FINAL REPORT

Red Bluff Subbasin

Sustainable Groundwater Management Act

Groundwater Sustainability Plan

(Executive Summary)

January 2022 Revised April 2024

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EXECUTIVE SUMMARY

ES 1. Introduction

In 2014, the California legislature enacted three bills, AB 1739 (Dickinson), SB 1168 (Pavley), and SB 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act (SGMA) in response to overdraft conditions of California's groundwater resources. Since 2016, the Tehama County Flood Control and Water Conservation District (Tehama County FCWCD) (District), a local and regional authority, is the exclusive GSA for the Red Bluff Subbasin. The Tehama County Groundwater Commission serves as an advisory commission to the Tehama County Flood Control and Water Conservation District Board of Directors for GSA related matters. Groundwater Commission meetings, which are open to the public, were held on the 4th Wednesday of each month, except holidays.

The GSP provides information demonstrating that the past and present actions of the GSA have created a sustainably managed groundwater basin. The GSP outlines planned management oversight and activities that will result in continued sustainability of the groundwater resources in the Red Bluff Subbasin.

This Executive Summary and the companion GSP are organized as follows:

- Executive Summary
- Section 1 Introduction
- Section 2 Plan Area, Basin Setting and Water Budgets
- Section 3 Sustainable Management Criteria and Monitoring Network
- Section 4 Projects and Management Actions
- Section 5 Plan Implementation
- Appendices

The following sections provide factors about the Subbasin and an overview of technical content in the GSP.

The Red Bluff Subbasin (Subbasin) (DWR Subbasin No. 5-21.50) (**Figure ES-1**) has been identified by the California Department of Water Resources (DWR) as a high priority subbasin. Under SGMA high priority subbasins are required to prepare and be managed under a GSP by January 31, 2022. This GSP, prepared by the GSA, adequately defines groundwater conditions in the managed area and establishes criteria to maintain and/or achieve sustainability within 20 years of the GSP adoption.

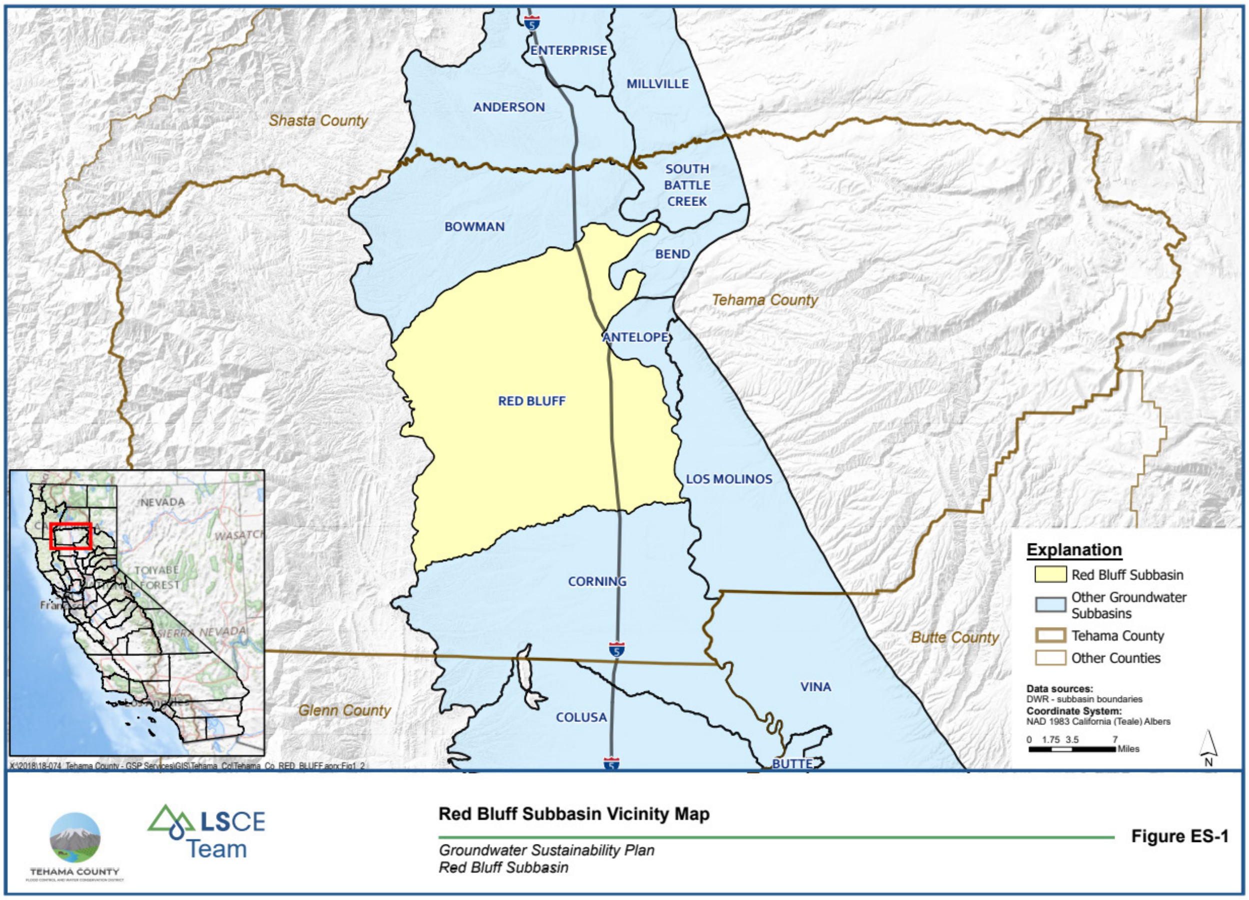

Figure ES-1. Red Bluff Subbasin Location Map

A Public Draft GSP was made available for public review and comment on September 24, 2021, for a period of 45 days. The GSA will receive comments, review, and prepare responses to comments, and revise the Draft GSP. The Final GSP will include those revisions. Comment letters and responses will be included as GSP appendices.

ES 1.1 GSP Revisions

In 2024, the GSA revised the GSP to resolve deficiencies identified by DWR in October 2023.

On October 26, 2023, the GSA received a letter from DWR documenting the incomplete determination of the GSP submitted for the Subbasin in January 2022. The letter described deficiencies identified by DWR and indicated that the GSA would have the opportunity to perform corrective actions to address the noted deficiencies within a 180-day period concluding on April 23, 2024.

In 2024, the GSA revised the GSP through a collaborative process to address the identified deficiencies. Following coordination meetings and public outreach, significant revisions to the GSP have been made including:

- Revisions to the description of undesirable results;
- Revisions to the Minimum Thresholds (MTs) for Chronic Lowering of Groundwater Levels;

- A revised assessment of overdraft conditions in the Subbasin and strategies to mitigate;
- Revisions and additions to Projects and Management Actions, to include revised and expanded recharge projects, a demand reduction plan, and a well mitigation program.

These changes are reflected in the relevant sections of this new revised version of the GSP.

ES 2. Summary of Plan Area

The Red Bluff Subbasin (DWR Subbasin No. 5-021.54) covers 271,800 acres and is in the Northern Sacramento Valley Groundwater Basin (**Figure ES-1**). Red Bluff is one of seven (7) subbasins within Tehama County. The Tehama County FCWCD is the exclusive GSA for six (6) of those subbasins: Antelope, Bend, Bowman, Los Molinos, Red Bluff, and South Battle Creek. The seventh, the Corning Subbasin, extends into Glenn County, and the GSP for that subbasin is being developed in a coordinated effort between the Tehama County FCWCD and Corning Sub-basin GSA.

The lateral extent of the Subbasin is consistent with Bulletin 118 (DWR, 2018). It is bounded on the north by the Bowman Subbasin on the east by the Bend Subbasin, the Antelope Subbasin, and the Los Molinos Subbasin, on the south by the Corning Subbasin and on the west by the Coastal Mountain Range. The eastern and western boundaries of the Subbasin generally follow the Sacramento River and Coastal Mountain Range, respectively, and the southern boundary generally follows Thomes Creek. The vertical boundaries of the Subbasin are the land surface (upper boundary) and the definable bottom of the basin (lower boundary). The definable bottom is the base of fresh water located at depths approximately from 400 to 2,400 feet below ground surface (bgs) at different locations within the Subbasin.

Lands in Red Bluff Subbasin are mostly privately owned with state and federal agencies owning a small portion. Private lands are majority farmland with nearly equal amounts riparian and other native vegetations. Over 5,000 groundwater wells exist in the Subbasin, and most are domestic wells. A small number of wells are operated for the public water supply and roughly fifteen times that number of wells are maintained for agricultural production. Numerous monitoring programs are operated in the Subbasin by federal, state, and local public agencies including the EPA, USGS and DWR. Monitoring programs collect data on groundwater levels, groundwater quality, land subsidence and surface water conditions. Data from these programs were incorporated (as applicable) into the evaluation of basin conditions within this GSP and were part of previous management plans including the Tehama County AB3030 Groundwater Management Plan (GWMP) and the Northern Sacramento Valley Integrated Regional Water Management Plan (IRWMP). Components of these management plans were incorporated into this GSP.

ES 2.1. Basin Setting and Hydrogeologic Conceptual Model

The ground surface generally slopes from the west to east with steeper slopes in the west of the Subbasin and water generally flows eastward towards the Sacramento River. Aquifer recharge contributions to the deeper geologic formations occur where the formations outcrop at the surface, however recharge of the Subbasin primarily occurs from the flow of the Sacramento River and perennial streams where saturated hydraulic conductivity of soils is high. Water flows downward in the Upper Aquifer driven by natural recharge. Gaining conditions along streams represent discharge from the aquifer to surface water and occur seasonally. Larger sources of discharge from the aquifer are likely from production of wells even though a portion of the water returns to the aquifer via recharge from irrigations. Even with the noted groundwater withdraw there is little to no reported evidence of subsidence within the Subbasin.

A horizontal groundwater gradient magnitude ranges from about 9 ft/mile to 20 ft/mile in the valley floor, and 30 and 38 ft/mile in hillslopes. Seasonal high water levels range between about 10 and 110 ft bgs. Groundwater quality is good with no widespread presence of contaminants at undesirable levels reported in the Subbasin.

The Subbasin is defined as a two-aquifer system with unconfined to semi-confined conditions in the Upper Aquifer and semi-confined to confined conditions in the Lower Aquifer. Fresh water occurs as groundwater to a maximum depth of over -2,400 ft msl in the east of the Subbasin. The major water bearing formations within the Subbasin are the Tuscan and Tehama Formations with some contribution from the shallower Quaternary sedimentary deposits. More recent geologic history is dominated by fluvial and alluvial deposition.

ES 2.2 Water BudgetIn accordance with technical guidance documents provided by DWR, water budget scenarios were evaluated using a groundwater flow model that quantified historical, current, and projected groundwater budget conditions. The water budgets were developed through application of the Tehama Integrated Hydrologic Model (Tehama IHM), a numerical groundwater flow model that characterizes surface water and groundwater movement and storage across the entire Subbasin and extending outside of the Subbasin. The Tehama IHM is an integrated groundwater and surface water model developed for the purpose of conducting sustainability analyses within Tehama County. The model used foundational elements of DWR's SVSim regional model for the Sacramento Valley (DWR, 2021) and was refined locally for improved application in the Subbasin area. Use of publicly available modeling platforms is a guiding principle under DWR Best Management Practices and facilitates independent assessment of modeling results.

The model was calibrated using records from 1990-2019 (29 years). This period represents long-term average hydrologic conditions and is considered the historical water budget period. The current water budget presents information on the effects of recent hydrologic and water demand conditions on the groundwater system and spans five different recent periods. The historical and current water budget periods were selected to evaluate conditions over discrete representative periods considering the following criteria: Sacramento Valley water year type; long-term mean annual water supply; inclusion of both wet and dry periods, antecedent dry conditions, adequate data availability; and inclusion of current hydrologic, cultural, and water management conditions in the Subbasin. Water budgets were calculated for a projected 50-year period, 2022 through 2072. The 50-year projected water budget uses hydrologic conditions representative of the most recent 50 years of hydrology in the Subbasin, with adjustments applied in scenarios for evaluating the water budget under climate change and altered water supply and demand conditions.

Model results indicate that over the historical period the largest outflow from the groundwater system (GWS) comes from groundwater pumping (on average 80 thousand-acre feet (taf) per year). Groundwater discharge to the surface is 55 taf per year. Deep percolation is the largest net inflow to the GWS (39 taf per year). Subsurface inflows from adjacent subbasins and upland areas represents 49 taf per year gain to the GWS. Groundwater root uptake represents a small flux of 9.7 taf per year of the leaving the GWS. Over the 29-year historic period cumulative change in storage was around -310 af per year.

The recent three-year period from 2016 through 2018 is believed to provide a reasonable representation of the recent water budget conditions based on an evaluation of past water budgets and the hydrologic conditions over these recent periods. A comparison of several future modeled water budgets was made to define the possible effect of different climate change and management action scenarios. Overall projected storage change in the Subbasin is small and differs little between the different climate change conditions.

This GSP revision addresses the determination letter corrective action 2a (excerpt below).

> "The GSAs should revise the GSP to provide a reasonable assessment of overdraft conditions and include a reasonable means to mitigate overdraft. Specifically, the Plan must be amended as follows:
>
> Reevaluate the assessment of overdraft conditions in the Subbasin. Specifically, the GSAs should examine the assumptions that were used to develop the projected overdraft estimates in the projected water budget considering the results vary greatly from the values reported in the historical and current water budgets and the recent annual report data. The assessment should include the latest information for the Subbasin to ensure the GSP includes the required projects and management actions to mitigate overdraft in the Subbasin."

The first part of correction action 2a is addressed below, and projects and management actions are updated in Chapter 4. At the 5-year Periodic Evaluation, the integrated surface water-groundwater model, SVSim, will be updated and calibrated with new information that includes but is not limited to improvements to the conceptual model based on information from the AEM survey, new geology water level and well information, new water budget inputs, and updates to climate change predictions. The numerical model was not used in the revised GSP. The Revised GSP provides a new estimate of groundwater storage change, overdraft, using published values from the GSP and recent empirical data documented in annual reports. This method to estimate water storage, overdraft was presented to DWR in consultation meetings. The annual storage changes for water years 2019 through 2023, in order and rounded to the nearest 100 AF: 75,000 AF, -49,000 AF, -164,000 AF, -87,000 AF and 66,000 AF are averaged to yield the updated overdraft estimate of -31,800 AFY. These five years were Wet, Dry, Critically Dry, Critically Dry, and Wet, respectively. The range of years was selected to begin in 2019 based on land use changes that indicate an increase in water use from crops, mainly walnuts and almonds, and hence likely to influence future water use.

The GSP documents a projected groundwater overdraft of 4,100 AFY, whereas annual reports for WY 2021 and WY 2022 report -164,000 acre-feet and -87,000 acre-feet, respectively. The water budget elements were derived from the model through WY 2019 and were derived from an empirical method described in the annual report for WY 2020-2023. The significant difference in the values from 2019 compared to subsequent years is likely both a function of the method and hydrology, with WY 2021 and WY 2022 both Critically Dry. The new estimate of overdraft, -31,800 AFY, will be evaluated in future annual reports.

The revised estimate of overdraft in section 2.3.6.2, Groundwater System Water Budget Summary is -31,800 AFY, instead of the previous estimate of the 2016-2018 average of 11,000 AFY. This difference between 11,000 AFY and -31,800 AFY indicates that the sustainable yield may be 42,800 AFY lower than the range above (112,500 to 187,500 acre-feet per year). The sustainable yield will be included in the Periodic Evaluation in January 2027 using the Tehama IHM.

The sustainable yield was estimated to be 150,000 acre-feet per year, which is equal to the volume of groundwater extracted annually in the Subbasin (by pumping and by uptake) minus the simulated change in storage in the projected model scenario with future land use and 2070 climate change conditions. Under these conditions groundwater extractions total about 154,000 acre-feet per year on average. Projected change in storage is nearly -4,100 acre-feet per year which results in the sustainable yield equaling 150,000 acre-feet. Assuming potential uncertainty of 25 percent associated with the water budget estimates, an associated range of values for the estimated sustainable yield would be 112,500 to 187,500 acre-feet per year.

ES 3. Sustainable Management Criteria

The GSA recognizes that impacts to beneficial usershave occurred in the Red Bluff Subbasin. These impacts coincided with the 2020 to 2022 groundwater elevation lows when dry conditions existed in the region. Consequently, groundwater extraction increased and water levels correspondingly decreased. The areas that roughly define the experienced impacts are called Focus Areas. The boundary of the Focus Areas were made in consideration of reported dry wells (since 2015) and the hydrographs at RMS, especially their rate of decline. In the Red Bluff Subbasin, there are three Focus Areas.

Focus Areas are areas that have observed impacts and, as such, we can use that information to define the MTs. MTs for chronic lowering of groundwater levels are "the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results." Undesirable results occur when significant and unreasonable effects for any of the six sustainability indicators defined by SGMA are caused by groundwater conditions occurring in the Subbasin. The GSA defines the negative effects to beneficial uses and users that would be experienced at undesirable result conditions as 10 wells becoming dry (after the GSP revision) within each Tessellation Hexagon or 2) when water levels at any RMS in the future decline 7.5 ft or more over a five (5) year period.

The GSA is aware of the hardship to well owners if their wells no longer provide water due to management of the subbasin and the related decline in water levels. Currently, in Tehama County, residents whose household wells or springs have gone dry can apply for free water deliveries through North Valley Community Foundation (NVCF). Water delivery is a temporary solution, and the GSA will implement a well mitigation program to provide a long-term solution. The GSA has adopted a resolution (Appendix 4-C) to commit to this program. The well mitigation program is a response to DWR's determination letter: "Lastly, the GSA should explain how potential alternate supplies of water or well mitigation will be considered by the GSA during its management of the Subbasin in a project or management action as part of the GSP."

Sustainable management criteria include establishing a sustainability goal for the Subbasin, defining undesirable results, and quantifying minimum thresholds and measurable objectives.

The sustainability goal for the Red Bluff Subbasin GSP is to manage the groundwater Subbasin to:

- Protect and maintain safe and reliable sources of groundwater for all beneficial uses and users.
- Ensure current and future groundwater demands account for changing groundwater conditions due to climate change.
- Establish and protect sustainable yield for the Subbasin by achieving measurable objectives set forth in this GSP in accordance with implementation and planning periods.
- Avoid undesirable results defined in the GSP in accordance with SGMA.

Sustainable management criteria (SMC) also define the conditions that constitute sustainable groundwater management. Note that undesirable results have not occurred historically in the Red Bluff

Subbasin and are not projected to occur in the future. The sustainable management criteria will commit the GSA to meeting the sustainability goal for the Subbasin.

Sustainability indicators are measurable indicators that are used to set Measurable Objectives (MO), interim milestones and Minimal Thresholds (MT) to ensure that the sustainability goals are met. Undesirable results occur when significant and unreasonable effects are caused by groundwater conditions for a given sustainability indicator. Sustainability indicators are listed in **Table ES-1** along with whether undesirable results occurred in the subbasin and if they are likely to occur in the future without GSP implementation. Sustainability indicators will be measured at representative monitoring sites (RMS) selected based on location, aquifer, and historical data. MOs, MTs and undesirable results are defined in **Table ES-2.**

Table ES-1. Summary of Undesirable Results Applicable to the Plan Area

SUSTAINABILITY INDICATOR	HISTORICAL PERIOD	EXISTING CONDITION	FUTURE CONDITIONS WITHOUT GSP IMPLEMENTATION
Chronic Lowering of Groundwater Elevations	Yes	Yes	Yes
Reduction of Groundwater Storage	Yes	Yes	Yes
Seawater Intrusion	Not Applicable	Not Applicable	Not Applicable
Degraded Water Quality	Limited	Limited	Limited
Land Subsidence	No	No	No
Depletion of Interconnected Surface Water	Data Gap	Data Gap	TBD

Table ES-2. Summary of MT, MO, and Undesirable Results

SUSTAINABILITY INDICATOR	MINIMUM THRESHOLD	MEASURABLE OBJECTIVE	UNDESIRABLE RESULT
Chronic Lowering of Groundwater Elevations	**Focus Areas:** 2020-2022 groundwater lows **Outside Focus Areas:** 2020-2022 lows minus 20 feet	**Upper & Lower Aquifer:** Spring 2015 groundwater elevation minus five feet (for wells with increasing or no groundwater trends) or projected Spring 2042 groundwater elevation minus five feet for wells with declining groundwater elevations	10 supply wells become dry (after the GSP revision) within a tessellation hexagon, or when water levels at any RMP in the future decline 7.5 ft or more over a five (5) year period.
Reduction of Groundwater Storage	**Upper & Lower Aquifer:** Amount of groundwater in storage when groundwater elevations are at their minimum threshold	**Upper & Lower Aquifer:** Amount of groundwater storage when groundwater elevations are at their measurable objective	25% of groundwater elevations measured at same RMS wells exceed the associated MT for two consecutive fall measurements.
Land Subsidence	Two feet over 20 years (i.e., no more than 0.5 feet of cumulative subsidence over a five-year period (beyond the measurement error), solely due to lowering of groundwater elevations	One foot over 20 years (Zero inelastic subsidence, in addition to any measurement error). If InSAR data are used, the measurement error is 0.1 feet and any measurement 0.1 feet or less would not be considered inelastic subsidence	50% of RMS exceed the minimum threshold over a 5-year period that is irreversible and is caused by lowering of groundwater elevations
Seawater Intrusion	Not Applicable	Not Applicable	Not Applicable

SUSTAINABILITY INDICATOR	MINIMUM THRESHOLD	MEASURABLE OBJECTIVE	UNDESIRABLE RESULT
Degraded Water Quality	**Upper & Lower Aquifer:** TDS concentration of 750 mg/L at all RMS wells	**Upper & Lower Aquifer:** California lower limit secondary MCL concentration for TDS of 500 mg/L measured at RMS wells	At least 25% of RMS exceed the minimum threshold for water quality for two consecutive years at each well where it can be established that GSP implementation is the cause of the exceedance
Depletion of Interconnected Surface Water	Same as chronic lowering of groundwater levels (Initial)	Same as chronic lowering of groundwater levels (Initial)	25% of groundwater elevations, measured at the same RMS wells, exceed the associated MTs for 2 consecutive fall measurements.

ES 3.1. Chronic Lowering of Groundwater Elevations

The Revised GSP updated the MTs for RMS, however MOs are maintained as are IMs. The MOs for Chronic Lowering of Groundwater Elevations indicator is defined at each of the RMS (wells) as that well's spring 2015 groundwater elevation minus five feet or projected 2042 groundwater elevation minus five ft for wells with declining groundwater elevations. MTs for chronic lowering of groundwater levels were developed and updated in 2023-2024 through the GSP revision process. The MT for groundwater levels is defined with recognition of experienced impacts to beneficial users (Focus Areas) and potential future impacts to beneficial users (outside the Focus Areas). The MTs outside the Focus Area are the 2020-2022 low water levels with a 20 ft operational margin below those levels, meaning, 2020-2022 lows -20 ft. Undesirable Results occur if 1) 10 supply wells become dry (after the GSP revision) within a tessellation hexagon, or 2) when water levels at any RMP in the future decline 7.5 ft or more over a five (5) year period.

Well impact analysis was conducted and includes wells from all dates and of all types. This dataset likely is incomplete and not completely accurate. However, the projected basin-wide number of wells that could go dry if all RMS water levels are at their MTs is 1,230 of the 4,783 wells, or 26%. The well impact analysis and a map of predicted impacted wells at MTs are included in Chapter 3.

ES 3.2. Reduction of Groundwater Storage

The groundwater storage reduction sustainability indicator will be evaluated using groundwater levels as a proxy in conjunction with annual evaluations of monitored groundwater level changes. Based on considerations applied in developing the groundwater level minimum thresholds, reduction in groundwater storage minimum thresholds do not exceed any identified significant and unreasonable level of depleted groundwater storage volume.

ES 3.3. Subsidence

Land subsidence is not known to have occurred in the subbasin, is not occurring presently and is not expected to occur without GSP implementation. MOs have been defined as a decline of one foot over 20 years. Subsidence is based on InSAR data. InSAR measurement error is 0.1 feet and any measurement 0.1 feet or less would not be considered inelastic subsidence. MTs are defined by a decline of two feet over 20 years. Undesirable Results are defined as 50% of RMS exceeding the minimum threshold over a 5-year period that is irreversible and is caused by lowering of groundwater elevations. RMS for subsidence are the InSAR pixels collocated or near the water level RMS wells.

ES 3.4. Degraded Water Quality

Groundwater quality in the Subbasin is good with no widespread presence of contaminants at undesirable levels reported in the Subbasin. Present conditions are unchanged from conditions within the historical period however conditions could worsen without GSP implementation. MOs are defined by the California MCL for TDS of 500 mg/L measured at RMS wells. MTs are set at 750 mg/L measured at RMS wells. Undesirable Results occur if 25% of RMS exceed the minimum threshold for water quality for two consecutive years at an individual well where it can be established that GSP implementation is the cause of the exceedance.

ES 3.5. Seawater Intrusion

Due to the location of the Subbasin relative to any potential source of seawater this sustainability criterium is not applicable to this subbasin.

ES 3.6. Depletion of Interconnected Surface Waters

The interconnected surface water sustainability indicator could not be properly defined due to gaps in historical surface and groundwater monitoring programs. It is not known if conditions will worsen without GSP implementation without a reliable way to correlate the groundwater and surface water elevations. Due to the lack of data associated with this sustainability indicator the MOs and MTs are considered interim and will use the Chronic Lowering of Groundwater Elevations sustainability indicator as a proxy. An Undesirable Result is defined as 25% of groundwater elevations measured at upper aquifer RMS wells dropping below the associated threshold during two consecutive fall measurements.

ES 3.7. Monitoring Network

Monitoring networks are developed to quantify current and future groundwater conditions in the Red Bluff Subbasin, as well as within individual GSA jurisdictions. The monitoring network for sustainability indicators is summarized in **Figure ES-2.** There are a total of eight RMS wells in the Red Bluff Subbasin, seven in the Upper Aquifer and one in the Lower Aquifer. In addition to these eight wells the monitoring network will include three new TSS wells that will be completed to monitor both aquifers. The seven Upper Aquifer wells and three TSS wells serves as the monitoring locations for the Chronic Lowering of Groundwater Elevations, Reduction of Groundwater Storage, Depletion of Interconnected Surface Water, and Water Quality indicators. The Lower Aquifer wells and TSS wells are associated with the first three indicators, but not the Interconnected Surface Water Depletion indicator. The InSAR RMS are pixels collocated or near the water level RMS wells. Measured water level elevations will inform MO and MTs for Chronic Lowering of Groundwater Elevations, Reduction of Groundwater Storage, Depletion of Interconnected Surface Water indicators. Water quality samples taken from RMS wells will inform the MOs and MTs for the Degraded Water Quality indicator. Land Subsidence will be informed at RMS (select pixels) using satellite InSAR data. The monitoring network will be periodically reviewed and modified as needed; for instance, additional RMS wells may be added to better understand interconnected surface waters. The TSS wells are multi-screened wells intended to monitor both the upper and lower aquifers. TSS-1 is installed, and monitoring of its water levels has commenced. However, TSS-2 and TSS-3 are yet to be installed. Insufficient water level data has been collected to establish SMC for TSS-1.

A Data Management System (DMS) was developed to store and analyze data collected as part of this GSP. With submittal and implementation of the Red Bluff Subbasin GSP, there will be a publicly accessible weblink to view reports, maps, graphs, and current data under the Subbasin monitoring plan.

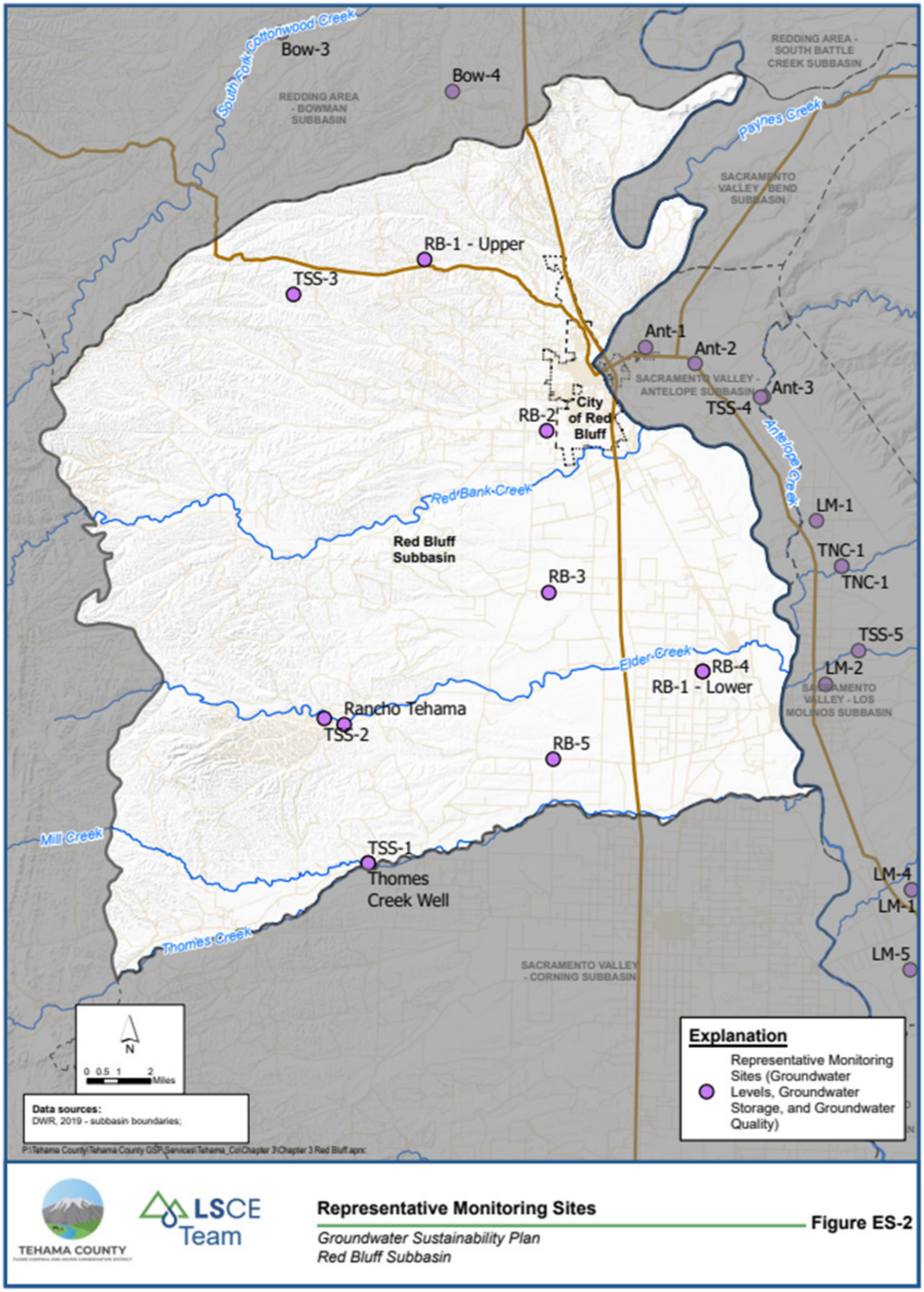

Figure ES-2. Map of all Sustainability Indicator Wells

ES 4. Overview of Projects and Management Actions

In accordance with 23 CCR §354.44, Projects and Management Actions (PMAs) were developed to achieve and maintain the Subbasin sustainability goal by 2042 and avoid undesirable results over the GSP planning and implementation horizon. Projects generally refer to structural features whereas management actions are typically non-structural programs or policies designed to support sustainable groundwater management.

The GSA will monitor sustainability indicators throughout GSP implementation and will initiate and scale PMAs as needed to ensure that the measurable objectives are met. The following describes PMAs identified for the Red Bluff Subbasin. The Revised GSP in Chapter 4 describes a Well Mitigation Program and a Demand Management Program, to address potential adverse effects to beneficial uses and users and to curtail or limit groundwater use, respectively. The GSA has signed resolutions for both these programs, which are contained in Appendices 4-B for Demand Management and 4-C for Well Mitigation.

ES 4.1. PMAs Planned for Implementation

The GSA has identified PMAs that are planned to be completed prior to 2042. These projects and management actions are expected to support the GSA in achieving the GSP sustainability goal and responding to changing conditions in the Subbasin.

ES 4.1.1. Multi-Benefit Groundwater Recharge Programs

A multi-benefit recharge program will provide groundwater recharge through normal farming operations while also providing critical wetland habitat for shorebirds migrating along the Pacific Flyway. The Nature Conservancy (TNC) has prepared guidance to assist GSAs in planning on-farm multi-benefit groundwater recharge programs.

ES 4.1.2. Grower Education and Outreach

This program will provide growers with educational resources that help them to plan and implement on-farm practices that simultaneously support groundwater sustainability and maintain or improve agricultural productivity.

ES 4.1.3. Thomes Creek and Elder Creek Diversion for Direct or In-Lieu Groundwater Recharge

Project to divert flood flows from Thomes Creek and Elder Creek. This diversion could provide direct or in-lieu groundwater recharge benefits to the Subbasin and support local groundwater sustainability. During periods of flood flow in the winter and spring, project participants would divert a portion of the flows along Thomes Creek and Elder Creek for either (1) off-stream storage and subsequent use for irrigation, or (2) direct groundwater recharge via flood managed aquifer recharge (Flood-MAR), dedicated recharge basins, or modified stream beds. Currently, five locations have been identified which meet initial criteria and are being further developed.

ES 4.1.4. Expanded Use of CVP Contract Supplies in Proberta Water District and Thomes Creek Water District

This project would incentivize expanded use of CVP supply by irrigators in Proberta Water District (PWD) and Thomes Creek Water District (TCWD), with the goal of using the full contract supply available to each district. By encouraging irrigators to use more surface water, this project would offset groundwater demand and provide in-lieu recharge benefits to Red Bluff Subbasin.

ES 4.1.5. El Camino Restoration Project

To support groundwater sustainability in the Red Bluff Subbasin, the El Camino Irrigation District plans to restore and modernize its water supply infrastructure. This project would identify and fix the most inefficient pumps in the El Camino Irrigation District conveyance and distribution system, replace concrete pipelines with more durable PVC pipe, replace hub gates, and install flowmeters on each discharge pipe from every pump.

ES 4.1.6. Elder Creek Non-Native, Invasive Species (NIS) Plant Control

This project would remove invasive plant species in the Elder Creek watershed, with a focus on giant reed (Arundo donax) and salt cedar (Tamarisk). The goal of this project would be to reduce demand on riparian and groundwater resources, with benefits to increased groundwater availability for all beneficial users of groundwater in the Subbasin and improved surface water conveyance and ground and surface water interactions.

ES 4.1.7. Tehama West Non-Native, Invasive Species (NIS) Plant Control

This project would identify and strategically remove non-native, invasive plant species from riparian zones in watersheds originating in the western edge of Tehama.

ES 4.1.8. Demand Management

The GSA passed a resolution to develop a Demand Management Program (Program). The Program incudes various measures to reduce demand on existing groundwater resources in the Subbasin. Some of the measures will be voluntary and will be implemented immediately, while others will be developed and implemented when groundwater conditions within the Subbasin warrant further management actions.

ES 4.1.9. Well Mitigation Program

The GSA has proceeded with coordination and focused planning efforts to develop a Well Mitigation Program, including the development of a resolution committing the GSA to take action. The Program will provide assistance to domestic, small water system, and municipal wells adversely impacted by declining groundwater levels since 2015 that interfere with groundwater production or quality. Assistance efforts would benefit domestic and municipal well users, including disadvantaged communities and underrepresented communities, experiencing adverse impacts as a result of overdraft conditions.

ES 4.2. Proposed Potential PMAs

Projects and Management Actions in this category are proposed as potential options that GSAs may wish to implement, as needed, to support ongoing sustainability, to adapt to changing conditions in the Subbasin, and to achieve other water management objectives.

ES 4.2.1 Direct Groundwater Recharge

Potential projects would support efforts to recharge groundwater with excess surface water in wet years for use in dry years. Recharge may be done in conveyances such as unlined canal and laterals, natural drainages such as creek beds, recharge basins, agricultural fields, and aquifer storage and recovery (ASR) wells. Projects could also be directed at making improvements to stormwater management facilities to enhance groundwater recharge of stormwater, capture rainfall through modification of on-field conditions and facilitate use of recycled water for groundwater recharge.

ES 4.2.2. Groundwater Demand Reduction

Groundwater demand reduction can be achieved by conveyance improvements such as removal of invasive plants from creeks and irrigation canals. Plant removal would reduce conveyance issues, reduce evapotranspiration (ET), and allow for more water in the shallow groundwater areas, restoring conditions for GDEs and native riparian species.

ES 4.2.3. Surface Water Supply Augmentation & In-Lieu Groundwater Recharge

Programs directed at promoting inter-basin surface water transfers or exchanges can potentially subsidize surface water costs so that it is less expensive than groundwater. Construction, renovation, or conversion of flood control facilities to water supply reservoirs can increase available supply of surface water.

ES 4.2.4. Education/Outreach, In-Lieu Groundwater Recharge

This management action assist growers with conversion to efficient and dual-source irrigation systems, improve surface water conveyance and irrigation infrastructure to allow growers to utilize both surface water and groundwater for drip irrigation of orchards, assist growers with capital improvements to irrigation infrastructure, from use of groundwater to use of surface water or dual-source systems.

ES 4.2.5. In-Lieu Groundwater Recharge

Management actions aimed at increasing In-Lieu recharge may incentivize use of surface water for irrigation when available to allow groundwater levels to recover in between drought years when surface water is not available. Effective management actions may also increase use of surface water by creating a water market for exchanging surface water and groundwater.

ES 4.2.6. Monitoring to Fill Data Gaps & Programs to Support Wells

Several data gaps have been identified in this GSP. Additional studies of GDEs and groundwater surface water interactions, expanded subbasin monitoring and aquifer testing, install additional agroclimate stations, maintain and expand groundwater level monitoring network, and a one-time groundwater quality snapshot are all actions that can be taken to improve data gaps.

To support well owners and reduce impacts of potential undesirable results a county-wide system to tracking dry domestic wells will better inform and lead to better management of assistance to domestic well owners when water levels drop, and wells go dry.

ES 5. Plan Implementation

This GSP will be implemented to achieve the Subbasin sustainability goal by 2042 and avoid undesirable results through 2070 as required by SGMA and GSP regulations. Implementation of this GSP includes PMAs in addition to on-going activities that will be completed by the GSA related to monitoring, management, administration, updates, reporting, and public outreach.

GSP implementation costs include both costs specific to projects and management actions and costs for the GSA to administer and operate all other tasks associated with the GSP over the 20-year implementation period. The total cost is estimated to be approximately $19,757,000.

These costs may be subject to change, as they are projections based on the time of development of this report. GSP implementation and GSA support costs are estimated on an annual basis and are described in further detail below.

Table ES-3. Estimated GSP Implementation Costs through 2042

FISCAL YEAR	GSA ADMINISTRATION	MONITORING	5-YEAR UPDATES	10% CONTINGENCY	TOTAL
2022	$470,000	$104,000	$0	$57,000	$631,000
2023	$484,000	$107,000	$0	$59,000	$650,000
2024	$499,000	$110,000	$0	$61,000	$670,000
2025	$514,000	$114,000	$0	$63,000	$690,000
2026	$529,000	$117,000	$150,000	$80,000	$876,000
2027	$545,000	$121,000	$150,000	$82,000	$897,000
2028	$561,000	$124,000	$0	$69,000	$754,000
2029	$578,000	$128,000	$0	$71,000	$777,000
2030	$595,000	$132,000	$0	$73,000	$800,000
2031	$613,000	$136,000	$169,000	$92,000	$1,010,000
2032	$632,000	$140,000	$174,000	$95,000	$1,040,000
2033	$651,000	$144,000	$0	$79,000	$874,000
2034	$670,000	$148,000	$0	$82,000	$900,000
2035	$690,000	$153,000	$0	$84,000	$927,000
2036	$711,000	$157,000	$196,000	$106,000	$1,170,000
2037	$732,000	$162,000	$202,000	$110,000	$1,205,000
2038	$754,000	$167,000	$0	$92,000	$1,013,000
2039	$777,000	$172,000	$0	$95,000	$1,044,000
2040	$800,000	$177,000	$0	$98,000	$1,075,000
2041	$824,000	$182,000	$227,000	$123,000	$1,357,000
2042	$849,000	$188,000	$234,000	$127,000	$1,397,000
Total	$13,478,000	$2,983,000	$1,502,000	$1,798,000	$19,757,000

Development of this GSP was funded through Proposition 1 and Proposition 68 Grants. Ongoing implementation, monitoring, and reporting are expected to be funded through fees and outside grants and funding. The GSA is currently developing a financing plan that will include one or more of the following financing approaches

- Grants and low-interest loans: GSA will continue to pursue grants and low interest loans to help fund planning studies and other GSA activities. However, grants and low-interest loans are not expected to cover all of the GSA operating costs for GSP implementation
- GSP Implementation Costs: Initial implementation costs not covered by grant funding will be assessed through either land-based charge or groundwater usage charge. In the future the GSA may adopt a volumetric charge on groundwater extracted from the Subbasin.
- Taxes: This could include general property related taxes that are not directly related to the benefit or cost of a service (ad valorem and parcel tax), or special taxes imposed for a specific purpose related to GSA activities.

The GSA is pursuing a combined approach, targeting available grants and low interest loans, and considering a combination fee and assessment to cover operating and program-specific costs. The GSA will comply with statutory and California constitutional requirements to adopt any rate, fee, charge, or assessment to fund implementation of the GSP.

This GSP will be adopted and submitted to DWR by January 31, 2022. The implementation timeline will begin thereafter and will allow the GSA to develop and implement projects and management actions to meet sustainability objectives by 2042. GSP implementation also includes annual and periodic evaluations and submittals to DWR. The full schedule for implementation is subject to change and will be evaluated and updated as necessary based on implementation progress, sustainability goals, monitoring, and other factors that could affect implementation. The implementation timeline as presently described is outlined below in **Figure ES-3**.

The GSP uses best available information and the best available science to provide a road map for the Red Bluff Subbasin to meet its sustainability goal by 2042 and comply with SGMA regulations. During each five-year update, progress will be assessed, and the GSP revised as necessary, to achieve the sustainability goal by 2042 and comply with SGMA regulations.

Annual reports will be completed and submitted to DWR by April 1 of each year pursuant to GSP Regulation §356.2. Annual reports will include sections on general information, basin conditions, and plan implementation progress for the reporting period. The annual report submitted to DWR will comply with the requirements of §356.2. The GSA will evaluate the GSP every five years and whenever the plan is amended. The evaluation will be submitted to DWR and include the elements of the Annual Report, a summary of the GSP, project, and management action implementation progress, and progress toward meeting the sustainability goal of the Subbasin.

The Revised GSP will be adopted and submitted to DWR by April 23, 2024. The updated implementation timeline will begin thereafter, to include updated projects and management actions. Specifically, the

Demand Management and Well Mitigation Programs will be developed and implemented no later than January 1, 2026.

Figure ES-3. GSP Implementation Schedule

TASK NAME	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Plan Implementation																					
GSP Submittal to DWR	x																				
Revised GSP Submittal to DWR			x																		
Outreach and Communication																					
Monitoring and DMS																					
GSP Reporting																					
Annual Reports	x	x	x	x	x		x	x	x	x		x	x	x	x		x	x	x	x	
5-year GSP Evaluation Reports						x					x					x					x

x Indicates a submittal.
Indicates ongoing event.

ES 6. Overview of Governance

In adopting the Sustainable Groundwater Management Act ("SGMA"), the Legislature made clear that nothing in SGMA "determined or alters surface water of groundwater rights under common law or any provision of the law that determines or grants surface water rights. In other words, the Legislature intended that actions undertaken in accordance with SGMA to respect common law water rights.

This GSP established the objectives of maximizing the beneficial use of water with the Red Bluff Subbasin, without causing undesirable results. The powers of the GSA are set forth in SGMA. This GSP meets the requirements of SGMA and vests the management authority in the GSA. Authorities include Powers of the Board, Rules and Regulations, Committees, Specific Powers, Variances and Complaints.