Tasks		2020							2021		
		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Task 1.	Collaborative Outreach										
Task 2.	Create a map of relevant layers for land prioritization										
Task 3.	Create criteria for land ranking and fee structure										
Task 4.	Collaborative Outreach										
Task 5.	Completion of Final Plan										

Mr. Thoreson's presentation included the following:

- Ag Land Conservation: incentivizing reduction in water use
    - Two possible approaches for fee structure: defined fee amounts or through bidding
        - Klamath River and Walker River basins use bidding
    - Ensure that programs are consistent with other existing programs in the county, including allocation and water market
- Incentive structure:
    - Considerations
        - Including mix of crops and their contributions to the county economy
        - Land use
        - Capital investments required
        - Other county economic implications
        - Jobs
        - Other stakeholder feedbacks
- Preliminary mapping of current land use
    - Over 50 GIS layers so far, starting with those used for the GSP
    - Draft land use categories
        - Unirrigated land that is currently in use as grazed rangeland
            - It would be useful to achieving sustainability to maintain these unirrigated
        - Irrigated land that could become unirrigated (approximately 37,000 total acres)
            - Considered the economic impact of potentially moving this land to unirrigated – permanent crops have long-term investments
            - Approximately 37,000 acres could potentially become dry land farmed or restored to rangeland
            - Identified land in the vicinity of disadvantaged communities (DACs) that could become unirrigated, based on the DWR DAC mapping tool and LandIQ cropping data
        - Irrigated farmland that may remain irrigated

Advisory Committee Member Questions/Comments and Responses

- As you are moving forward with refining land use categories and incentive structures, consider building in equity component, for example that those targeted for fallow won't automatically be small farms or BIPOC farmers.
    - No areas are targeted – working to develop incentives that individual farmers can choose to utilize or not.

- Who developed the criteria for the land use classifications?
  - The Farmland Mapping and Monitoring Program at the State Department of Conservation.
- Some of our properties didn't have designation on the map shown, and on another map, some of our lands were listed as annual crops though they are used for dairy feed and might not fit in that category.
  - Some lands were removed from the designation map based on being rangeland and other reason; we will review.
- Maps need to be accurate in terms of the kind of production and for how long.
- There are two types of alfalfa, that grown directly by dairies and grown for sale on an open market. These should not necessarily fall into the same category.
  - At this time we do not have a way to develop that information, as the dataset lists simply what the crop is.
- Typically those who grow alfalfa are growing it for dairy, regardless of who is farming it.
- As land gets rehabilitated, the current designation of "prime" land may lose validity.
- What is the definition of "unique farmland"?
  - The program would develop incentives and individual landowners would then make decisions based on those incentives, rather than the program determining which land will or will not be taken out of irrigated production.
- The program should consider that cultivation of hay can provide multiple benefits when its complete cycle is considered, though it uses a lot of water. Some benefits include the ability to recharge over winter, supporting habitat, and having irrigation flexibility that many other crops do not have. The program should consider comprehensive elements beyond dollars or gallons per acre. Another consideration should be whether it is fertilized.

Questions and Responses from Members of the Public

- What is the website being referred to?
  - MaderaCountyWater.com
- When you do your economic value for various crops, you need to be sure to include in your calculations the value of dairy production that needs the crop lands to comply with Regional Board dairy discharge permits.
- Will environmental considerations be included?
  - Yes, they will be considered. The maps presented today are initial examples, and we do have an environmental category for GIS layers.

Chairperson Devin Aviles emphasized that this is a first step and the program is based on creating an incentive structure. The County will not take crops out of production; it will categorize land that may be eligible to receive incentives, and then individual growers and landowners will make their respective decisions.

Appendix D: January 14, 2021 Meeting Summary

SUMMARY

SUSTAINABLE AGRICULTURAL LANDS CONSERVATION (SALC) PROGRAM UPDATE

MADERA COUNTY GSAs

Date: January 14, 2021

Time: 10am-12 noon

Location: via Zoom webinar

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1. WELCOME AND INTRODUCTIONS

Stephanie Anagnoson, County of Madera, welcomed participants to the Sustainable Agricultural Lands Conservation (SALC) Program workshop, noting that it was one of several workshops related to demand management and supply augmentation projects to support the County's Groundwater Sustainability Plan (GSP) implementation; others include recharge, measurement, allocation, and water market.

Malka Kopell, Sacramento State Consensus and Collaboration Program, reviewed the workshop agenda and use of the remote participation platform and noted that workshop presentation slides would be available on the Madera County Water website following the meeting, at https://www.maderacountywater.com/land-conservation/.

In addition to live discussion during the workshop, participants were invited to provide feedback through a survey. The survey link was shared initially during the introductions and again during each discussion period.

2. OVERVIEW OF SALC PROGRAM STUDY

Bryan Thoreson, Davids Engineering, briefly reviewed the Madera Subbasin GSP, which requires both consumptive use reduction and increased supply. The SALC program – land resting, retirement, and easements – is one of the ways that Madera County GSA is working on reducing consumptive use. The SALC program study objectives are to develop

- Criteria for identifying and prioritizing land for its potential to be temporarily rested, permanently retired, or retired and restored and
- An incentive program structured for resting, retiring, restoring, or protecting land under alternative water-centric conservation easements/land retirement

The SALC program will be used in conjunction with, and will be consistent with, other projects and management actions.

Mr. Thoreson showed the areas covered by the Madera County GSAs and reviewed key mapping data referenced in the SALC study and program development. The data will be used to evaluate alternative program structures and can be queried to select different types of lands, allowing flexibility to respond to future program needs.

3. OVERVIEW OF OTHER PROGRAMS SIMILAR TO SALC

Duncan MacEwan, ERA Economics, gave an overview of other programs in and outside of California that take land out of production for a specified time to support demand management. He highlighted key features of two programs in particular: the Klamath Water and Power Agency (KWAPA) Water User Mitigation Program and the Kern 7th Standard Rotational Fallowing program. The former is organized as a reverse-auction bid program and KWAPA accepts the lowest bids that add up to the total needed reduction in a given year. In the latter, direct payments to landowners are offered on an annual basis and interested landowners can enroll. The program has had to increase the payment offered when no landowners chose to participate at the initial price offered.

4. SALC PROGRAM OPTIONS AND PARTICIPANT FEEDBACK

Mr. MacEwan reviewed the demand management options and targets for the Madera County GSAs: reduction in consumptive use of 27,550 AF in Chowchilla Subbasin and 90,000 AF in Madera Subbasin by 2040. This total reduction will be achieved through a combination of some or all of the following approaches: allocation, water market, land resting/retirement and easements, and fee structures; the share achieved through each has not yet been defined.

Key aspects of the SALC program which need to be defined include the program incentives and how these costs would be recovered, as well as specifics of the easement terms.

Mr. MacEwan presented three illustrative example scenarios of SALC program cost, overall and per irrigated acre, at different proportions of total demand management achieved by SALC.

Mr. MacEwan reviewed other key program considerations, including length of easement, multi-benefit lands, partners and funding, potential for third-party impacts, consistency with other GSP programs, and incentives for currently unirrigated lands.

Participants were invited to ask questions and share feedback on these or other considerations.

- Are there any more current results from the KWAPA program?
    - The data presented is the most recent publicly available data, though since the program is currently active there may be more current information.
- Can an area be considered retired while also being dryland farmed and used as a recharge basin?
    - This has not yet been determined. Careful water and cost considerations are needed for this potential arrangement as the incentives and costs of both recharge and SALC are developed. For purposes of SALC, the key goal is reduction of evapotranspiration of applied water (ETAW); land that was historically irrigated and is changed to dryland farming would likely be considered to no longer have ETAW.
- If different lands will receive different incentives for participation in SALC, for example if there are different incentives for different land uses, how will that ranking or

scoring be determined?
    - This would be a program decision for the Madera County Board of Supervisors to make in their capacity as the Board of the Madera County GSAs.
- How will the SALC program be tied to the water market pilot, if at all? If it is not, how will the potential overlap be addressed?
    - This study recognizes that the various projects and management actions are all related and therefore their incentive structures also need to be related and aligned in some way. The specifics of how this will look have not yet been determined, but the consultants working on the different projects are in communication as they are all being developed. The County understands that for the growers, there are multiple layers and considerations related to the different programs and projects.
- If a water market is established and a grower participates in a SALC incentive program, what will happen to the sustainable yield allocation that parcel would have been entitled to use? Will someone be able to use it?
    - This has not yet been determined. As mentioned above, these programs and their incentive structures are all interrelated and the answer to this question is a critical consideration in this study.
- How would annual obligations like those discussed in the examples fit into the need to permanently reduce use?
    - This was not answered directly as these considerations were discussed later in the presentation; see below.
- Is this study considering how a SALC program might support protection of species under Endangered Species Act, for example by developing a habitat conservation plan and targeting multi-year fallowing?
    - The SALC study has not looked specifically at this. The participant was invited to share more detailed comments through the survey.
- Would annual payments be consistent each year?
    - It is most likely that they will change over time, reflecting changes in the value of water and land.
- Program structure needs to consider how much land can be enrolled while maintaining an affordable tax assessment to fund the program. In the 7th Standard program, those paying for the program through Prop 218 rates get a share of the benefit, based on their acreage. For those participating in the program, the payment is adjusted based on the actual amount of land fallowed and the $150 charge is essentially waived, through a reassessment the following year.
- Consider pursuing funding through the Natural Resources Conservation Service Regional Conservation Partnership Program (RCPP). The RCPP may require that lands be conserved in perpetuity.
- When determining the basin's demand reduction, is it compared to the historical average? If the SALC program takes land out of production only one year at a time and that land can come back into production the next year, how will long-term demand reduction be assured?
    - The GSP specifies the annual reduction target, based on the total consumptive use reduction needed by 2040. An advantage of longer-term or permanent easements is that they provide greater assurance that SALC-related demand reduction will be maintained over time.
- Could the SALC payment vary with the price of water in the water market each year? This way the water user would be protected while also sharing the risk of water market price fluctuations.

  - The value of water should be fairly aligned between the market and the incentive structures for programs like SALC so that they can work in concert. However, the program is not aimed toward hedging risk related to the price of water on the water market.
- The cost of the transitional water is also related to all the GSP projects and actions.
- The GSP projects and actions should be structured in a way that allows for coordination between them to provide flexibility and multiple benefits, rather than making growers pick and choose between programs.
- Many farms have areas that are less productive and have poorer soil. If small, targeted areas could be enrolled in the program it would lessen the economic impact while saving the same amount of water. This would require more participants in total, but lessen the impact on each.
  - Specific decisions like this will be made in the implementation stage. During the planning stage, many options are being considered in order to achieve the goal of reducing ETAW while minimizing the costs to all.
- Is a “permanent transferable” option being considered?
  - Yes, this could be considered. The key consideration would be whether the intended demand reduction is being achieved.
- Short-term annual easements may be a good mechanism allowing landowners to “test drive” participating in the program before making a longer-term commitment.
- Two key considerations for landowners considering participating are what would happen to the allocation for the enrolled land and whether there are any limits on non-irrigated uses of enrolled land.
- What portion of total demand management will SALC address?
  - SALC will likely be part of a portfolio of demand management actions and the Board will determine the ultimate distribution between the actions. If SALC were the main driver of demand management reduction, it would be very expensive, as the examples demonstrated. There is overlap as well as tradeoffs between the different programs. A benefit of SALC is the potential to leverage partners for multi-benefits, however the more demand reduction is carried by SALC, the more expensive it becomes per acre-foot.
- Would the price in SALC ultimately be close to the price in the water market?
  - Yes, we expect that the prices will be fairly closely aligned.

5. NEXT STEPS

Ms. Anagnoson reviewed next steps in the SALC program study:

- Receive and incorporate stakeholder feedback
  - Participants were encouraged to submit comments in the survey by January 15th
- Finalize incentive structure
  - Currently irrigated lands
  - Unirrigated lands
  - Other multi-benefit funding opportunities
- Prepare draft SALC program outline
  - The draft outline will identify options
  - Adoption and program specifics will be determined by the GSA
- Next presentation: March or April 2021

6. ADJOURN

Appendix E: March 23, 2021 Meeting Summary

SUMMARY

MADERA COUNTY GSAS PUBLIC WORKSHOP

RECHARGE & SUSTAINABLE AGRICULTURAL LANDS CONSERVATION (SALC) PROGRAMS

Date:	March 23, 2021
Time:	2:00 – 4:00 pm
Location:	via Zoom webinar

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1. WELCOME AND INTRODUCTIONS

Stephanie Anagnoson, County of Madera, welcomed participants to the public workshop on two Madera County Groundwater Sustainability Agencies (GSAs) programs: the Sustainable Agricultural Lands Conservation (SALC) and Recharge programs. The programs represent two parts of the County's groundwater sustainability strategy, which incorporates both demand management (such as SALC) and supply augmentation (such as recharge). Other related efforts include allocation, measurement, and water market.

Malka Kopell, Sacramento State Consensus and Collaboration Program, reviewed the workshop agenda and use of the remote participation platform and noted that workshop materials would be available on the Madera County Water website following the meeting. She invited participants to introduce themselves using the chat panel.

In addition to live discussion during the workshop, participants were invited to provide feedback through a survey. The survey link was shared initially during the introductions and again during each discussion period.

2. Introduction and GSP Review

Ms. Anagnoson shared background information on the County GSAs Groundwater Sustainability Plan (GSP). Analysis in the GSP estimates that without any demand management or supply augmentation programs, the Madera Subbasin would face an average overdraft of 165,900 acre-feet (AF) each year from 2040-2090. To close that gap, the County GSA requires both consumptive use reduction and increased supply. By diverting all available flood waters, the County will increase recharge by an average of approximately 60,000 AF annually over the fifty-year period mentioned above. The County's crop water use reduction program will reduce extraction by 90,000 AF and the remaining 15,900 AF crop water use reduction will result from permanent recharge basins replacing areas that are currently irrigated. These programs will be implemented between now and 2040, with different programs ramping up at different times and transitional water used to cover the difference as the programs are implemented.

3. SALC PROGRAM

Study Overview

Duncan MacEwan, ERA Economics, gave an overview of the SALC program. The SALC study developed

- Criteria for identifying and prioritizing land for its potential to be temporarily rested, permanently retired, or retired and restored and
- An incentive program structured for resting, retiring, restoring, or protecting land under alternative water-centric conservation easements/land retirement

The central purpose of the SALC program is reducing water use, though other objectives may also be considered in the future. It will be used in conjunction with and be consistent with other projects and management actions.

The SALC program provides an incentive payment for lands enrolled in the program and in exchange acquires water, and other benefits, from enrolled lands. The SALC program is paid for through charges to lands not enrolled in SALC. The program will cover lands in the Madera County GSAs in all three Subbasins.

Feedback Received at Earlier Meetings

The SALC program has been the focus of previous stakeholder meetings, at which stakeholders shared the following input:

- Multi-Benefit Lands and Funding
  - What does multi-benefits mean?
    - Lands that generate water in addition to flood management, habitat, other ecosystem services, and other strategic land uses
  - Multi-benefit opportunities
    - Outside funding sources could augment SALC program costs in the future, such as AB 252 (Rivas)
    - Funding opportunities are unlikely to cover full SALC program costs
  - Continue to pursue grants and other partner funding opportunities, but structure SALC program incentives independent of these sources
- SALC Program Structure
  - The SALC program should be flexible to allow landowners to enroll and switch parcels in the program over time
  - Length of easements
    - Interest expressed in short-term agreements (maximum flexibility)
    - Longer-term (including permanent) agreements were also considered
- SALC Program Consistency
  - Can a parcel enroll in both SALC and recharge programs?
    - A parcel could enroll in both SALC and the recharge program
  - Does a parcel enrolled in SALC receive any water credits that could be sold in the water market (Sustainable Yield or Transitional Water)?
    - The SALC program is effectively purchasing the water, and an enrolled parcel would not be not included in the Farm Unit
  - Can a landowner pursue additional outside funding opportunities for land enrolled in SALC?
    - An individual landowner may receive additional outside funding and still be eligible for SALC

- Outreach to local land conservancies is ongoing

Workshop participants shared the following comments and questions:

- Will the County conduct outreach to communities located adjacent to industrial agricultural operations? Communities are interested in leveraging the SALC program to achieve multiple objectives, including establishing buffer zones between residential areas and agriculture to address pesticide and air quality threats while also reducing water use.
  - At this time, the program is focused particularly on reducing water use, but the multiple benefits mentioned could be added as additional goals as the program is implemented and funding opportunities sought.
- Other than not using water, will there be other requirements for what must or may not be done with enrolled land, for example must land be kept mowed or disced?
  - This has not yet been defined.

SALC Program Incentive Payments

The SALC program is voluntary, so the County will incentivize participation in the program by offering a payment to enrolled lands. These incentives are part of the overall program implementation costs related to the County GSPs, along with water acquisition, recharge, and domestic well mitigation programs. Given that landowner considerations regarding whether to participate in the SALC program will likely include income from farming, existing crops and land quality, alternative land uses, and transition planning, typical crop returns are a standard basis for approximating incentive payments. Incentives based on crop returns depend on various factors, for example:

- Crops produced
- Age of orchard/vineyard
- Costs
- Crop market conditions (prices)
- Available water supply

Mr. MacEwan reviewed two examples of existing land repurposing demand management programs to illustrate how the incentives might be structured: the Klamath Water and Power Agency (KWAPA) Water User Mitigation Program and the Kern 7th Standard Rotational Fallowing program. In the Klamath Basin program, potential participants submit bids to the program. As the program acreage increases, the incentive amount per acre increases because higher value crops or lands come into play. The Kern 7th Standard program pays a set price per acre to all participants. However, when the program was first implemented, the initial offer was not accepted by any landowners so a second, increased incentive had to be offered to attain the target participation.

In Madera, the incentive payment amounts would change over time, as the program scales up and the available transitional water supply decreases. Mr. MacEwan shared examples of the range in the incentive values with current transitional water and market conditions.

Lands that are currently irrigated can receive both sustainable yield and transitional water, if they opt in to the latter. SALC would acquire both the sustainable yield and transitional water for any currently irrigated lands that enroll. As the transitional water amount decreases over time, the SALC incentive payments will be adjusted proportionally.

Lands that are currently not irrigated, such as grass or rangelands, can opt in to sustainable yield water, and SALC would acquire that water for any such lands that enroll in the program. A final decision has not yet been made as to whether non-irrigated lands that do opt in and/or that do not opt in to sustainable yield can participate in the SALC program. If so, additional considerations such as ecosystem benefits may be considered.

Participants were encouraged to respond to the survey questions related to SALC.

Workshop participants shared the following comments and questions:

- Would lands enrolled in SALC be subject to the GSA assessments? How will the assessments be structured – will transitional water carry all the cost or both sustainable yield and transitional water?
  - This has not yet been decided – enrolled lands may or may not be subject to the assessments. The rate consultant will consider whether the charges will be per acre, carried only by transitional water, or split between sustainable yield and transitional water, and will present options to the Madera GSAs Board.
- If non-irrigated lands participate in the SALC program, how would that contribute to reduction in consumptive use?
  - This program is focused on water savings, however some stakeholders contend that these programs should not be limited only to those lands that contributed to existing overdraft through irrigation. Additionally, grasslands and rangelands can have valuable ecosystem co-benefits. No decision has yet been made on this.
- California State Assembly Bill 252 could, if passed, be a vehicle for SALC collaboration.

SALC Program Cost

The overall cost of the SALC program depends on the scale of the program. Mr. MacEwan shared three examples of SALC program cost, at different scales: with SALC accounting for 25%, 50%, or 100% of the total demand management target. All of the examples used current transitional water and crop conditions to estimate the costs. The examples illustrate that program cost rises at an increasing rate as SALC covers more of the demand reduction.

Workshop participants shared the following comments and questions on the scale and cost:

- In these estimates, how much was the estimated per acre payment for enrolled lands?
  - The incentive rate differs in each of the three examples because as the program scale increases, the incentive will need to increase to bring in more valuable lands. The examples use a similar crop mix and approach to that used in the Kern program discussed above, with the incentive payment amounts used in the three examples ranging between about $400-$700 per acre.
- In the examples shared, does the “cost per acre” represent the incentive paid to the landowner of enrolled lands or the cost to the landowners who are continuing to irrigate of funding the program?
  - It represents the cost of funding the program to landowners that are continuing to irrigate, on a per acre basis.
- The cost ranges in the examples are wide; does the analysis include how these costs might change as factors, such as the price of almonds, change?
  - Yes, we have the ability to see how costs might change as component factors change. The focus at this time is on determining what portion of total demand management the SALC program will account for. Once that has been set, we will get more specific about the factors influencing the program incentives and

costs.

Next Steps

Next steps in the SALC program study include gathering feedback from stakeholders, completing outreach, and finalizing the SALC program report and options. Once the report and options are finalized, they will be presented to the Board of the County GSAs, who will make decisions about program adoption and implementation.

4. RECHARGE

Study Overview

Tommy Ostrowski, Davids Engineering, gave an overview of the recharge study. The objective of the Recharge Study is to develop a strategic recharge plan and implementation program to achieve groundwater recharge through in-lieu practices, Flood-MAR, and spreading basins with the following specific objectives:

- Develop projects that address “low hanging fruit” first.
- Develop and implement projects that optimize on-farm recharge versus recharge basins another methods.
- Identify and pursue funding opportunities for implementation of projects.
- Identify or establish partnerships with public agencies and non-profits to advance recharge

As noted for SALC above, program costs should be consistent with other GSA project and demand management program efforts.

The study estimates that the County GSAs could use flood flows to recharge an average of 27,953 AF per year in the Chowchilla Subbasin and 39,177 AF per year in the Madera Subbasin.

Recharge Areas

To identify lands to use for recharge, the study will select the “best” areas based on:

- Hydrogeologic Factors
- Distance to Water Supply and Conveyance
- Relationship to Underrepresented Communities (URCs)
- Grant-specific factors
- Current cropping
- Landowner interest

For the latter factor, interested landowners submitted forms identifying lands they would be interested in using for recharge. The forms submitted identified 164 parcels, representing a total of 31,458 acres, in the Madera and Chowchilla Subbasins.

The Study identified focus areas in both Subbasins, based on the factors above:

- Chowchilla Subbasin
  - East area with conveyance via Madera Canal and Chowchilla Water District (CWD) system (subject to CWD approval)
  - West area with conveyance via Eastside Bypass and new constructed conveyance

(pumps and pipes or gravity)

- Madera Subbasin
  - East area with conveyance via Madera Canal and Madera Irrigation District (MID) system (subject to MID approval)
  - West area with conveyance via Eastside Bypass and new constructed conveyance (pumps and pipes or gravity)

Prop 68 Grant Project Overview

In January 2021, grant applications were submitted for Proposition 68 funding for both Subbasins. Draft awards are now under review. The project submitted for the Chowchilla Subbasin is the west focus area, including:

- Flood water in Eastside Bypass
- New constructed conveyance (pumps and pipes)
- Two recharge areas (basins)
- Flood-MAR

The Madera Subbasin project is in the east area and includes:

- Madera County Reclamation contract for Section 215 water
- Conveyance via Madera Canal and MID system
- One recharge basin—turnouts on MID lateral 6.2 and gravity pipeline
- Flood-MAR—3 turnouts on MID laterals 6.2 and 32.2

Status of Project Concept Development

Mr. Ostrowski said the approach applied in the Prop 68 Chowchilla Subbasin project will be replicated along the bypass to achieve recharge goals in the west areas of both Subbasins. The application included 37 points of diversion; some of those will likely be utilized to expand the project concept and recharge outcomes.

For the east areas of the Subbasins, the project concept is to convey Section 215 water through the Madera Canal and CWD facilities to lands identified through the recharge interest forms, including both dedicated basin and Flood MAR areas.

A phased approach will be used implement these recharge project concepts, to distribute the capital outlay and provide a feedback loop for adapt and enhance the approach. Recharge elements (for example, basins or pipelines) will be packaged strategically into projects, beginning with the Prop 68 projects. The projects represent significant infrastructure, with an estimated 60 miles of pipeline between the two Subbasins and nearly 90 diversion/delivery points. The projects will be implemented over the next five to six years achieve the total recharge targets.

Next Steps

Next steps include:

1. Reviewing and refining project concepts and locations
   a) Preparing descriptions of conceptual projects
2. Preparing preliminary estimates of costs
   a) Planning costs (design, environmental, etc.)
   b) Capital cost/construction costs

    c) Operations & maintenance costs
3. Coordinating with rate study team and Madera County staff regarding financing the projects

The Recharge Study team will evaluate options to reduce costs, such as

- Prioritize lands with high recharge capability to reduce length of pipe required. High recharge potential based on:
    - Soils/hydrogeologic factors
    - Capable of being inundated on a frequent basis
    - Topography
- Strategic distribution systems that utilize existing channels, pipelines, or private irrigation systems.
- Consolidation of diversion points

Stakeholders were invited to suggest other cost reduction ideas or considerations.

Workshop participants shared the following comments and questions on recharge:

- Has the recharge study considered ways to increase the recharge potential of a given parcel of land?
    - No, however it is likely a worthwhile consideration given the program's cost reduction considerations.
- Is the County addressing "place of use" limitations with the Bureau of Reclamations?
    - Yes, the County is meeting regularly with the Bureau and there do not appear to be legal hurdles to conceptually expanding the place of use.

5. NEXT STEPS

Ms. Anagnoson thanked participants for joining the workshop and encouraged them to share feedback through the survey.

Participants asked the following questions

- Will a recording of the workshop be posted online?
    - The workshop recording and summary will be posted; other materials, such as the presentation slides, are already posted on the County website.
- Will stakeholders have an opportunity to review the proposed recharge plans in more detail?
    - Interested properties have not yet been grouped into phases, but interested stakeholders can reach out to Ms. Anagnoson for further information.

6. ADJOURN

Appendix F: June 16, 2021 Meeting Summary

Q&A SUMMARY

JOINT PROJECTS PUBLIC WORKSHOP

MADERA COUNTY GSAs

Date:	June 16, 2021
Time:	3pm – 5pm
Location:	via Zoom webinar

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1. RECHARGE STUDY

- Is the County coordinating with Madera Irrigation District (MID) on the recharge plans?
  - Doing recharge using the MID system requires coordination with MID; they will also be using that system at the same time. That is not the only way to get water, but it is a major one, as the County does not have its own infrastructure. If there is capacity and their needs are met, MID is willing to coordinate.

- Please explain further about Proposition 68 funding.
  - It is a State funding source. The County submitted two proposals, one the Chowchilla and one for the Madera Subbasin. The Chowchilla proposal builds on the Triangle T project and funds some of the work, though there is more work to be done that will require additional funds. Triangle T has submitted a water right to divert water on the bypass, with points of diversion identified within the County GSA. The grant project is centered around those existing points of diversion, to secure the water source.

- Regarding selection of recharge sites, how deep of soil information does SAGBI provide? Does the plan include other characterization methods like geophysics?
  - In addition to SAGBI, the team looked at sources like well completion reports, borings, and others to understand conditions beneath the vadose zone.

- If a landowner develops their own recharge basin, do they get credit for that in their individual account, or does the recharged water go to the basin as a whole?
  - As part of the allocation, a landowner with their own recharge basin would get a credit to their own farm unit, with some amount of leave behind. The leave behind goes to the GSA, not the Subbasin. Recharge credits would need to be metered to measure the dynamics.

- Are the recharge basins in Chowchilla, Madera, or both?

  - For those in the County GSA (white areas) recharge basins – whether dedicated basins or on-farm flood recharge – do not have to be in the district.

- Would the recharge credits be tradable?
  - This is not yet determined.

- Could growers get credit for recharge if the bypass or San Joaquin River banks break, leading to land being flooded?
  - Recharge will need to be metered in order to determine credits, so there is not a way to credit recharge from a levee breaking.

- Does the county have any resources to help individual landowners obtain appropriative rights to storm water passing by or through their land?
  - The County offer does not offer a service like this, but landowners should reach out to the County to coordinate efforts. The County is working to coordinate with Triangle T and Aliso to ensure that messaging to the State Water Resources Control Board are consistent and well understood.

- When will the list of those interested in recharge be updated?
  - Please follow up individually.

2. SUSTAINABLE AGRICULTURAL LAND CONSERVATION PROGRAM STUDY

- Are you distinguishing between never irrigated and non-irrigated lands?
  - No, that is why we are using the word "non-irrigated"

- How is the program paid for?
  - All the programs under discussion are rate-payer based – assessments will pay for the programs.

- Do the production costs used to estimate a price include the GSA administration and water fees?
  - Yes, that is part of why the payments change over time. Other costs, independent of this program, will impact returns to farming over time, such as changes in transitional water and other costs.

- When land is taken out of production for a single year, how will the program ensure the land does not cause dust or contribute to agricultural burning? Do the incentives include support for additional costs related to land use change?
  - The costs do not include additional payment for changing the land use – the "repurposing" aspect of the program – though some similar programs do have an additional payment for that aspect. The numbers shared here would aim to incentivize forgoing irrigation, without additional management on top of that. The key to the program will be to look at multi-benefit outcomes, which would provide access to additional funding sources.

- Will the county participate in lowering taxes on these lands? Would the value of the land be reassessed for lands participating in repurposing?
  - The County is aware of the economic challenges that could bring.

3. DOMESTIC WELL INVENTORY

- Does the County have a timeline for when the rate study will be completed and the mitigation program to begin? Who will be included in that rate study – irrigators only?
  - The County anticipates completion by the end of the year. This is a board decision. The Board could also choose to distribute the costs of the different programs differently.

- Does the County have data on the average depth of domestic wells versus depth to water in areas of the basin?
  - Yes, the Study is looking at how water levels relate to well depths, with domestic well depth information based on construction information from well completion reports and depth to water based on groundwater level data and modeling.

- Will the analysis identify a healthy well depth – a depth beyond which drilling a well would impact the aquifer's health?
  - Some continued decline in groundwater levels is anticipated during the implementation period. Hopefully the water levels will rebound as the sustainability period approaches.

4. OTHER QUESTIONS

- Is there a timeframe for when farmers should expect to get a bill for pumping groundwater for irrigation?
  - Yes, this year is a dry run where you will have a dry run, can track your water use using IrriWatch; then the rate study will be completed this year and will be charged for next years use and it will be billed all at once. Will be billed by how much you pump.

- Growers are making budgets now for 2022; it would be very helpful to know now what the anticipated costs will be, as growers need to go to the banks by July 2021.
  - Will pass this feedback on regarding the timeliness.

- One of the charts showed SALC staying consistent over time – are other programs making up for the loss of the TW – what could be our sustainable yield if we are doing additional recharge? The blue is growing from where we are now – are we able to use that additional water? And is SALC not adding something back in?
  - On the screen we are looking at aggregate; the total amount is based on the water budget, shown here as constant. What is available on a per-acre basis. Yes, the SALC program is adding into the bucket, and so is recharge.
  - You are saying – what does water use in 2040 look like – what would be available to us above the SY.
- When I look at this, it looks like a solvable problem.
  - Yes, it is a solvable problem, but not at this level of farming. You can combine these numbers into a solution, but it does involve taking some acres out of production.
- More like subtracting from the deficit than adding to the bucket?
  - Yes.

- If evapotranspiration, not applied water, is measured, why does the type of irrigation used matter?
  - The difference between applied water and the evapotranspiration of that applied water depends on the method of irrigation – for example with drip irrigation, it will be very close number.

- What is the total cost per acre of all of the programs combined?
    - The rate study will combine the individual costs of all the programs. The reason the answer is tricky is that the recharge program has big capital costs paid for by bonds, so that will be repaid in the rates. There are also considerations within the programs that will impact the eventual cost.

- Is there a ballpark number for the total cost per acre?
    - Not at this time.

- What is being done about building additional storage, for example the bond measure passed to build more dams?
    - Recharge is a water storage program, storing water in the ground.

- The State and County should work on above ground storage.

- As growers divert land out of production, the amount of groundwater in the system will change. The chart doesn't show how the sustainable yield will grow as farmers retreat from growing. It there a way to circle back to pump more later on?

- Growers need to know the cost as soon as possible to plan accordingly, including how they will need to change their practices. Growers also need to understand how that money will be spent.
    - These programs are being built largely from the ground up, therefore these numbers take time to develop.

- There is existing expertise on how to address these problems; collaborative problem solving is important, rather than siloing the work in the County.

- Will IrriWatch show the total allocation for each farming unit parcel?

- Can you please repeat your description of the dry run and rate study, as well as when pumping charges will be implemented?
    - This year is the dry run – growers will be able to track groundwater use against an allocation that was just adopted. The rate study should be complete by the end of 2021, which will result in volumetric rates for calendar year 2022. The billing mechanism for the charge at the end of the calendar year is still being worked out.

- I have a 10-acre pasture that has not been flood irrigated since prior to 2014. Can I opt-in for sustainable yield to irrigate this field?
    - For questions related to particular parcels, please follow up after the meeting.

- If the rate study goes through, will pumping be assessed? How much?
    - This is not yet determined. The assessment will go in a special fund for GSA management.

- Will the total allocation on IrriWatch be by total farm unit, or per field?
    - It can show both.

- If a grower uses less than they were allocated, do they get a credit?

- The County does not have a policy or rule on that yet, but is considering some level of rollover credit.

- Would the rollover be for sustainable yield, transitional water, or both?
  - The County does not yet have a policy on this.

- Other GSPs aim for sustainable yield over a five-year, rather than annual, period – so that one could overirrigate one year and underirrigate the next to be considered in balance. Is this being considered.
  - This has not yet been discussed.

- Will allocation be based in any way on the crop being grown?
  - The allocation is not based on crop type.

- If a grower has a crop that needs more water than the allocation amount, what do they do?
  - Each grower will consider these questions based on their individual situations, and determine the best course of action, such as taking a part of their land out of production or deficit irrigating the full area.

- What will happen, and how much will it cost, if a grower irrigates more than allocated.
  - This is not yet determined.

- Do these projects account for planned population growth and associated water use in the County projected by 2040?
  - Yes, the GSP accounted for planned development in Madera County.

- One suggestion for overpumping is looking at what subordinate water is costing in MID.

- Regarding conveyance of surface water, key considerations include whether other GSAs in the valley are also planning to use water from the same sources, and whether future expected change in flow of these conveyance sources has been taken into account.
  - Yes, the County is aware of this regional challenge. Acting quickly is therefore important.

- If a grower deficit irrigates, or stops irrigating altogether, how can IrriWatch tell that this approach has been taken while plants are still producing? A green canopy, whether irrigating or not, will be shown as using water.
  - ETAW can see how much plants are transpiring, not just whether the canopy is green. The County will follow up to share more technical details with interested stakeholders.

- A study from Cal Poly showed that even on idle ground there is annual ET of 7.5 inches. How is this accounted for? How is ET from double cropping and fallowing half the year calculated?
  - Plants do continue to transpire on fields even after irrigation from residual moisture. The system will need to account for that. Reporting when crops come out may be the easiest way to address some of these issues.

- Fallowed land continues to show ET because of precipitation. I would encourage the Madera County GSA to develop a policy on how to handle precipitation evaporation.

- If you some number of growers take enough land out of production to meet the Subbasin's need for reducing groundwater use for the year, how will this be communicated to other growers so that they are able to use what they need?

- This is a dynamic landscape. However, each farmer will need to meet their own quota (their allocation), even if someone else fallows land. A re-allocation would only be taken up is there were very large-scale fallowing. The County hears regularly from stakeholdes that are interested in being paid to retire land.

Appendix G: ParcelField Database Characteristics Summary

A total of 37 unique characteristics were determined for each ParcelField. These are listed below in Table C-1, briefly described, and organized into a characteristic category.

Table C-1. ParcelField Database Characteristics.

Category	Characteristic	Characteristic Description
ParcelField Characteristics	ParcelField ID	Unique identifier for each parcel field
	Parcel ID	Parcel ID from Public Lands Survey System (PLSS)
	Land IQ Field ID	Identification of Land IQ Irrigated Field Number from 2016 Coverage
	Land IQ Crop	Identification of Crop from 2016 Land IQ Coverage
	Proxy Crop	Proxy Crop, based on Proxy Summary Sheet
	Zoning	County Zoning Code for Land Use
	Zoning Description	Description of County Zoning Code for Land Use
	Parcel Acreage	Acreage of Parcel
	ParcelField Acreage	Acreage of ParcelField
	Land IQ Field Acreage	Acreage of Land IQ Field
	ParcelField Perimeter-Area Ratio	Ratio of Perimeter/Area (feet/acres) of ParcelField, provides a measure of the regularity of ParcelField shape with the smaller the value, the more regular the shape
Soils Characteristics	Dominant General Land Capability Class	Dominant General Land Capability Class of the ParcelField, expressed as a number between 1 and 8 according to criteria defined by NRCS, with lower values being indicative of better suitability for agricultural cultivation
	Full Land Capability Class	Full Land Capability Class of the ParcelField, as defined by NRCS
	Dominant Land Capability Class Percentage	Percentage of the ParcelField within primary General Land Capability Class
	General Land Capability Class Count	Count of the General Land Capability Classes within the Parcel Field
	Dominant Farmland Mapping and Monitoring Program (FMMP) Classification	Dominant Farmland Mapping and Monitoring Program Classification

Category	Characteristic	Characteristic Description
	Dominant FMMP Classification Percentage	Percentage of the ParcelField within the dominant FMMP Classification
	FMMP Classification Count	Count of FMMP Classifications within the ParcelField
	Dominant Soild Agricultural Groundwater Banking Index (SAGBI) Classification	Dominant Soil Agricultural Groundwater Banking Index Classification
	Dominant SAGBI Classification Percentage	Percentage of the ParcelField within the dominant SAGBI Classification
	SAGBI Classification Count	Count of SAGBI Classifications within the ParcelField
Location and Proximity Characteristics	County	County that ParcelField falls within
	Groundwater Subbasin	Groundwater Subbasin that ParcelField falls within
	Groundwater Sustainability Agency (GSA) Area	GSA Area that ParcelField falls within
	Within Water District	List Water Districts for ParcelFields within a Water District Service Area
	Proximity to Nearest Madera County Confined Animal Feeding Operation (CAFO)	Distance (miles) to Nearest Madera County CAFO
	Nearest City	Name of the nearest city
	Proximity to Nearest City	Distance (miles) to nearest city
	Nearest Disadvanted Community (DAC) (Census Designated Place)	Name of the nearest DAC (Census Designated Place)
	Proximity to Nearest DAC (Census Designated Place)	Distance (miles) to Nearest DAC (Census Designated Place)
	Within DAC (Census Designated Place)	Name of DAC (Census Designated Place)
	Within DAC (Census Designated Tract)	Name of DAC (Census Designated Tract)
	Within DAC (Census Designated Block Group)	Name of DAC (Census Designated Block Group)
	Within DAC	Notes Yes or No (Y/N) to mark if ParcelField is within any DAC coverage
	Within Economically Distressed Area (EDA) (Census Designated Place)	Name of EDA (Census Designated Place)

Category	Characteristic	Characteristic Description
	Within EDA (Census Designated Tract)	Name of EDA (Census Designated Tract)
	Within EDA (Census Designated Block Group)	Name of EDA (Census Designated Block Group)
	Within EDA	Notes Yes or No (Y/N) to mark if ParcelField is within any EDA coverage

Appendix H: Ecosystem Service Value Literature Review

This appendix summarizes the studies reviewed to present a range of potential benefit values for different types of ecosystem services.

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