# FINAL REPORT

*Red Bluff Subbasin*

Sustainable Groundwater Management Act

# Groundwater Sustainability Plan

## (Chapter 4 – Projects and Management Actions)

**January 2022 Revised April 2024**

**Prepared For:**

Tehama County Flood Control and Water Conservation District

**Prepared By:**

Luhdorff & Scalmanini

## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## LIST OF APPENDICES

# 4. GROUNDWATER MANAGEMENT: PROJECTS AND MANAGEMENT ACTIONS (§ 354.44)

## 4.1. Introduction

This section describes the projects and management actions (PMAs) that are planned or considered for implementation in the Red Bluff Subbasin (Subbasin). In accordance with 23 CCR §354.44, 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.

### 4.1.1. Development Approach

PMAs were developed and prioritized through a tiered approach, beginning with an initial exploration with stakeholders of various PMA concepts, and then refining those concepts to a specific set of PMAs developed for implementation in the Red Bluff Subbasin, and a set of conceptual PMAs for further development if monitoring indicates they are needed. The following sections describe the process used to evaluate potential future changes in Subbasin conditions, identify PMAs for implementation, and achieve and maintain sustainability through adaptive management. The adaptive management approach planned for the Subbasin involves ongoing monitoring of Subbasin conditions and addressing any challenges related to maintaining groundwater sustainability by scaling and implementing PMAs in a targeted and proportional manner in accordance with the needs of the Subbasin.

#### 4.1.1.1. Evaluation of Current and Future Subbasin Conditions

PMAs were formulated and evaluated for their potential to support sustainable groundwater management in the Red Bluff Subbasin. PMAs developed for implementation are designed to mitigate localized, adverse effects of current groundwater conditions in the Subbasin, and to address possible future changes in Subbasin conditions that could cause undesirable results over the long term.

Current Subbasin conditions and possible future changes in Subbasin conditions were assessed through comparison of the projected water budget with current land use and the projected water budget with future land use, adjusted for 2070 central tendency (2070CT) climate change. Water budget results from the Tehama Integrated Hydrologic Model (Tehama IHM) represent the best available data and science for describing projected future groundwater conditions in the Red Bluff Subbasin at the time of GSP development (consistent with 23 CCR §354.44(c)). Use of 2070CT climate change is regarded as a conservative approach for evaluating possible future changes in Subbasin conditions related to climate change. While the 2070CT climate change adjustment assumes that the 2070CT effects are occurring every year in the projected water budget period, in actuality these effects will occur gradually over time with significant uncertainty in their magnitude and interannual variability.

**Table 4-1** provides a comparison of key water budget parameters considered in formulation of the PMAs, and **Table 4-2** summarizes the changes in projected Subbasin conditions following implementation of two PMAs developed for implementation (described later in this section). Average water budget results are presented for three scenarios:

- the projected with current land use scenario (assuming 2019 land use occurs in all years),
- the projected with future land use and 2070CT climate change scenario (assuming that urban land increases slightly and orchard acreage increases significantly over the future period and that 2070CT climate change factors occur in all years),
- the projected with future land use, 2070CT climate change, and PMAs scenario (same assumptions as the projected with future land use and 2070CT climate change scenario, with the addition of two simulated PMAs developed for implementation)

Model results are expressed in average annual volumes of acre-feet per year (af/yr) over the 2022-2072 projected water budget period, unless otherwise indicated.

As indicated in **Table 4-1**, without projects and management actions groundwater storage in the projected future land use 2070CT scenario is expected to decline by approximately 3,600 af/yr. This is a further decline of 1,800 af/yr below the change in groundwater storage of -1,800 af/yr that occurs in the projected current land use water budget (approximately 2 percent of total inflows to the groundwater system). This decline in groundwater storage coincides with increases in groundwater pumping, net seepage, and net subsurface inflow from adjacent subbasins relative to the projected current land use water budget. Projects and management actions were thus developed for implementation to address these imbalances by reducing groundwater pumping and increasing groundwater recharge.

As indicated in **Table 4-2**, with simulation of two PMAs the total groundwater pumping and net subsurface inflows from adjacent Subbasins are each expected to decrease by approximately 1,600 af/yr, on average, relative to the projected future land use 2070CT scenario without PMAs. Decreases in groundwater pumping and net subsurface inflow both support ongoing sustainable management of the Subbasin. Deep percolation is also expected to increase by 700 af/yr, on average. While the average change in groundwater storage with simulation of two PMAs remains approximately -3,500 af/yr (a decline in storage) across the entire Subbasin (-0.01 feet per acre), this change is within the estimated uncertainty of the projected water budget results (described in **Section 2.3**).

Other PMAs were also developed for implementation in the Red Bluff Subbasin that will also support groundwater sustainability. The PMAs that were developed but not simulated include a grower education program that would provide in-lieu recharge benefits to the Subbasin, a multi-benefit recharge project, and projects to remove non-native, invasive species from riparian corridors that would reduce demand for shallow groundwater along waterways. These PMAs can be configured and scaled to address localized groundwater concerns and respond to changing groundwater conditions in the Subbasin.

Altogether, the PMAs developed for implementation are expected to support sustainable groundwater management in the Red Bluff Subbasin. The GSA plans to continue monitoring sustainability indicators throughout GSP implementation and will initiate and scale PMAs as needed to ensure that the measurable objectives are met. Groundwater sustainability will be maintained through adaptive groundwater management, described below. Section 3, Monitoring Networks, and Section 2.1, Basin Setting, identify data gaps that will be addressed as part of GSP implementation (Section 5). Addressing data gaps will improve the modeled outputs, water budget parameters, and understanding of groundwater conditions in the Red Bluff Subbasin. Improvements in understanding of groundwater conditions will inform adaptive management of the Red Bluff Subbasin.

**Table 4-1. Summary of Key Groundwater System Water Budget Parameters Influencing Formulation of Projects and Management Actions in the Red Bluff Subbasin (average annual volumes in acre-feet per year, rounded).**

| GROUNDWATER SYSTEM WATER BUDGET PARAMETER[1] | PROJECTED, CURRENT LAND USE (2022-2072) | PROJECTED, FUTURE LAND USE WITH 2070CT CLIMATE CHANGE (2022-2072) | DIFFERENCE (PROJECTED, FUTURE – PROJECTED, CURRENT) | PERCENT DIFFERENCE[2] |
|---|---|---|---|---|
| Net Seepage | -20,200 | 1,800 | 22,000 | -109% |
| Deep Percolation | 66,600 | 65,900 | -700 | -1% |
| Subsurface Flow from Uplands (Small Watersheds) | 1,100 | 1,100 | 0 | 0% |
| Groundwater Pumping | -94,100 | -146,300 | -52,200 | 55% |
| Root Water Uptake | -6,300 | -4,100 | 2,200 | -35% |
| Net Subsurface Inflow from Adjacent Subbasins | 52,000 | 78,900 | 26,900 | 52% |
| **Change in Groundwater Storage** | | | | |
| **Average Volume (acre-feet per year)** | -1,800 | -3,600 | -1,800 | -2% |
| **Average Rate (acre-feet per acre per year)** | -0.007 | -0.013 | -0.006 | |

[1] Positive values indicate a net inflow to the groundwater system. Negative values indicate a net outflow from the groundwater system.

[2] Percent difference is calculated as the "Difference" column divided by the Projected, Current Land Use average volume for that parameter, except for the average annual change in groundwater storage, for which the percent difference is calculated relative to the Projected, Current Land Use average total inflows to the groundwater system.

**Table 4-2. Summary of Key Groundwater System Water Budget Parameters to Evaluate the Potential Effects of Projects and Management Actions on the Red Bluff Subbasin (average annual volumes in acre-feet per year, rounded).**

| GROUNDWATER SYSTEM WATER BUDGET PARAMETER[1] | PROJECTED, FUTURE LAND USE WITH 2070CT CLIMATE CHANGE (2022-2072) | PROJECTED, FUTURE LAND USE WITH 2070CT CLIMATE CHANGE AND PROJECTS AND MANAGEMENT ACTIONS[2] (2022-2072) | DIFFERENCE (PROJECTED, FUTURE WITH PROJECTS AND MANAGEMENT ACTIONS – PROJECTED, FUTURE) | PERCENT DIFFERENCE[3] |
|---|---|---|---|---|
| Net Seepage | 1,800 | 1,900 | 100 | 6% |
| Deep Percolation | 65,900 | 66,600 | 700 | 1% |
| Subsurface Flow from Uplands (Small Watersheds) | 1,100 | 1,100 | 0 | 0% |
| Groundwater Pumping | -146,300 | -144,700 | 1,600[4] | -1% |
| Root Water Uptake | -4,100 | -4,200 | -100 | 2% |
| Net Subsurface Inflow from Adjacent Subbasins | 78,900 | 77,300 | -1,600[4] | -2% |
| **Change in Groundwater Storage** | | | | |
| **Average Volume (acre-feet per year)** | -3,600 | -3,500 | 100 | 0% |
| **Average Rate (acre-feet per acre per year)** | -0.013 | -0.013 | 0.000 | |

[1] Positive values indicate a net inflow to the groundwater system. Negative values indicate a net outflow from the groundwater system.

[2] Includes simulation of two PMAs: the Thomes Creek and Elder Creek Diversion for Direct or In-Lieu Groundwater Recharge project, and the Expanded Use of CVP Contract Supplies in Proberta Water District and Thomes Creek Water District project. Other PMAs are also developed for implementation that were not simulated in the model.

[3] Percent difference is calculated as the "Difference" column divided by the Projected, Future Land Use with 2070CT Climate Change average volume for that parameter, except for the average annual change in groundwater storage, for which the percent difference is calculated relative to the Projected, Future Land Use with 2070CT Climate Change average total inflows to the groundwater system.

[4] Difference corresponds to a reduction in groundwater pumping and a reduction in subsurface inflows to the Subbasin, both of which are supportive of groundwater sustainability in the Red Bluff Subbasin.

#### 4.1.1.2. PMAs Identified for Adaptive Groundwater Management

Recognizing the GSP data gaps and uncertainties in the basin setting (per 23 CCR §354.44(d)), PMA development and implementation in the Red Bluff Subbasin applies an adaptive approach informed by continued monitoring of groundwater conditions.

The adaptive approach includes two categories of PMAs:

- **PMAs developed for implementation** that would help to achieve and maintain groundwater sustainability while supporting other local goals. These PMAs include a project that would divert available surface water from Thomes and Elder Creek onto fields in the Subbasin for direct or in-lieu recharge benefits, and an in-lieu recharge project that would expand use of existing CVP contract supplies in Proberta Water District (WD) and Thomes Creek WD. Other PMAs developed for implementation include a proposed grower education program, a proposed multi-benefit groundwater recharge project that would supply groundwater recharge and provide habitat for migrating shorebirds, a proposed pump restoration project in El Camino Irrigation District, and two projects aimed at invasive species removal along various waterways in the Red Bluff Subbasin.
- **A portfolio of other potential PMAs** that could be implemented, as needed, to achieve and maintain long-term sustainable groundwater management across the Red Bluff Subbasin. These potential PMAs would be further evaluated and selected for implementation if Subbasin conditions changed such that they would be necessary to maintain groundwater sustainability. Management actions include a potential demand management program that could be implemented as a backstop to other PMAs to ensure groundwater sustainability.

PMAs are presented in this GSP according to these two categories of implementation for adaptive management. In accordance with 23 CCR §354.44(a), PMAs developed for implementation are expected to support the GSA in achieving the Red Bluff Subbasin sustainability goal and avoid exceedance of MTs defined in this GSP under future, potentially changing conditions. PMAs developed for implementation are described in greater detail in this GSP, in accordance with all the requirements in 23 CCR §354.44(b). The portfolio of other potential PMAs is described in lesser detail, reflecting their conceptual nature at the time of GSP development. It is anticipated that additional information will be provided in annual reports and periodic, five-year GSP updates, if these PMAs are needed, evaluated for feasibility, and selected for implementation.

Per 23 CCR § 354.44(b)(9), PMAs described in this GSP are expected to maintain the balance of groundwater extractions and recharge to ensure that lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels and storage in other years. In particular, in-lieu and direct recharge benefits of the PMAs developed for implementation are expected to increase the use and recharge of available surface water supplies during wetter years, offsetting any potential increases in groundwater pumping during drought when surface water supplies are limited. The expected recharge benefits of these PMAs are described in each project description in Section 4.4. The GSA's extensive portfolio of other potential PMAs will also be informed by continued monitoring of groundwater conditions and implemented, if needed, to maintain long-term sustainable groundwater management.

These remaining subsections are structured as follows:

- Section 4.2 provides an overview of all PMAs described in this GSP.
- Section 4.3 introduces the various PMA concepts that were explored as part of GSP development.

- Sections 4.4 and 0 describe the specific PMAs developed for implementation and the portfolio of other potential PMAs that may be implemented through adaptive management of the Red Bluff Subbasin. Within each category, PMAs are further classified by type (project or management action).

A matrix summary of all developed and potential PMAs is also provided in **Appendix 4-A**.

## 4.2. Summary of Projects and Management Actions

### 4.2.1. Overview of All Proposed Projects and Management Actions

**Table 4-3** summarizes all PMAs identified for the Red Bluff Subbasin GSP. Summary information includes the PMA name, type, proponent, and a brief description of activities that would be completed as part of the PMA. The main PMA categories include:

- Direct groundwater recharge: PMAs that recharge groundwater using available surface water, flood water, stormflows, or other supplies.
- In-lieu groundwater recharge: PMAs that offset groundwater pumping by supplying or otherwise incentivizing use of surface water or other water supplies "in lieu" of groundwater.
- Groundwater demand reduction: PMAs that reduce or remove sources of groundwater demand and extraction, such as invasive and non-native plant species along riparian corridors.
- Management action: Non-structural programs or policies designed to support sustainable groundwater management (e.g., grower education, demand management)

PMAs are grouped into subsections in the table according to their implementation category (PMAs developed for implementation, or other potential PMAs). As described above, PMAs developed for implementation are planned to be implemented before 2042 to maintain groundwater sustainability while supporting other local goals. Other potential PMAs could be implemented, as needed, to achieve and maintain long-term groundwater sustainability, depending on changing conditions in the Red Bluff Subbasin.

PMAs are described in this GSP according to the requirements of 23 CCR §354.44(b). PMAs developed for implementation are described in greater detail. Other potential PMAs are described concisely and more generally, reflecting the conceptual nature and need for future development of these PMAs as they are needed. Additional project development and description will occur as those projects are needed, evaluated for feasibility, and selected for implementation.

**Table 4-4** summarizes the estimated groundwater recharge benefit and capital, operating, and maintenance costs of PMAs developed for implementation. Specific project benefit and cost information is limited for many other proposed projects because a detailed feasibility assessment has not been completed. If needed, the GSA may further develop projects during the GSP implementation period and after 2042 and refine estimated costs as projects are identified for implementation. Additional information about all PMAs is provided in a matrix format in **Appendix 4-A**.

As GSP implementation proceeds, the GSA will continue to accept additional PMAs proposed by agencies and stakeholders. A list of all proposed PMAs will be maintained on the GSP website. PMAs can be added to the matrix (**Appendix 4-A**) at any time, and will be reviewed for inclusion in the GSP at the discretion of the GSA. Review of new projects and management actions will occur during the periodic, five-year GSP updates, and at other times at the discretion of the GSA.

**Table 4-3. Summary of Projects and Management Actions Proposed for the Red Bluff Subbasin.**

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| **Projects and Management Actions Developed for Implementation**: Projects and Management Actions in this category 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. | | | |
| Multi-Benefit Recharge | Direct Groundwater Recharge (Project) | Multi-Agency/ Jurisdiction | The Nature Conservancy (TNC) has prepared guidance to assist GSAs in planning on-farm, 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 waterbirds migrating along the Pacific Flyway. Fields with soil and cropping conditions conducive to groundwater recharge will be flooded and maintained with shallow depths to benefit waterbirds. Water will be sourced from existing or new water rights, depending on availability. The GSA may also consider incentives for participants, offsetting field preparation, irrigation, and water costs. |
| Grower Education | Education/ Outreach (Management Action) | Multi-Agency/ Jurisdiction | A grower education and outreach program is proposed as a management action for all subbasins in Tehama County. The 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. This program would be accomplished through workshops and distribution of educational materials, as well as on-site irrigation system evaluations and irrigation water management assistance. The program would continue and expand the irrigation evaluation services currently in place through the Mobile Irrigation Lab (MIL), operated in Tehama County by the Tehama County Resource Conservation District since 2002. |

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| Thomes Creek and Elder Creek Diversion for Direct or In-Lieu Groundwater Recharge | Direct or In-Lieu Groundwater Recharge (Project) | Multi-Agency / Jurisdictions | Thomes and Elder Creek originate to the west of the Red Bluff Subbasin and flow eastward into the Red Bluff Subbasin. During periods of flow in the winter and spring, a portion of these flows could be diverted for either (1) off-stream storage and subsequent use for irrigation or (2) direct groundwater recharge through Flood-MAR, dedicated recharge basins, or modified stream beds. |
| Expanded Use of CVP Contract Supplies in Proberta Water District and Thomes Creek Water District | In-Lieu Groundwater Recharge (Project) | Multi-Agency / Jurisdictions | This project would incentivize expanded use of CVP supply by irrigators in Proberta WD and Thomes Creek WD, with the goal of using the full supply available to each district on the Corning Canal. Encouraging irrigators to use more surface water would offset groundwater demand, providing in-lieu recharge benefits to Subbasin. |
| El Camino Restoration Project | In-Lieu Groundwater Recharge (Project) | El Camino Irrigation District | 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. |
| Elder Creek Non-Native, Invasive Species (NIS) Plant Control | Groundwater Demand Reduction (Project) | Tehama County Resource Conservation District | This project would identify the location of and remove non-native plants in the Elder Creek watershed, with a focus on Arundo donax and Tamarisk. |
| Tehama West Non-Native, Invasive Species (NIS) Plant Control | Groundwater Demand Reduction (Project) | Tehama County Resource Conservation District | This project would identify the location of and remove non-native plants in the Tehama West watersheds (excluding Elder Creek; a separate project is proposed for Elder Creek because of the levee systems), with a focus on Arundo donax and Tamarisk. |
| Well Mitigation Program | Impact Mitigation | Multi-agency / Jurisdictions | This program will provide assistance to owners of wells adversely impacted by declining groundwater levels since 2015 that interfere with groundwater production or quality. |

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| Demand Management | Groundwater Demand Reduction | Multi-agency / Jurisdictions | Voluntary measures to groundwater demand through agricultural best practices, water conservation, land repurposing, dryland farming, fallowing and other strategies. Additional measures for consideration and phased implementation include well restrictions, pumping restrictions, and water trading or fee structures. |
| **Portfolio of Other Potential Projects and Management Actions:** Projects and Management Actions in this category are proposed as potential options that the GSA 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 | | | |
| **Projects** | | | |
| Direct Groundwater Recharge of Stormwater and Flood Water | Direct Groundwater Recharge | | • 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. Areas identified for recharge should have suitable recharge surficial geology, low enough groundwater levels to provide storage for recharge, and access to surface water.<br>• Divert floodwater for off-stream temporary storage on private lands, providing direct recharge and potentially in-lieu recharge. |
| Stormwater Management Improvements | Direct Groundwater Recharge | | • Improve stormwater management facilities to enhance groundwater recharge of stormwater.<br>• Maintain stormwater pumps and ensure stormwater holding basins are of adequate size for retention.<br>• Restore watersheds burned in wildfires and restore unused grazing land to reduce runoff and improve recharge. |
| Levee Setback and Stream Channel Restoration | Direct Groundwater Recharge | | • Restore stream channel and levee setback to increase groundwater recharge, provide wildlife habitat, and improve the overall riparian ecosystem. |

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| Rain-MAR | Direct Groundwater Recharge | | • Capture additional rainfall through modification of on-field conditions and recharge the aquifer |
| Recycled Water Projects | Direct Groundwater Recharge, In-Lieu Groundwater Recharge | | • Facilitate use of recycled water of suitable quality (e.g., treated wastewater) for groundwater recharge and for urban or agricultural irrigation.<br>• Enhance wastewater treatment facilities to supply tertiary-treated<br>Title-22 effluent for use as irrigation water.<br>• Construct and operate wetlands as a discharge site for treated wastewater (e.g., the Rio Alto Water District Wastewater Treatment Plant & Constructed Wetlands Project in the Bowman Subbasin). Creation of constructed wetlands would enhance the surrounding community by increasing natural habitat for waterfowl and wildlife, while offering educational and recreational opportunities for local schools and community residents through the development of walking trails and informational kiosks. |
| Invasive Plant Removal from Creeks and Irrigation Conveyance Canals | Groundwater Demand Reduction | | • Remove invasive plants from creeks and irrigation conveyance canals (e.g., Arundo donax, tamarisk, Himalayan blackberry). Many small tributaries in the watersheds of Tehama County have decreased conveyance, high levels of siltation, and diminished flood-carrying capacity due to invasive vegetation overgrowth. Debris-clearing is a challenge due to environmental permitting restrictions. Plant removal would reduce conveyance issues, reduce evapotranspiration (ET), and allow for more water in the shallow groundwater area, restoring conditions for GDEs and native riparian species. |
| Inter-Basin Surface Water Transfers or Exchanges | In-Lieu Groundwater Recharge | | • Promote inter-basin surface water transfers or exchanges and potentially subsidize surface water costs so that it is less expensive than groundwater. |

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| | | | • Import underutilized surface water and other supplies from other subbasins in Tehama County and use for direct recharge or in lieu of groundwater pumping. Potential opportunities include:<br>○ Treated wastewater from the City of Red Bluff<br>○ Trout Unlimited Groundwater substitution transfers<br>○ Groundwater substitution transfers. |
| Water Supply Reservoir Construction, Renovation, or Conversion | Surface Water Supply Augmentation | | • Construct, renovate, or convert flood control facilities to a water supply reservoir. |
| Enhanced Boundary Flow Measurement | In-Lieu Groundwater Recharge | | • Enhance measurement of boundary outflows resulting from precipitation runoff and irrigation return flows, which are estimated to be a substantial component of the water budget. Improved understanding of boundary outflows, which vary substantially from year to year, can facilitate capture of and use of this water for in-lieu recharge. |
| Well Metering | In-Lieu Groundwater Recharge | | • Meter larger agricultural wells to better assess the total volume of groundwater pumped in the Subbasin. Data will help to better manage continued sustainability of the Subbasin within its sustainable yield and improve management of pumping for in-lieu recharge benefits. |
| **Management Actions** | | | |
| Assistance and Incentives for On-Farm Irrigation Infrastructure Improvements | Education/ Outreach (Management Action), In-Lieu Groundwater Recharge (Project) | | • Assist growers with conversion to efficient and dual-source irrigation systems. Related efforts may include soil mapping to customize irrigation timing and duration and grower education to encourage soil management to improve moisture retention.<br>• Improve surface water conveyance and irrigation infrastructure to allow growers to utilize both surface water and groundwater for drip irrigation of orchards. Typical components required for a |

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| | | | dual-source system are a surface water irrigation "turnout" or point of delivery to the field, a pipeline or ditch to convey water from the turnout to a pump station, a pump or pumps for pressurization, and filtration. Improvements in the Subbasin may include installation of regulating reservoirs, filters or treatment, and pressurization equipment.<br>• Assist growers with capital improvements to irrigation infrastructure, from use of groundwater to use of surface water or dual-source systems. |
| Incentives for Residential and Municipal Water Use Efficiency Improvements | Groundwater Demand Reduction | | • Offer incentives for urban, residential, and commercial projects that improve water use efficiency, such as high efficiency appliance rebates and incentives for lawn removal, low-water landscape installation, rain barrels, graywater reuse, etc.<br>• Evaluate municipal water system operation and reduce losses to reduce municipal groundwater pumping demand. |
| | | | ○ |
| Incentives for Use of Available Surface Water and Recycled Water | In-Lieu Groundwater Recharge | | • 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.<br>• Provide incentives for use of recycled water of suitable quality (e.g., treated wastewater) for groundwater recharge and for urban or agricultural irrigation to decrease groundwater demand. |
| Water Market for Surface Water and Groundwater Exchange | In-Lieu Groundwater Recharge | | • Create a water market for exchanging surface water and groundwater, allowing for flexibility in water use to meet irrigation demands in the Subbasin while remaining within the overall sustainable yield. |

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| Tehama County Domestic Well Tracking and Outreach Program | Additional Monitoring Programs to Support Wells | | • Provide domestic well owners with resources and funding for well testing, inspection, and replacement. Target well owners in locations where domestic wells are known to go dry or have water quality impacts.<br>• Create a county-wide system to track dry domestic wells. Information will allow Tehama County to better manage assistance to domestic well owners when water levels drop and wells go dry, identify if wells need to be replaced, and provide information on well replacement. |
| | | | • |
| Review of County Well Permitting Ordinances | Well Permitting Ordinances | | • Review existing ordinances and assess if additional well permitting requirements are warranted. Follow updated DWR well construction recommendations (Bulletin 74), as needed. Improve the well permitting and installation program to help protect water quality, allow for better screening, and avoid interference or impacts on neighboring wells. |
| **Other Activities (Studies, Monitoring, Modeling)** | | | |
| Coordination and Development of Public Data Portals | Coordination and Data Sharing | | • Continue coordination with member units and other water purveyors to develop shared public data portals. Coordination would determine the types of data and data formats available, and establish standard methods for receiving, storing, and sharing data with the public, DWR, other agencies.<br>• Continue coordination and information sharing among agencies in Tehama County and with agencies in neighboring subbasins. Coordination would include holding regular public meetings, attending meetings in neighboring subbasins, coordination with land use planning entities, and fostering relationships with relevant agencies and organizations. |

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| | | | • Continue and improve sharing of contaminant data across organizations, including data to track and monitor contaminant plumes. |
| Additional Studies of GDEs and Groundwater - Surface Water Interactions | Additional Monitoring | | • Analyze the relationship between groundwater levels and GDE health to improve the understanding of how GDEs are affected by conditions in the groundwater aquifer accessed by pumping.<br>• Analyze the water supplies accessed by potential GDEs, potentially using a combination of surface water data, shallow groundwater level data, and remote sensing data related to vegetative cover.<br>• Evaluate the need for additional studies or monitoring of groundwater-surface water interactions. Additional information would improve the understanding of how GDEs relate to the groundwater aquifer accessed by pumping, and may allow for refinement of how GDEs and their water supply needs are monitored |
| Expanded Subbasin Monitoring and Aquifer Testing | Additional Monitoring | | • Aquifer testing will improve the understanding of aquifer conditions, particularly the level of confinement, connectivity between depths, connectivity with surface water bodies, and the understanding of hydraulic properties needed for simulation within the Tehama IHM and an improved estimate of recharge entering the Subbasin.<br>• Collect LIDAR (Light Detection and Ranging) data across the Subbasin to support monitoring all sustainability indicators.<br>• Identify locations in the Subbasin that are potentially vulnerable to damage from subsidence. |
| Install Additional Agroclimate Stations | Additional Monitoring | | • Install additional stations that monitor agriculture-related weather and climate parameters. Improved data will inform |

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| | | | agricultural water use practices and potentially enhance water conservation. Data can also improve the accuracy of the Tehama Integrated Hydrologic Model (Tehama IHM). |
| Maintain and Expand Groundwater Level Monitoring Network | Additional Monitoring | | • Maintain existing monitoring network to improve the understanding of aquifer conditions and dynamics and to monitor groundwater conditions related to sustainable management criteria.<br>• Maintain existing coordination with other monitoring entities to support the use of identified monitoring locations as part of the monitoring network and to share relevant collected data.<br>• Identify existing wells that may be incorporated into the groundwater level monitoring network. Wells may be used to fill data gaps and improve understanding of aquifer conditions and dynamics, and groundwater conditions related to GDEs and surface water depletions.<br>• Identify new monitoring sites that may be added to the groundwater level monitoring network. Wells may be used to fill data gaps and improve understanding of aquifer conditions and dynamics, and groundwater conditions related to GDEs and surface water depletions. |
| One-Time Groundwater Quality Snapshot and Evaluation | Additional Monitoring | | • Conduct a one-time sampling of groundwater quality parameters over a wide range of wells in Tehama County. Data will improve understanding of groundwater quality conditions and provide a basis for refinement of monitoring networks.<br>• Evaluate groundwater quality monitoring options, potentially informed by the one-time groundwater quality snapshot. Consider options to better characterize widespread groundwater quality conditions and address localized groundwater quality concerns. |

| PROJECT/MANAGEMENT ACTION NAME | PROJECT/ MANAGEMENT ACTION TYPE | PROPONENT | BRIEF DESCRIPTION |
|---|---|---|---|
| Tehama County Well Inventory and Registration Program | Additional Monitoring | | • Create a county-wide well inventory to compile all available information on active wells in Tehama County and improve understanding of well distribution, construction, and hydrogeology. Inventory will be useful for filling monitoring data gaps.<br>• Create a well registration program to collect well locations, screening information, and pumping data for use in GSP updates. |

**Table 4-4. Benefits and Costs of Projects and Management Actions Developed for Implementation.**

| PROJECT/ MANAGEMENT ACTION NAME | PROPONENT | FIRST YEAR OF IMPLEMENTATION | GROSS AVERAGE ANNUAL BENEFIT AT FULL IMPLEMENTATION (AF/YR) | ESTIMATED CAPITAL COST ($) | ESTIMATED ANNUAL COST AT FULL IMPLEMENTATION ($/YR) |
|---|---|---|---|---|---|
| Multi-Benefit Recharge | Multi-Agency / Jurisdictions | To Be Determined[1] | 1,160 | (Reported as part of annual cost) | $77,000 |
| Grower Education | Multi-Agency / Jurisdictions | To Be Determined[1] | N/A[2] | N/A | $10,000 |
| Thomes Creek and Elder Creek Diversion for Direct or In-Lieu Groundwater Recharge[3] | Multi-Agency / Jurisdictions | 2025 | 6,074 | To Be Determined[4] | To Be Determined[4] |
| Expanded Use of CVP Contract Supplies in Proberta Water District and Thomes Creek Water District[3] | Multi-Agency / Jurisdictions | To Be Determined | 1,640 | To Be Determined | To Be Determined |
| El Camino Restoration Project | El Camino Irrigation District | To Be Determined | To Be Determined | To Be Determined | To Be Determined |
| Elder Creek NIS Plant Control | Tehama County Resource Conservation District | To Be Determined | To Be Determined | To Be Determined | To Be Determined |
| Tehama West NIS Plant Control | Tehama County Resource Conservation District | To Be Determined | To Be Determined | To Be Determined | To Be Determined |
| Demand Management | Multi-Agency / Jurisdictions | 2027 | To Be Determined | N/A | $500,000-1,000,000 |
| Well Mitigation Program | Multi-Agency / Jurisdictions | 2027 | N/A | $37,000,000 | $75,000 |

[1] Planned initiation of the project or management action will occur before 2042, though the precise year will be determined as GSP implementation and annual reporting proceeds. The timing of implementation will be informed by improved understanding of basin groundwater conditions over time, and will be planned to manage changing hydrologic or groundwater conditions to achieve the GSP sustainability goal.

[2] Grower education does not have a specific annual volumetric benefit, but is expected to generally improve use of existing surface water supplies and reduce net consumption of groundwater supplies, supporting groundwater sustainability efforts.

[3] Project was modeled in the Tehama IHM projected with future land use, 2070CT climate change, and PMAs scenario. The gross average annual benefit at full implementation comes from the Tehama IHM results.

[4] Potential estimated on-farm costs (per site), and potential estimated capital and indirect costs for diversion infrastructure (per diversion point) are provided in Section 4.4.3.4.

### 4.2.2. Sustainability Indicators Benefitted by Projects and Management Actions

The sustainability indicators expected to directly benefit from each type of project or management action are summarized in **Table 4-5**. Among the proposed PMAs with anticipated direct benefits to sustainability indicators, all are expected to benefit groundwater levels and groundwater storage, whether through direct or in-lieu groundwater recharge, or improved management and augmentation of water supplies. All projects with anticipated benefits to groundwater levels are also expected to reduce surface water depletion by enhancing understanding and management of interconnected surface water. Grower education is expected to also benefit water quality by encouraging on-farm management of nutrient application, tailwater, and pumping to reduce potential degradation of water quality.

**Table 4-5. Sustainability Indicators Expected to Benefit from Projects and Management Action Types Proposed for the Red Bluff Subbasin.**

| PROJECT/MANAGEMENT ACTION TYPE | SUSTAINABILITY INDICATORS EXPECTED TO DIRECTLY BENEFIT | | | |
|---|---|---|---|---|
| | GROUNDWATER LEVELS | GROUNDWATER STORAGE | WATER QUALITY | SURFACE WATER DEPLETION |
| Coordination and Data Sharing | -[1] | -[1] | -[1] | -[1] |
| Direct Groundwater Recharge | X | X | | X |
| Education/Outreach | X | X | X | X |
| Groundwater Demand Reduction | X | X | | X |
| In-Lieu Groundwater Recharge | X | X | | X |
| Monitoring to Fill Data Gaps | -[1] | -[1] | -[1] | -[1] |
| Programs to Support Wells[1] | -[2] | -[2] | -[2] | -[2] |
| Surface Water Supply Augmentation | X | X | | X |
| Well Permitting Ordinances | X | X | X | X |

[1] Coordination, data sharing, and additional monitoring are beneficial to GSP implementation and tracking progress toward the Subbasin sustainability goal. However, there are no anticipated direct benefits to specific sustainability indicators.

[2] Programs designed to support wells (e.g. well tracking, well deepening or replacement) are beneficial for monitoring and addressing any potential impacts to those beneficial uses and users of groundwater during GSP implementation. However, there are no anticipated direct benefits to specific sustainability indicators.

### 4.2.3. Achieving and Maintaining Sustainability

Ongoing management of the Red Bluff Subbasin under this GSP is planned to achieve and maintain sustainability and respond to unforeseen future conditions that may impact sustainable operation of the Red Bluff Subbasin. The GSA plans to achieve and maintain sustainability through an adaptive management strategy: continuing to monitor sustainability indicators throughout the GSP planning and implementation horizon and implement PMAs as needed to ensure that the sustainability goal is achieved and that undesirable results do not occur.

PMAs developed for implementation are expected to support ongoing sustainability. Grower education is planned to encourage on-farm practices that support direct and in-lieu recharge, and multi-benefit groundwater recharge is planned to supply direct recharge of available floodwater to the Subbasin while also providing habitat to migratory shorebirds. Other potential PMAs would also be evaluated and selected for implementation if the GSA finds that established measurable objectives (MOs) cannot be maintained and/or if minimum thresholds (MTs) are being approached. This adaptive approach will be informed by continued monitoring of groundwater conditions, using the monitoring network and methods described in Section 3.

## 4.3. Overview of Concepts Explored

This section provides a brief overview of various concepts explored when proposing and identifying PMAs for the Red Bluff Subbasin. While not all concepts were proposed for implementation in the Red Bluff Subbasin, exploring these concepts is useful for identifying the types and scale of potential PMAs that could be explored and implemented in the future to maintain sustainability, depending on future changes in subbasin conditions.

### 4.3.1. Well Permit Revision

The need for and benefit from potential modifications to well regulations was considered as a potential mechanism to ensure that groundwater sustainability is achieved and maintained in the Subbasin. Well permitting regulations can help avoid adverse impacts on groundwater beneficial users by reducing potential for mutual well interference or streamflow depletion through limitations on well screen depths and well spacing and/or setbacks.

### 4.3.2. Demand Management

Demand management broadly refers to any water management activity that reduces the consumptive use of irrigation water. When considered as a management action to support sustainable groundwater management, demand management must result in a net reduction in groundwater pumping (pumping net of recharge). Activities that, for example, reduce canal seepage or reduce deep percolation to the groundwater system are generally ineffective at demand management for groundwater planning. While they may decrease the quantity of water diverted or applied, they also reduce the quantity of recharge to usable groundwater, resulting in no (or little) net reduction in groundwater pumping.

Demand management activities considered as concepts for implementation in the Red Bluff Subbasin include:

- Voluntary Measures:
    - Best management practices (agronomic practices, soil moisture monitoring and management, delayed irrigation and/or regulated deficit irrigation, runoff capture, etc. to reduce groundwater extraction)
    - Water conservation (focusing on activities to reduce consumptive use and groundwater extraction)
    - Encouraging use of all available surface water in lieu of groundwater pumping
    - Multi-benefit land repurposing (e.g., recharge basins, renewable energy, habitat, recreational spaces)
    - Incentivized land use changes that provide net groundwater benefit
    - Dry farming
    - Fallowing (not associated with groundwater substitution transfers)
- Phased Adaptive Implementation Measures:
    - Well restrictions
    - Pumping restrictions
    - Water market/trading and/or fee structures

Demand management actions are scalable to suit the volume of groundwater reduction that is needed, both in the timing and the spatial extent of implementation. While long-term, wide-ranging demand management actions may be necessary to achieve and maintain sustainability in severely overdrafted areas, shorter-term and localized demand management actions are also possible to address localized groundwater concerns.

As described previously, other PMAs developed for implementation are expected to allow the Red Bluff Subbasin to be managed sustainably by 2042 and without undesirable results over the GSP planning and implementation horizon. Demand management actions are thus considered only as conceptual, "backstop" measures that would be considered and implemented only if other planned PMAs are insufficient to maintain sustainability.

### 4.3.3. Multi-Benefit Recharge Project

Multi-benefit recharge projects have emerged as promising tools to maximize the benefits of recharge projects for numerous groundwater and environmental water uses and users. The multi-benefit recharge projects explored in Tehama County are specifically focused on strategic flooding of agricultural fields for managed aquifer recharge (MAR).

The main goals of these multi-benefit recharge projects are to simultaneously:

- recharge groundwater supplies using available surface water supplies, and
- create temporary habitat for migratory shorebirds along the Pacific Flyway

These multi-benefit recharge projects are distributed, operating through participating growers who voluntarily flood their fields during peak migratory periods to create temporary habitat for the shorebirds while also recharging the underlying aquifer. These projects can offer incentives to encourage grower participation and can also offer assistance for field preparation prior to flooding. The scale of

implementation may vary depending on grower interest, which in turn may vary depending on water availability, water reliability, outreach, local interests, and incentives (if applicable).

Successful multi-benefit recharge projects will realize the greatest benefit from selecting sites with high groundwater recharge potential, flooding those sites at times when the environmental benefits to migratory shorebirds are highest, and implementing recharge with the greatest practicality. Ideal sites have soil and crop conditions favorable for flooding and recharge during peak migratory periods (generally July 15-October 1 and/or March 15-April 30). Practical sites have existing access to surface water and infrastructure that supports flooding.

Multi-benefit recharge is a concept with great potential to support environmental surface water users and all beneficial users of groundwater in the Subbasin. Thus, a multi-benefit recharge project has been developed for implementation in the Red Bluff Subbasin (see Section 4.4.1 for more information).

### 4.3.4. Flood Managed Aquifer Recharge (Flood-MAR)

Conceptually, projects that use floodwater for on-farm managed aquifer recharge (i.e., Flood-MAR) are similar to the multi-benefit recharge projects described in the previous section, although the timing of Flood-MAR projects are confined to periods when flood water is available rather than the migratory periods of shorebirds. Flood-MAR projects operate through distributed, voluntary participation of growers, who divert and apply floodwater to fields when it is available to supply groundwater recharge.

Implementation of Flood-MAR can occur at various scales, from individual landowners diverting flood water from creeks and streams using existing infrastructure, to larger facilities operated by one or more agencies to divert larger volumes of floodwater to detention and recharge areas. Besides groundwater recharge, Flood-MAR can also provide benefits to flood risk reduction, ecosystem enhancement, water quality improvement, climate change adaptation, and recreation in the Red Bluff Subbasin.

While no specific Flood-MAR project is specifically developed for implementation in the Red Bluff Subbasin at this time, Flood-MAR is proposed among other potential PMAs that could be implemented to support adaptive management of the Subbasin.

### 4.3.5. Rainfall Managed Aquifer Recharge (Rain-MAR) to Capture Runoff from Fields

Rainfall Managed Aquifer Recharge (Rain-MAR) projects considered in Tehama County would be designed to modify on-field conditions and infrastructure to capture and hold precipitation, taking water that would have otherwise run off the field and instead recharging that to the groundwater system through on-field infiltration. Like the multi-benefit recharge and Flood-MAR projects described above, Rain-MAR projects would provide distributed groundwater recharge throughout the Subbasin, operating through voluntary grower participation. Besides groundwater recharge, Rain-MAR can also provide benefits to flood risk reduction by decreasing runoff and to ecosystem enhancement by creating habitat for birds and other wildlife.

A Rain-MAR project is a scalable and potentially low-cost option for addressing localized groundwater issues or for responding to future climate change effects greater than those simulated. While no specific Rain-MAR project is specifically developed for implementation in the Red Bluff Subbasin at this time, a Rain-MAR project is proposed among other potential PMAs that could be implemented to support adaptive management of the Subbasin.

### 4.3.6. Other Groundwater Management Strategies (Projects and Management Actions and Cost Feasibility)

Various other groundwater management strategies have also been discussed in the Subbasin. Some of the strategies discussed include use of recycled water, incentivizing maximum use of all surface water available through existing or potential future water rights or allocations, and coordinated and cooperative management between key groundwater user groups (e.g., urban, agricultural, environmental), and groundwater ordinances. The feasibility of different management strategies in the Subbasin is closely tied to cost. Cost makes some groundwater management strategies difficult to implement, although these management strategies are available for consideration if needed in the future.

### 4.3.7. Ongoing Evaluation of Groundwater Management Efforts (LSCE)

In accordance with SGMA and GSP regulations, the GSA will conduct ongoing assessments of groundwater conditions in the Subbasin, including annual GSP reporting and five-year GSP evaluations. Ongoing assessments will evaluate new information on changes in water use, changes in Subbasin and management area groundwater conditions, the efficacy or benefits from management actions implemented, and will consider additional management tools or actions needed to achieve and maintain Subbasin sustainability. These efforts will support adaptive management of the Subbasin groundwater resources and enable the GSA to respond to groundwater management needs if they arise.

## 4.4. Projects and Management Actions Developed for Implementation

This section describes the PMAs that were developed for potential implementation in the Red Bluff Subbasin. Implementation of these PMAs would address adverse groundwater conditions that currently exist in the Subbasin, and will support the GSA in its efforts to achieve the Subbasin sustainability goal, maintain sustainability, and adapt to potential future changes in Subbasin conditions. These PMAs are described below, and will be scaled as needed to support adaptive management of the Subbasin.

### 4.4.1. Multi-Benefit Recharge Project

#### 4.4.1.1. Overview

An on-farm, multi-benefit groundwater recharge program has been developed for potential implementation in the Red Bluff Subbasin based on guidelines provided by The Nature Conservancy (TNC). The program would build on the successful TNC BirdReturns program by strategically flooding agricultural fields with the goals of (1) recharging groundwater supplies while (2) simultaneously creating critical winter habitat for shorebirds migrating along the Pacific Flyway. GSAs may consider offering financial incentives to growers to compensate them for recharging groundwater through field flooding in the course of normal farming operations, with multiple benefits to the underlying aquifer and shorebirds migrating along the Pacific Flyway.

The multi-benefit recharge project would be implemented through the coordinated actions of growers who volunteer to participate and flood their fields during the course of normal farming operations. During the migratory period, fields with soil and cropping conditions conducive to groundwater recharge would be flooded and maintained with shallow water depths, recharging groundwater while also providing critical wetland habitat for migrating shorebirds. If an incentive structure is established, the program could provide financial incentives to growers, potentially paying for field preparation, irrigation, and water costs to encourage grower participation.

This section summarizes implementation activities, operation and monitoring efforts, and related costs and benefits of a multi-benefit groundwater recharge program in the Red Bluff Subbasin.

#### 4.4.1.2. Implementation

Implementation of a multi-benefit groundwater recharge program in the Red Bluff Subbasin would occur in multiple phases, with expansion of the program over time as voluntary grower participation increases. Multi-benefit recharge would be implemented at selected sites in the Red Bluff Subbasin, with multiple-benefits to groundwater recharge and temporary wetland habitat for migrating shorebirds. Recharge and wetland habitat benefits in the early phases of the project would be analyzed, reported, and used to inform development and later implementation of the program.

Implementation of this project would commence with selection of sites suitable for multi-benefit recharge, and initiation of any necessary permitting and environmental documentation. The GSAs would use tools and resources provided by TNC to identify fields with soil and cropping conditions conducive to groundwater recharge and temporary wetland habitat formation.[1]. In later phases of project implementation, suitable fields would continue to be identified following similar criteria, with refinement according to lessons learned from early project implementation.

Suitable project sites would be selected by the following characteristics:

- Soil characteristics that are conducive to recharge, as indicated by:
  - Soil types

[1] TNC offers an online Multi-Benefit Recharge Suitability Tool for identifying areas potentially suitable for multi-benefit recharge: https://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=b898ab568d374cc9baf89f762d9bb78c.

- SAGBI rating relationship

- Crop types that are conducive to high-quality, open wetland habitat suitable for shorebird stopovers when flooded (i.e., not orchards)
- Crop types that are suitable for recharge (i.e., suitable for flooding in February through April, and conducive to deep percolation)
- Water supply and infrastructure characteristics that are suitable for flooding (i.e., existing flood irrigation infrastructure, existing surface water supply)

The process for identifying and enrolling suitable fields in the program is documented extensively on the TNC BirdReturns project website (https://birdreturns.org/).

The GSA would conduct or coordinate outreach to local growers to identify willing participants that irrigate fields where multi-benefit groundwater recharge can be implemented. Outreach would be conducted through existing communication pathways described in the GSP. Participant responses would be gathered and organized through surveys that request information regarding:

- Field characteristics (location, size, cropping, field preparation methods)
- Existing water supply characteristics (water supply source(s), timing of water source(s))
- Existing measurement and monitoring infrastructure (flow meters, groundwater well)
- Other relevant information

The GSA, with potential support from other proponents in the Subbasin, would then coordinate with participating growers to implement on-farm, multi-benefit groundwater recharge. Following initial site selection and completion of any necessary permitting and environmental documentation, fields would be prepared for flooding and monitoring. At that time, necessary monitoring equipment would be installed, as needed. The program could be designed to pay for field preparation, irrigation, and water costs through an GSA-planned incentive structure.

During the "flooding window" (generally February through April), enrolled fields would then be flooded and maintained at a shallow water depth to supply groundwater recharge and temporary open wetland habitat for migrating shorebirds. Finally, after completion of the program requirements, contract fees (if applicable) would be paid to participants.

#### *4.4.1.2.1 Implementation Schedule*

A typical annual timeline of project implementation is provided in **Table 4-6.** At this time, the multi-benefit groundwater recharge program has been developed and evaluated only at an investigative, planning level. This project will ultimately be selected for implementation according to the criteria identified in Section 4.4.1.2.5. At that time, the GSA would develop and implement the program annually following the general implementation schedule presented in **Table 4-6**.

**Table 4-6. Expected Annual Implementation Timeline for the Red Bluff Subbasin Multi-benefit Groundwater Recharge Project.**

| TIMELINE ACTIVITY | START | END |
|---|---|---|
| Participant Applications | December-January | March |
| Site Selection | January-February | March |
| Construction, Site Preparation | February | March |
| Operation | February | April |
| Financial Incentive Payment | April | June |

#### 4.4.1.2.2 Notice to Public and Other Agencies

The public and other agencies will be notified of project implementation activities through outreach and communication channels identified in the GSP.

#### 4.4.1.2.3 Construction Activities and Requirements

This project may be configured and operated to utilize existing diversion and conveyance infrastructure available within the Subbasin or may require construction of new diversion and conveyance infrastructure. If existing infrastructure and facilities are available and used for this project, there would be no anticipated infrastructure construction activities and requirements. If new diversion and conveyance infrastructure must be constructed, it is anticipated that this project would require one or more diversion structures, each equipped with a pump, fish screen, and magnetic flow meter. Conveyance pipeline and metered turnout structures would also be required to supply water to participating fields, and to facilitate project monitoring and reporting. The precise configuration and capacity of necessary infrastructure would be refined during future project development.

The project may also require on-farm activities for participating growers to enhance field flooding and recharge on existing fields. The program is designed to work within existing field infrastructure and irrigation systems. Any on-farm water management modifications are expected to be modest to increase standing water on fields outside of the growing season to support both recharge and habitat.

Prior to field flooding, the GSA could facilitate a survey of the fields and install pressure transducers and/or flow meters at inlets and outlets and in adjacent wells to facilitate measurement of applied water depths and changes in groundwater depth.

#### 4.4.1.2.4 Water Source

Surface water used in this project is expected to be available from existing or new surface water rights contracts from waterways within or adjacent to the Subbasin. The availability and reliability of surface water for projects is described in Section 4.8. Existing or newly constructed diversion and conveyance infrastructure would be used to supply surface water to participating fields for multi-benefit groundwater recharge. Surface water would be delivered during a “flooding window,” generally from February through April.

#### 4.4.1.2.5 Circumstances and Criteria for Implementation

The primary constraints on the operation of this project are (1) the availability of sufficient surface water supply, and (2) the participation of growers with fields conducive to groundwater recharge.

Surface water supply conditions needed for this project include:

- Availability of surface water supplies that are sufficient to flood participating fields according to the specified flooding depth and duration
- Appropriate timing of surface water supply availability during the project "flooding window" (generally February through April), when wetland habitat for shorebirds migrating along the Pacific Flyway is needed
- Reliability of surface water supplies, based on historical reliability and expected future reliability

Grower participation needed for this project includes:

- Willingness of growers to participate in this program, informed by program applications
- Availability of participating fields suitable for groundwater recharge, based on soil texture, crop type, and availability of suitable surface water flood irrigation infrastructure

A multi-benefit groundwater recharge program is planned for future implementation pending funding and changes in future groundwater conditions in the Red Bluff Subbasin. The GSA will monitor groundwater levels in the Subbasin through the monitoring plan in this GSP. If groundwater levels decline near or below minimum thresholds, this project may be prioritized to support in-lieu recharge in those areas where undesirable results may occur. The GSA may also decide to implement this project at an earlier time to achieve these multi-benefits for the Subbasin.

Ongoing implementation of a multi-benefit groundwater recharge program does not depend on the implementation or performance of other projects or activities. While operation of this program is not expected to terminate, any future changes will be made to align with the GSA's goals and the overall Subbasin sustainability goal.

#### 4.4.1.2.6 Legal Authority, Permitting Processes, and Regulatory Control

The following entities and agencies have potential permitting roles for the multi-benefit groundwater recharge project: Tehama County, the State Water Resources Control Board (SWRCB), and USBR (if using CVP contract supply). If necessary, the GSA or other project proponent will obtain land grading permits from the County. If necessary, the GSA or other project proponent will apply or facilitate applications for permits required from the SWRCB for diversion of surface water to the extent that diversion is not already permitted under existing water rights and contracts. Recharge projects may also require an environmental review process under CEQA. If required, this project would need a Negative Declaration or Mitigated Negative Declaration.

### 4.4.1.3. Operation and Monitoring

Following site selection, operation of the multi-benefit recharge project would begin with site preparation. Field preparation would be completed prior to flooding to enhance wetland habitat and recharge potential. Existing vegetation may be removed or incorporated, depending on recommendations or requirements associated with initial field conditions. Flow rate and groundwater level monitoring equipment may also be installed in the fields, as needed, to facilitate project monitoring. Soil and water

samples could be collected to ascertain water quality prior to wetting, as desired. Wooden stakes should also be installed to support monitoring of water depths and bird presence.

After site preparation, multi-benefit groundwater recharge would be implemented through field flooding. During the implementation period (generally February through April), participants would spread water on their fields and maintain a shallow depth (four inches maximum) for typically four to six weeks. Participants would record any changes in water flow in an irrigation log. Meanwhile, the GSA or other project proponent would coordinate monitoring of field depth, bird presence, water delivery volume, and changes in groundwater depth.

#### 4.4.1.4. Project Benefits and Costs

The expected benefits and costs of the multi-benefit recharge program are summarized in **Table 4-7**. Potential benefits to the groundwater system are estimated based on soil infiltration rates and analyses of potential recharge areas in the Red Bluff Subbasin (documented in **Appendix 2-J, Tehama IHM Model Documentation**). Habitat benefits are estimated to be equal to the participating area.

While actual participation in the program would vary from year to year, depending on grower interest, water availability, changes in cropping, and other factors, preliminary mapping was done to identify potential recharge areas that may be suitable for participation in the project. The total area suitable for the multi-benefit recharge project was evaluated based on recharge potential and cropping, as described in **Appendix 2-J**. Recharge potential was quantified based on the area-weighted soil agricultural groundwater banking index (SAGBI) rating of fields in the Subbasin, considering only fields with a SAGBI rating of "moderately good" or higher (UC Davis, 2021). Crop areas suitable for multi-benefit recharge were evaluated based on 2018 Land IQ spatial land use data, filtering land areas by crop type to exclude permanent crops, rice, crops with growing seasons unsuited to the flooding window, and non-agricultural areas. In total, approximately 1,310 acres in the Red Bluff Subbasin are potentially suitable for multi-benefit recharge according to these criteria. Additional information is described in **Appendix 2-J**. Of this total, it is estimated that an average of approximately 660 acres may participate in the multi-benefit recharge program in a given year (approximately 50 percent of the total potential recharge area).

Based on observed infiltration rates from a multi-benefit recharge pilot project conducted on fields with soil infiltration characteristics similar to potential recharge areas identified in the Red Bluff Subbasin[2], infiltration rates are expected to range between 0.2 and 1.2 inches per day for participating fields in the Red Bluff Subbasin. Assuming an average of 30 days of flooding per year, the average expected recharge benefit of the multi-benefit recharge program is approximately 1,160 AF per year (ranging from 330 to 1,980 AF per year, depending on actual field recharge rates and areas participating). Analyses in Section 4.8 indicate that the potential water available for diversion from waterways in the Subbasin are generally sufficient to supply at least several hundred acre-feet of water for this project each year. While changes in water availability may impact the extent of program participation from year to year, the program could operate in most years, providing both groundwater recharge and migratory bird habitat along the Pacific Flyway.

[2] Observed infiltration rates for fields with a SAGBI rating of "moderately good" or higher for a 2020 pilot project conducted in Colusa County.

Besides groundwater recharge and habitat, the multi-benefit recharge project can also provide benefits to flood risk reduction and climate change adaptation. Those potential benefits are not quantified at this time.

Typical program cost components are summarized in **Table 4-8**, on a per site basis. These costs include only on-farm equipment and direct costs and estimated program operation costs, and do not include costs for any new diversion and conveyance infrastructure that may be needed. The precise configuration and costs of any new diversion and conveyance infrastructure would be identified and refined during future project development.

Slightly higher on-farm and program costs are typically incurred in the first year a site participates in the program, as more coordination and site preparation is typically required. As a site continues to participate in the program, lower costs are anticipated from year to year. Costs per site may vary depending on future changes in program requirements and incentives. The total costs of the program will vary over time, depending on the number of sites enrolled and the extent to which new sites are enrolled or returning sites continue to participate in the multi-benefit recharge program.

**Table 4-7. Estimated Average Recharge Volume and Temporary Wetland Babitat Formation for the Multi-benefit Groundwater Recharge Project.**

| PROJECT | ESTIMATED POTENTIAL RECHARGE AREA (ACRES) | ESTIMATED PARTICIPATION AREA (ACRES/YEAR) | ESTIMATED AVERAGE ANNUAL RECHARGE[1] (AF/YEAR) | ESTIMATED AVERAGE ANNUAL ON-FARM COST[2] | AVERAGE ANNUAL ON-FARM COST PER AF BENEFIT |
|---|---|---|---|---|---|
| Multi-Benefit Groundwater Recharge | 1,310 | 660 | 1,160 | $77,000 | $66 |

[1] Average estimated benefit, assuming 660 acres flooded for 30 days each year, with an estimated recharge rate ranging from 0.2-1.2 inches/day (330 – 1,980 AF/year).

[2] Assumes that on average 50% of sites are new and 50% of sites are established in a given year, and that average participating field sizes are 30 acres. See Table 4-8 for unit costs per site.

**Table 4-8. Estimated Capital Cost and Average Annual Operating Cost per Site for the Multi-benefit Groundwater Recharge Project.**

| COST COMPONENT PER SITE | ESTIMATED AVERAGE ANNUAL COST AT NEW SITES ($)[1] | ESTIMATED AVERAGE ANNUAL COST AT ESTABLISHED SITES ($) |
|---|---|---|
| **CAPITAL COSTS** | | |
| Equipment and Direct Cost | $2,000 | $1,000 |
| Operations and Maintenance Costs | | |
| Labor, Coordination, Administration, and Analysis | $2,000 | $2,000 |
| **Total** | **$4,000** | **$3,000** |

[1] Costs estimated based on implementation costs for a multi-benefit recharge pilot project in Colusa County. Typical costs will vary between individual programs, depending on how the GSA and/or participating agencies plan to implement and monitor the program.

### 4.4.2. Grower Education Relating to On-Farm Practices for Sustainable Groundwater Management

#### 4.4.2.1. Overview

A grower education and outreach program is proposed as a management action for the Red Bluff Subbasin. The 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. Implementation of these on-farm practices will be recorded, along with estimated or measured benefits to groundwater sustainability resulting from these practices.

This program would be accomplished through workshops and distribution of educational materials, as well as on-site irrigation system evaluations and irrigation water management assistance. The program would continue and potentially expand the irrigation evaluation services currently in place through the Mobile Irrigation Lab (MIL), operated in Tehama County by the Tehama County Resource Conservation District since 2002.

Four categories of on-farm practices, or on-farm management actions, which may be covered in this program are:

1. maximizing the use of surface water (e.g., “in-lieu” recharge),
2. managing soils to improve infiltration and root zone soil moisture storage,
3. reducing (and minimizing) non-beneficial ET, and
4. precision nutrient management.

In aggregate, these on-farm practices will promote both agricultural productivity and economic benefits along with sustainable groundwater management[3]. **Table 4-9** identifies the sustainability indicators that will be supported by each category of on-farm management actions.

General topics identified for the grower education program are summarized below. Additional information and topics are summarized in **Appendix 2-J**.

**Table 4-9. Sustainability Indicators Benefitted by On-Farm Management Actions.**

| ON-FARM MANAGEMENT ACTION | SUSTAINABILITY INDICATORS BENEFITTED |
|---|---|
| Maximizing surface water use | groundwater levels, groundwater storage |
| Managing soils to improve infiltration and root zone soil moisture storage | groundwater levels, groundwater storage |
| Reducing non-beneficial ET | groundwater levels, groundwater storage |
| Precision nutrient management | water quality |

#### *4.4.2.1.1 Maximizing Use of Surface Water ("in-lieu" recharge)*

The use of surface water for irrigation whenever it is available is a crucial practice to support sustainable groundwater management. The use of surface water both offsets local groundwater demand through reduced groundwater pumping ("in-lieu" recharge) and increases groundwater recharge through the non-consumptive recoverable flow of deep percolation of applied surface water from the land surface to the underlying aquifer. The on-farm practices to maximize the use of surface water include implementing a dual-source irrigation system, reducing tailwater resulting from irrigation, and other actions to promote the conjunctive management of surface water and groundwater. This education program could be coupled with an incentive program to encourage additional use of surface water in-lieu of pumping groundwater. This would be particularly effective in instances where groundwater is, from the perspective of the grower, effectively cheaper than surface water.

A dual-source irrigation system is capable of utilizing surface water for irrigation from an irrigation water supplier's conveyance system when available and utilizing groundwater if surface water is unavailable. Developing a dual-source irrigation system generally involves adding on-farm infrastructure to connect the on-farm irrigation system, that currently uses groundwater, to an irrigation water supplier's distribution system. The benefits of this practice are that every acre-foot of surface water that is utilized is an acre-foot of groundwater that remains in the aquifer ("in-lieu recharge"), supporting sustainable groundwater levels and maintaining groundwater storage. Additionally, the applied surface water will inevitably result in some direct groundwater recharge through deep percolation. These positive impacts will initially occur in the aquifer directly beneath the grower's lands, while also influencing surrounding lands. The potential drawbacks to this system are the initial construction costs and higher maintenance

[3] In most cases, not all on-farm practices will be able to be implemented. Also, some practices will not work in tandem with one another. For example, maximizing the use of available surface water and precision irrigation scheduling are not possible on the same field at the same time.

costs associated with a more complex irrigation system that can draw from two water sources, as well as the potential for sediments and debris in surface water to obstruct irrigation systems. If the dual-source irrigation system is designed to accommodate this, surface water and groundwater could be intermixed during irrigation to mitigate these effects.

The on-farm management practice of reducing tailwater from irrigation and holding that water within the irrigated area will either increase the ET, increase the deep percolation, or some combination of the two. The practical steps taken to achieve these will vary from field to field. If there are irrigation application uniformity issues with over-irrigation occurring in certain parts of the field, addressing these issues will promote tailwater reduction. Also, if there are low-lying portions of a field or border strips that are not in agricultural production, excess applied water can be directed to these areas where it can be contained by topography or the construction of low berms and allowed to infiltrate the ground and recharge the underlying groundwater system, rather than flowing off the field.

The two practices above are examples of conjunctive management, which recognizes that surface water and groundwater are interdependent and seeks to combine and balance the beneficial use of both water sources to promote sustainable water use while minimizing any negative economic or environmental impacts that have the potential to occur (Dudley and Fulton, 2006). Conjunctive management is often practiced on a larger scale, but it can be applied by individual growers through the practices above (and others) to maximize surface water usage when available and promote groundwater sustainability.

#### 4.4.2.1.2 Managing Soil to Improve Infiltration and Root Zone Soil Moisture Storage

Another on-farm practice that will promote groundwater sustainability is management of soil at the ground surface and within the root zone to improve infiltration of applied water and reduce runoff or ponding on the ground surface. This can be implemented through a variety of on-farm practices including planting cover crops or utilizing crop rotations to increase organic matter content in the root zone, application of manure or other organic material, limiting soil compaction by minimizing use of heavy equipment, and if there is a restrictive layer near the surface of the ground, potentially using deep ripping or tillage to improve infiltration past the restrictive layer (Sanden et al, 2016; USDA-NRCS, 2014). Improving infiltration will result in increases in direct recharge and improving soil moisture storage may increase effective precipitation and slightly reduce the required volume and frequency of irrigation.

#### 4.4.2.1.3 Reducing Non-beneficial Evapotranspiration

This section describes two potential methods for reducing non-beneficial ET through altering and carefully controlling the timing and volume of applied water.

##### 4.4.2.1.3.1 Precision Irrigation Scheduling

Precision irrigation scheduling has the potential to benefit both grower profits and sustainable groundwater management. Precision irrigation scheduling enables growers to accurately identify the timing and volume of irrigation water to apply to maximize crop productivity while minimizing water application. It typically requires real-time or near real-time information on soil moisture and weather conditions and is crop dependent. When effectively implemented, precision irrigation scheduling promotes sustainable groundwater management through increased water use efficiency; water that otherwise would have been applied to the field remains in the groundwater system or is available for use elsewhere.

#### 4.4.2.1.3.2 Regulated Deficit Irrigation

Regulated deficit irrigation applies irrigation water during important drought-sensitive growth stages for a crop and reduces applied irrigation water (i.e., deficit irrigation) during other growth stages where there will be little to no effect on crop yields. This on-farm management practice needs to be prudently applied, but it has the potential to reduce applied water and associated irrigation costs while having little to no impact on crop yields. It promotes sustainable groundwater management through reduced consumptive use; water that otherwise would have been applied to the field is not consumed and remains in the groundwater system or is available for use elsewhere.

#### 4.4.2.1.4 Precision Nutrient Management

Another negative impact to the groundwater system that can result from irrigated agriculture is the degradation of groundwater quality occurring from excess application of nutrients (i.e., nitrogen, phosphorus, etc.) and pesticides or herbicides. As applied water infiltrates the ground and percolates to the aquifer, it can transport excess nutrients, pesticides, or herbicides applied on the land surface during crop production or liberate these constituents that are present in the ground from historic practices. At high concentrations, these materials are a health concern if this groundwater is pumped and used for human consumption. Improving on-farm nutrient management and efficiency of nutrient application will save on-farm costs and reduce the nutrient influx to the groundwater system.

### 4.4.2.2. Implementation

The GSA would implement the grower education program by planning, preparing, and conducting outreach efforts related to the topics above, or by facilitating such efforts. Outreach efforts may include seminars, trainings, workshops, and publications on topics related to on-farm water management and groundwater sustainability. The program would continue and expand the irrigation evaluation services currently in place through the Mobile Irrigation Lab (MIL), operated in Tehama County by the Tehama County Resource Conservation District since 2002.

As the GSA begins to conceptualize and implement specific grower education programs and tools, it may consider partnering with local grower groups, educational and agricultural extension professionals, and others who are experienced in grower outreach and are knowledgeable about local agricultural practices. Potential agencies and groups that the GSA may consider partnering with are:

- University of California Cooperative Extension (UCCE)
- California State University, Chico (Chico State)
- University of California, Davis (UC Davis)

Staff and researchers at UCCE, Chico State, and UC Davis regularly partner with counties and other local agencies to conduct applied research and education programs throughout California.

#### 4.4.2.2.1 Implementation Schedule

A general implementation schedule for the grower education program is presented in **Table 4-10**. Planning and partnership development are expected to begin in the first two years of GSP implementation, recurring as needed over the GSP implementation period. As topics are planned and partnerships are developed, education programs are expected to occur throughout GSP implementation.

It is anticipated that the public and other agencies will be notified of planned grower education activities through outreach and communication channels identified in the GSP.

**Table 4-10. Grower Education Program Implementation Schedule.**

| PHASE/TIMELINE ACTIVITY | DESCRIPTION | YEAR START | YEAR END |
|---|---|---|---|
| Education Topic Planning | Identifying specific education topics relevant to local agricultural practices and groundwater conditions | Year 1 of Project Implementation | Ongoing |
| Partnership Development | Identifying and teaming with partner agencies to plan and implement grower outreach | Year 2 of Project Implementation | Ongoing |
| Education Program Implementation | Conducting grower education and outreach activities | Year 3 of Project Implementation | Ongoing |

#### 4.4.2.2.2 Notice to Public and Other Agencies

The public and other agencies will be notified of planned grower education activities through outreach and communication channels identified in the GSP.

#### 4.4.2.2.3 Construction Activities and Requirements

There are no anticipated construction activities that would affect the grower education program. The grower education program will primarily require development and distribution of technical and educational resources, which the GSA will prepare through the partnerships described above.

#### 4.4.2.2.4 Water Source

While there is no water source directly used in this program, the grower education program will promote conjunctive use of groundwater and all surface water sources available to growers and will promote reduction in non-beneficial ET of all water sources.

#### 4.4.2.2.5 Circumstances and Criteria for Implementation

Grower education programs will add value to other groundwater sustainability efforts at any time during GSP implementation. Because on-farm water management decisions are so impactful to achieving and maintaining groundwater sustainability, implementation of grower education programs is anticipated throughout GSP implementation, with planning efforts beginning the first year of GSP implementation. Over time, programs will be tailored to reflect current technologies and best practices in on-farm water management, especially as the GSA's understanding of groundwater conditions in the Red Bluff Subbasin grows.

#### 4.4.2.2.6 Legal Authority, Permitting Processes, and Regulatory Control

The GSA has the authority to plan and partner with other groups to implement grower education activities. There are no anticipated permitting or regulatory processes that would affect the grower education program.

#### 4.4.2.3. Operation and Monitoring

The grower education program will be accomplished by the GSA through partnerships with agencies, as described under the implementation section, above. The GSA and partner agencies will develop and distribute educational materials on topics relevant to local agricultural practices and groundwater conditions.

Grower responses to specific educational topics will be assessed and monitored through pre- and post-workshop surveys. These surveys will be designed to identify the extent to which growers adopt recommended practices.

All benefits to sustainability indicators in the Red Bluff Subbasin will be evaluated through groundwater monitoring and water quality monitoring at nearby monitoring sites, identified in the GSP.

#### 4.4.2.4. Benefits and Costs

Implementation of grower education activities is ultimately expected to benefit groundwater levels, groundwater storage, and water quality. Encouraging growers to implement on-farm water management practices that maximize surface water use and reduce non-beneficial ET is expected to provide in-lieu recharge benefits to the groundwater system. Encouraging soil management to enhance infiltration is expected to enhance direct groundwater recharge. Both in-lieu and direct recharge are anticipated to benefit groundwater levels and groundwater storage. Encouraging growers to implement precision nutrient management is also expected to help manage nutrient loading in the subbasin, with benefits to water quality.

The benefits of grower education are expected throughout program implementation, beginning the first or second year of education program implementation (**Table 4-10**). These benefits will be monitored as described in the operation and monitoring section, above.

The total cost of the grower education program will vary depending on the types and extent of educational outreach. Grower outreach and education through social media communication may be inexpensive or virtually free, while seminars, trainings, workshops, and publications will likely incur planning and development costs. Total costs are expected to be proportional to the expansion of the education program over time. Conceptual-level estimated costs for grower education are approximately $10,000, assuming approximately two workshops per year, and that $5,000 is required for workshop preparation, implementation, and related distributed materials. These efforts and costs may be distributed across one or more Subbasins in Tehama County. Refined costs will be developed, and actual costs will be described in the GSP annual reports as specific education activities are planned and implemented.

### 4.4.3. Thomes Creek and Elder Creek Diversion for Direct or In-Lieu Groundwater Recharge

#### 4.4.3.1. Overview

A series of projects to divert flood flows from Thomes Creek and Elder Creek is currently under development for implementation in the Red Bluff Subbasin that could provide direct or in-lieu groundwater recharge benefits to the Subbasin and support local groundwater sustainability. These projects are collectively referred to in this section as the Thomes Creek and Elder Creek groundwater recharge projects.

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, recharge wells, or modified stream beds.

Project implementation would be distributed across participating fields and areas, operating through voluntary participants with access to existing or newly constructed diversion, conveyance, and other infrastructure suitable for Flood-MAR and/or off-stream storage and recharge. The projects would be operated each year that stormflows are available.

The objectives of the Thomes Creek and Elder Creek groundwater recharge projects are primarily to benefit:

- All beneficial uses and users of groundwater, by replenishing groundwater through direct or in-lieu groundwater recharge, and
- Environmental water users, including wildlife and migratory shorebirds, by creating temporary shallow wetland habitat on fields (if implementing recharge through Flood-MAR) and by enhancing riparian habitat (if implementing recharge through modified stream beds).

This group of projects is one of two potential project groups developed for implementation that were modeled in the Tehama IHM as part of the projected with future land use, 2070CT climate change, and PMAs scenario. Assumptions and results of this scenario are summarized in Section 4.1.1.1 above and described in greater detail in Section 2 of the GSP. While the actual project configuration may use off-stream storage, recharge basins, and/or modified stream beds, for purposes of preliminary evaluation and modeling it was assumed that this project would be conducted through Flood-MAR. Thus, the project costs, benefits described, and configuration discussed in this section assume that Flood-MAR will be used.

#### 4.4.3.2. Implementation

Thomes and Elder Creek originate to the west of the Red Bluff Subbasin, and generally flow eastward through the Red Bluff Subbasin, eventually draining into the Sacramento River. During periods of flow in the winter and spring, a portion of these flows would be diverted for either (1) off-stream storage and subsequent use for irrigation or (2) direct groundwater recharge through Flood-MAR, dedicated recharge basins, or modified stream beds. The actual project configuration will vary depending on the availability of infrastructure, landowner participation, and the timing and volume of water availability. However, for purposes of preliminary evaluation and modeling it was assumed that this project would be conducted through Flood-MAR.

Prior to and during project implementation, the GSA or other project proponents would identify potential recharge areas and coordinate with growers willing to participate in this project. Following site selection and identification of voluntary participants, operation of the project would begin with site preparation. Field preparation would be completed prior to flooding to enhance recharge potential and wetland habitat. Existing vegetation may be removed or incorporated, depending on recommendations or requirements associated with initial field conditions. After site preparation, participants would implement Flood-MAR on their fields, diverting and spreading water whenever available.

While actual project participation will vary from year to year depending on water availability and grower interest, preliminary mapping was done to identify potential recharge areas that may be suitable for participation in the Thomes Creek and Elder Creek groundwater recharge project. Potential recharge areas were identified as the intersection of fields considered to be suitable for project participation according to the following criteria:

- **Groundwater recharge suitability**: Groundwater recharge suitability was evaluated using the Soil Agricultural Groundwater Banking Index (SAGBI). SAGBI is a suitability index indicating the potential for groundwater recharge on agricultural land, determined according to five main factors: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. SAGBI ratings for lands in California are developed by the California Soil Resource Lab at UC Davis and UC-ANR and are available online (https://casoilresource.lawr.ucdavis.edu/sagbi/). Areas with "Excellent," "Good," and "Moderately Good" SAGBI ratings were identified as potentially suitable for project participation.

- **Cropping suitability:** Cropping was evaluated using the Land IQ 2018 statewide crop mapping dataset. The dataset represents a statewide, comprehensive, field-scale assessment of agricultural land use that was prepared by Land IQ and made available through the DWR SGMA Data Viewer (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer) to provide consistent, current land use information for SGMA planning. Crop classifications identified as potentially suitable for project participation include various annual and field crops[4], alfalfa, pasture, grain, and fallowed land. Permanent crops (orchards, vineyards, etc.) and other non-agricultural land uses were generally excluded from participation.

- **Proximity to Thomes Creek and/or Elder Creek**: Areas potentially suitable were evaluated within a buffer region extending from 0.25 mile to 1.0 mile around Thomes Creek and/or Elder Creek. These buffer regions were selected to identify fields within a distance suitable for diversion and conveyance, using either available existing infrastructure or newly constructed infrastructure, while screening fields directly adjacent to waterways where flood water may flow back to the waterway instead of infiltrating to the underlying aquifer.

- Of the total area found to be suitable for project participation according to these criteria, only a fraction is expected to participate from year to year. Other factors that will need to be considered during project implementation are the availability of existing diversion, conveyance, and on-farm infrastructure for field flooding, or the need for new infrastructure and field preparation. In practice, the location and scale of the project will also depend on grower interest and willingness to participate. Locations will depend on grower participation and could be anywhere within the Red Bluff Subbasin where recharge conditions are favorable and where surface water supplies from Thomes or Elder Creek are available.

[4] Crops include beans, corn, cucumbers, melons, sorghum, squash, sudan, sunflowers, tomatoes, and all other miscellaneous field and truck crops.

To encourage project participation, the project may be developed to offer financial incentives to growers. Steps for developing financial incentives may include:

- Evaluation of grower interest, and the types and extent of economic incentives that may be required to support project participation.
- Evaluation of options for funding sources to support project participation. This may include state funding earmarked for the Department of Conversation to support multi-benefit agricultural land repurposing, or additional funding that may be allocated under potential bill AB-252 or similar initiatives.
- Development of program incentives and funding opportunities to encourage enrollment. This may require regular program monitoring and revision in response to grower feedback and changing incentive conditions in the Red Bluff Subbasin (e.g., changes in the returns to farming that would affect willingness to accept payment to participate in the program).

Currently, there are four locations identified which meet the initial criteria for project implementation. These locations are currently being evaluated for their water storage and/or recharge potential. Information about each potential location is provided in Table 4-10. Locations of the proposed project sites are depicted in **Figure 4-1**.

**Table 4-11. Potential Thomes Creek and Elder Creek Diversion Projects.**

| PROJECT SITE | WATER SOURCE | SITE AREA | POTENTIAL RECHARGE | PROJECT FUNDING SOURCE |
|---|---|---|---|---|
| Rancho Tehama | Elder Creek | 10 acres | 40 - 240 AFY | Prop 68 Grant |
| North Thomes Creek | Thomes Creek | 40 acres + 3 mile ditch | 164 - 984 AFY | Prop 68 Grant |
| Marenco Ranch | Elder Creek | 100 acres | 4800 AFY | TBD |
| Henleyville | Thomes Creek | 40 acres | 160 - 960 AFY | Prop 68 Grant |
| Willowcreek Flood-MAR | Willow Creek | 200 acres | 800 – 4800 AFY | Prop 68 Grant |

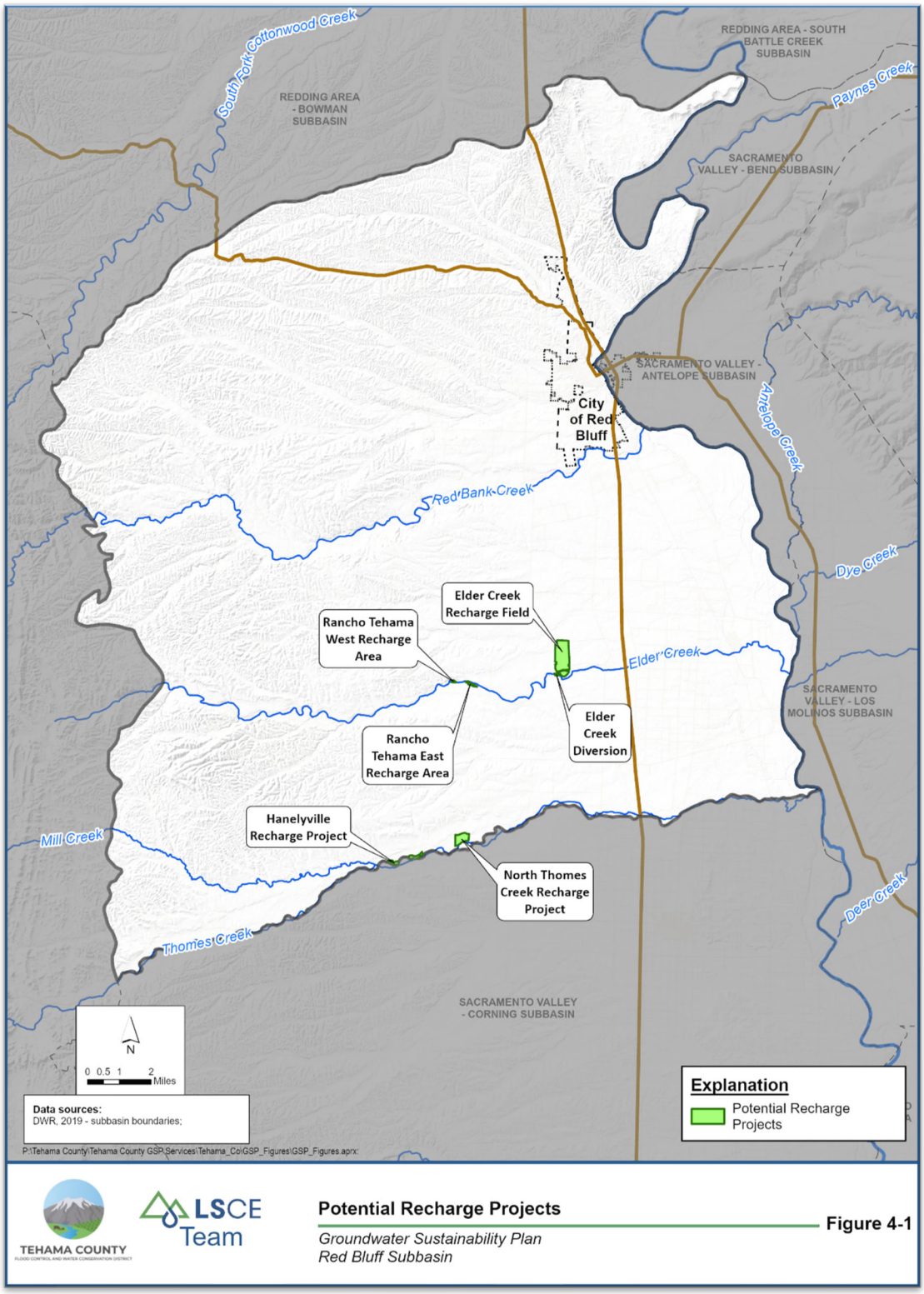


**Figure 4-1. Thomes Creek and Elder Creek Diversion Project Locations**

#### 4.4.3.2.1 Implementation Schedule

A typical annual timeline of project implementation is provided in **Table 4-12**. At this time, the project has been developed and evaluated at an investigative, planning level. Should the GSA or other project proponents obtain funds for implementation of the project, the program would be implemented each year following the general implementation schedule presented in **Table 4-12**.

**Table 4-12. Potential Annual Implementation Timeline for the Westside Streams Stormwater Capture Project.**

| TIMELINE ACTIVITY | START[1] | END[1] |
|---|---|---|
| Participant Applications | April-May | August-September |
| Site Selection | June-July | July-September |
| Site Preparation (If Needed) | June-July | July-September |
| Operation (Field Flooding) | July-October | March-April |
| Financial Incentive Payment (If Applicable) | October | June |

[1]Start and end dates assume that participants could implement Flood-MAR beginning in the fall migratory period along the Pacific Flyway (generally July 15-October 1) and ending in the spring migratory period (generally March 15-April 30), or whenever stormflows are available.

#### 4.4.3.2.2 Notice to Public and Other Agencies

The public and other agencies will be notified of planned project implementation activities through outreach and communication channels identified in the GSP.

#### 4.4.3.2.3 Construction Activities and Requirements

These projects may be configured and operated to utilize existing infrastructure available within the Red Bluff Subbasin. Availability and agreements for these uses would need to be refined during project planning and design. If existing infrastructure and facilities are available and used for this project, there would be no anticipated infrastructure construction activities and requirements.

If new diversion and conveyance infrastructure must be constructed for any projects, it is anticipated that one or more diversion points would be required on each creek to divert flood flows, each equipped with a pump (precise sizing will be refined during future project development), a magnetic flow meter, and a fish screen. Each diversion point would supply water through a conveyance pipeline to turnouts also constructed with magnetic flow meters to facilitate project monitoring and reporting.

The projects may also require on-farm activities for participating landowners to enhance field flooding and recharge on existing fields. The program is designed to work within existing field infrastructure and irrigation systems. Any on-farm water management modifications are expected to be modest to increase standing water on fields outside of the growing season to support both recharge and habitat. Prior to field flooding, the GSAs may facilitate a survey of the fields and install pressure transducers or flow meters at inlets and outlets and in adjacent wells to facilitate measurement of applied water depths and changes in groundwater depth.

#### 4.4.3.2.4 Water Source

The surface water source for the projects will be flood flows along Thomes and Elder Creeks. Subject to availability, flood water from the creeks would be conveyed and applied to participating fields. It is anticipated that flood flows will be available along the westside streams in wet and above normal years. The availability and reliability of water along Thomes and Elder Creeks are discussed further in Section 4.8.

#### 4.4.3.2.5 Circumstances and Criteria for Implementation

The primary sources of uncertainty and potential constraints on the operation of this project are: (1) the availability of sufficient surface water supply, and (2) the participation of growers with fields conducive to groundwater recharge.

Surface water supply conditions needed for these projects include:

- Availability of flood flows that are sufficient to flood participating fields
- Appropriate timing of stormflow availability relative to the timing of wildlife habitat needs, e.g., during migratory periods along the Pacific Flyway
- Reliability of flood flows, based on historical reliability and expected future reliability

Grower participation needed for this project includes:

- Willingness of growers to participate in this program, informed by program applications
- Availability of participating fields suitable for groundwater recharge, based on soil texture, crop type, and availability of suitable surface water flood irrigation infrastructure
- Proximity of participating fields to streams with sufficient flood flows

The Thomes Creek and Elder Creek groundwater recharge projects are planned for future implementation pending funding. The projects detailed in this section are currently in the planning stage and will be brought online as soon as practicable.

Ongoing implementation of the Thomes Creek and Elder Creek groundwater recharge project does not depend on the implementation or performance of other projects or activities. While operation of this program is not expected to terminate, any future changes will be made to align with the GSA's goals and the overall Subbasin sustainability goal.

#### 4.4.3.2.6 Legal Authority, Permitting Processes, and Regulatory Control

If the Thomes Creek and Elder Creek groundwater recharge projects are implemented using Flood-MAR (as anticipated at this time), the project would be organized by the GSA or other proponent as a collaborative effort with private landowners or growers that have the legal authority to implement theseprojects and facilitate Flood-MAR on their lands. Implementation will be done in accordance with the required County permitting processes and regulatory controls.

The following agencies have potential permitting roles for the projects if it is implemented via Flood-MAR: Tehama County and the State Water Resources Control Board (SWRCB). The projects may also require applications for permits required from the SWRCB for diversion of surface water to the extent that diversion is not already permitted under existing water rights and contracts. Recharge projects may also require an environmental 1199 process under CEQA. If required, this project would likely need a Mitigated Negative Declaration.

#### 4.4.3.3. Operation and Monitoring

These projects would directly recharge groundwater and may also offset groundwater pumping if implemented to provide off-stream storage of flood water for later use in irrigation. All benefits to groundwater conditions in the Red Bluff Subbasin will be evaluated through groundwater monitoring and water quality monitoring at nearby monitoring sites, identified in the GSP. Project performance would be summarized as part of GSP annual reports and periodic evaluations.

Benefits to groundwater conditions in the Red Bluff Subbasin would be evaluated by comparison of without- and with-project monitoring. If this project is implemented using Flood-MAR, as anticipated at this time, monitoring would track applied water depths and changes in groundwater depths in the vicinity of participating fields. During site preparation, flow rate and groundwater level monitoring equipment may be installed in the fields, as needed, to facilitate monitoring. Soil and water samples could also be collected to ascertain water quality prior to wetting, as desired, to evaluate any potential project effects on groundwater quality. Throughout GSP implementation, evaluation of benefits to groundwater conditions (especially groundwater levels and groundwater storage) will also be supported by modeling using the Tehama IHM used for GSP development.

As applicable, benefits to migratory shorebirds would be evaluated by monitoring bird presence. During site preparation, wooden stakes should also be installed to support monitoring of water depths and bird presence. During Flood-MAR, participants would record any changes in applied water in an irrigation log. Meanwhile, the GSA or other proponent would coordinate monitoring of changes in groundwater depth and bird presence.

#### 4.4.3.4. Benefits and Costs

Implementation of these projects is expected to primarily benefit groundwater levels and groundwater storage in the Red Bluff Subbasin. The projects would also help to prevent potential depletions of interconnected surface water or land subsidence, to the extent that these are connected to changes in groundwater levels and groundwater storage in and around the project area. These benefits are expected throughout program implementation, beginning the first or second year of program implementation (**Table 4-10**)**.** These benefits will be monitored as described in the operation and monitoring section, above.

The expected direct groundwater recharge benefits of this project are summarized in **Table 4-13**. Benefits to the groundwater system were modeled in the Tehama IHM by simulating potential diversions from Thomes and Elder Creek to potential recharge areas over the projected future water budget period. Habitat benefits are estimated to be equal to the participating area.

As described previously, the total potential area suitable for these projects was evaluated based on recharge potential, cropping, and proximity to the creeks. In total, approximately 2,070 acres are expected to participate in the project each year, assuming that not all potential recharge areas will participate in the program. Actual participation in the project will vary from year to year, depending on grower interest, water availability, changes in cropping, and other factors.

Based on these assumptions, estimated benefits to the groundwater system are approximately 690 AF/yr (0.33 AF/acre), and estimated annual habitat benefits are approximately 2,070 acres/yr. While changes in water availability may impact the extent of program participation from year to year, the program is anticipated to continue every year, providing both groundwater recharge and migratory bird habitat along the Pacific Flyway.

Besides groundwater recharge, the Thomes Creek and Elder Creek groundwater recharge project can also provide benefits to flood risk reduction and climate change adaptation. Those potential benefits are not quantified at this time.

**Table 4-13. Estimated Average Recharge Volume and Temporary Wetland Habitat Formation for the Thomes Creek and Elder Creek Groundwater Recharge Project (2022-2072).**

| PROJECT | ESTIMATED PARTICIPATING AREA (ACRES/ WATER YEAR) | ESTIMATED AVERAGE ANNUAL RECHARGE[1] (AF/WATER YEAR) | ESTIMATED AVERAGE ANNUAL RECHARGE DEPTH (AF/AC-WATER YEAR) | ESTIMATED ANNUAL HABITAT BENEFIT (ACRES/ WATER YEAR) |
|---|---|---|---|---|
| Thomes Creek and Elder Creek Groundwater Recharge Project | 2,070 | 690 | 0.33 | 2,070 |

[1] Average annual increase in deep percolation in the Red Bluff Subbasin attributed to the Thomes Creek and Elder Creek groundwater recharge project, calculated as the difference between the Tehama IHM projected future water budget results with 2070CT climate change and projects, and the projected future water budget results with 2070CT climate change but without projects.

Typical project costs for field preparation, flooding, and project administration are summarized in **Table 4-14**, on a per site basis. Slightly higher costs are typically incurred in the first year a site participates in the project, as more coordination and site preparation are typically required. As a site continues to participate in the project, lower costs are anticipated from year to year. Costs per site may vary depending on future changes in project requirements and incentives (if applicable). The total costs of the program will vary over time, depending on the number of sites enrolled and the extent to which new sites are enrolled or returning sites continue to participate in the project.

This projects may be configured and operated to utilize existing infrastructure available within the Red Bluff Subbasin. If existing infrastructure and facilities are available and used for this project, the infrastructure construction costs would be less. If new diversion and conveyance infrastructure must be constructed for this project, it is anticipated that this project would diversion structures, each equipped with a pump, fish screen, and magnetic flow meter. Conveyance pipeline and metered turnout structures would also be required to supply water to participating fields, and to facilitate project monitoring and reporting. The precise configuration and capacity of necessary infrastructure would be refined during future project development. Typical estimated costs for constructing a single new pumped diversion site with approximately 3,900 feet of conveyance line and 10 turnouts are summarized in **Table 4-15**. These costs are considered to be preliminary costs per diversion site, and would be refined during future project development, according to the selected project configuration and requirements.

**Table 4-14. Estimated Capital Costs and Average Annual Operations and Maintenance Costs Per Site for the Thomes Creek and Elder Creek Groundwater Recharge Project.**

| COST COMPONENT PER SITE | ESTIMATED AVERAGE ANNUAL COST AT NEW SITES ($)[1] | ESTIMATED AVERAGE ANNUAL COST AT ESTABLISHED SITES ($)[1] |
|---|---|---|
| **Capital Costs** | | |
| Equipment and Direct Cost | $2,000 | $1,000 |
| **Operations and Maintenance Costs** | | |
| Labor, Coordination, Administration, and Analysis | $2,000 | $2,000 |
| **Total Costs** | **$4,000** | **$3,000** |

[1] Costs estimated based on implementation costs for a multi-benefit recharge pilot project to conduct Flood-MAR and create wetland habitat for migratory shorebirds in Colusa Subbasin. Typical costs will vary between individual programs, depending on how the GSAs plan to implement and monitor the program.

**Table 4-15. Estimated Costs per Diversion Site for Construction of New Diversion and Conveyance Infrastructure for the Thomes Creek and Elder Creek Groundwater Recharge Project.**

| COST COMPONENT | NOTES | APPROXIMATE ESTIMATED COST PER SITE ($) |
|---|---|---|
| **Capital Costs** | | |
| Diversion and Conveyance Infrastructure | Includes: diversion structure equipped with one 20 CFS pump, a magnetic flow meter, and fish screen; 3,900 feet of PVC conveyance pipe (assuming 250-260 acres served per diversion, 15 feet per acre); 10 grower turnouts and magnetic flow meters | $900,000 |
| **Indirect Costs** | | |
| Planning, Admin, and Construction Contingencies | Includes: Mobilization/demobilization, bonds, and insurance, permits; planning, design, and environmental costs; construction management and admin; monitoring and assessment; stakeholder outreach; easement acquisition and access agreements; and other contingencies | $470,000 |
| **Total Costs** | | **$1,370,000** |

### 4.4.4. Expanded Use of CVP Contract Supplies in Proberta Water District and Thomes Creek Water District

#### 4.4.4.1. Overview

Proberta Water District (PWD) and Thomes Creek Water District (TCWD) each encompass more than 2,000 acres of land in the Red Bluff Subbasin. The entire service area of PWD and approximately half of the service area of TCWD are located within the Red Bluff Subbasin. Both districts have existing contracts for Central Valley Project (CVP) water supplies that are delivered along the Corning Canal. These CVP supplies are generally used for irrigation as a supplement to local surface water and groundwater supplies. The maximum contract quantity available to PWD is 3,500 AF/yr, and the maximum contract quantity available to TCWD is 6,400 AF/yr, subject to seasonal restrictions and potential curtailments depending on water year type and water supply conditions. CVP contract supplies available to both districts are used for agricultural purposes. Historically, irrigators in PWD and TCWD have not used the full contract quantity.

This project would incentivize expanded use of CVP supply by irrigators in PWD and 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.

This project is one of two potential projects developed for implementation that were modeled in the Tehama IHM as part of the projected with future land use, 2070CT climate change, and PMAs scenario. Assumptions and results of this scenario are summarized in Section 4.1.1.1 above and described in greater detail in Section 2 of the GSP.

#### 4.4.4.2. Implementation

This project has been proposed for implementation as one strategy for achieving and maintaining groundwater sustainability in the Red Bluff Subbasin. The overarching goal of this project is to reduce groundwater use and dependence by expanding utilization of available surface water supplies within the Subbasin. The project is planned for implementation before 2042, with the exact timeline dependent on grower willingness to take additional surface water and/or availability of funding for project incentives.

PWD and TCWD have existing water contracts, infrastructure, and associated permitting in place to operate the proposed program:

- Existing CVP contract supplies, subject to seasonal limitations and potential curtailments depending on water year type and water supply conditions
    - PWD contract: 14-06-200-7311-LTR1
    - TCWD contract: 14-06-200-5271A-LTR1
- Existing district infrastructure for delivering available CVP supplies to irrigators
    - Water is delivered in PWD through a district-maintained pipeline distribution system
    - Water is delivered in TCWD through a landowner-maintained canal system

Initial program implementation may require a planning study of program costs and financial parameters, and an evaluation of the costs of groundwater relative to the costs of surface water for irrigators. This would establish program feasibility and potential program scale.

Benefits are expected to begin accruing as early as the second or third year or project implementation, depending on voluntary grower willingness to participate and establishment of program incentives. Accrual of benefits would depend on water supply conditions, as all CVP contracts contain a shortage provision allowing Reclamation to reduce the amount of water made available for a variety of reasons, such as drought.

##### *4.4.4.2.1 Implementation Schedule*

A general implementation schedule for the project is presented in **Table 4-10.** At this time, the project has been developed at an investigative, planning level. The precise start date for the project may depend on grower willingness to take additional surface water and may depend on funding for project incentives. The precise timeline for implementation will be reported in GSP annual reports and periodic evaluations when known.

**Table 4-16. Project Implementation Schedule**

| PHASE/TIMELINE ACTIVITY | DESCRIPTION | YEAR START | YEAR END |
|---|---|---|---|
| Project Planning and Concept Development | Evaluate lands, existing infrastructure, permitting, and irrigators potentially willing to take additional surface water. | Year 1 of Project Implementation | Year 2 of Project Implementation; Ongoing as needed |
| Program Development and Incentives Analysis | Develop program costs and financial parameters; assess groundwater costs relative to surface water costs and irrigators' willingness to accept incentives; establish program costs and structure | Year 2 of Project Implementation | Year 3 of Project Implementation |
| Program Operation | Program implementation, monitoring, updates, and ongoing agreements | Year 2/3 of Project Implementation | Ongoing |

#### 4.4.4.2.2 Notice to Public and Other Agencies

The public and other agencies will be notified of planned project implementation activities through outreach and communication channels identified in the GSP.

#### 4.4.4.2.3 Construction Activities and Requirements

There are no anticipated infrastructure construction activities and requirements, as the project will use existing infrastructure and facilities.

#### 4.4.4.2.4 Water Source

This project would use CVP supplies that are currently available to PWD and TCWD through existing contracts with Reclamation. Water is diverted to both districts from the Sacramento River at the Red Bluff Diversion Dam and conveyed through the Corning Canal.

PWD has a contract for 3,500 AF/yr of CVP supplies, depending on water year type, through contract number 14-06-200-7311-LTR1. The contract volume is subject to seasonal limitations (water is available May 15$^{th}$ – September 15$^{th}$) and may be restricted depending on water year type and water supply conditions, as described in the contract shortage provisions. CVP supplies have been delivered to PWD since 1961 and are generally considered to be reliable. Table 4-17 summarizes the average annual allocation to PWD and the estimated unused allocation by water year type over the period 1992-2019.

TCWD has a contract for 6,400 AF/yr of CVP supplies, depending on water year type, through contract number 14-06-200-5271A-LTR1. The contract volume is subject to seasonal limitations (water is available May 15$^{th}$ – September 15$^{th}$) and may be restricted depending on water year type and water supply conditions, as described in the contract shortage provisions. CVP supplies have been delivered to TCWD since 1971 and are generally considered to be reliable. Table 4-17 summarizes the average annual allocation to TCWD and the estimated unused allocation by water year type over the period 1992-2019.

**Table 4-17. Summary of Annual Allocations and Estimated Unused Allocations of CVP Supply**

| DISTRICT: | PROBERTA WATER DISTRICT | THOMES CREEK WATER DISTRICT |
|---|---|---|
| Maximum Contract Quantity | 3,500 AF/year | 6,400 AF/year |
| **SACRAMENTO VALLEY WATER YEAR TYPE** | **AVERAGE ANNUAL ALLOCATION[1] (AF/WATER YEAR, 1992-2019)** | **AVERAGE ANNUAL ALLOCATION[1] (AF/WATER YEAR, 1992-2019)** |
| Wet (W) | 3,500 | 6,400 |
| Above Normal (AN) | 3,500 | 6,400 |
| Below Normal (BN) | 3,500 | 6,400 |
| Dry (D) | 2,625 | 4,800 |
| Critical (C) | 735 | 1,344 |
| All Years, Weighted Average | 2,850 | 5,211 |
| **SACRAMENTO VALLEY WATER YEAR TYPE** | **AVERAGE ESTIMATED UNUSED ALLOCATION[1,2] (AF/WATER YEAR, 1992-2019)** | **AVERAGE ESTIMATED UNUSED ALLOCATION[1,2] (AF/WATER YEAR, 1992-2019)** |
| Wet (W) | 1,510 | 2,760 |
| Above Normal (AN) | 900 | 1,640 |
| Below Normal (BN) | 1,440 | 2,630 |
| Dry (D) | 330 | 600 |
| Critical (C) | 180 | 320 |
| All Years, Weighted Average | 960 | 1,760 |

[1] Based on historical allocations and analysis of Central Valley Operations data for the period 1992 through 2019.

[2] Average Estimated Unused Allocation assumes the CVO-reported deliveries from the Corning Canal were delivered to individual contractors based on percent of contracts held by the individual contractors (64.5% to Corning Water District, 12.5% to PWD, and 22.9% to TCWD).

#### *4.4.4.2.5 Circumstances and Criteria for Implementation*

The primary sources of uncertainty and potential constraints on the operation of this project are: (1) the participation of irrigators willing to take additional surface water supplies, (2) the availability of CVP contract supplies relative to irrigation demand, and (3) the availability of funding for program incentives.

Irrigator participation needed for this project includes:

- Willingness of irrigators to participate in this program, informed by requests for surface water deliveries and program applications (if applicable)
- Availability of participating fields able to take surface water from the PWD and TCWD distribution systems

Surface water supply conditions needed for this project include:

- Appropriate timing of CVP contract supply availability relative to the timing of irrigation demand (CVP supplies are available May 15th – September 15th)
- Reliability of CVP contract supplies, based on historical reliability and expected future reliability
- Program funding needs for this project may include:
- Identification of funding for program development (to cover costs for incentive studies, etc.)
- Identification of funding for program incentives

This project is planned for future implementation pending funding and changes in future groundwater conditions in the Red Bluff Subbasin. The GSA will monitor groundwater levels in the Subbasin through the monitoring plan in this GSP. If groundwater levels decline near or below minimum thresholds, this project may be prioritized for earlier implementation to support in-lieu recharge in those areas where undesirable results may occur. The Districts may also decide to implement this project at an earlier time to support groundwater sustainability in the Subbasin.

Ongoing implementation of this project does not depend on the implementation or performance of other projects or activities in the Subbasin. While operation of this program is not expected to terminate, any future changes will be made to align with the GSA's and/or Districts' goals and the overall Subbasin sustainability goal.

#### *4.4.4.2.6 Legal Authority, Permitting Processes, and Regulatory Control*

PWD and TCWD have the legal authority to deliver additional CVP supplies to irrigators up to their maximum contract amount (or less, depending on the water year type). The planning and implementation of this project will be done in accordance with all required permitting processes and regulatory control. PWD and TCWD already have CVP contracts, permitting, and infrastructure in place to operate the program. No additional permitting requirements are anticipated, though PWD and TCWD will consult with governing agencies, as needed.

### 4.4.4.3. Operation and Monitoring

PWD and TCWD (or landowners in TCWD) will operate, maintain, and monitor existing facilities that would be utilized for the project during implementation and operation. No new additional facilities are planned for development.

Ongoing project monitoring will include a range of activities to evaluate the benefits described in the next section. This will include local monitoring to track the use of additional volumes of surface water made available through the project and estimates of the reduction in groundwater use relative to pre-project baselines. Assessments of economic incentives will also be conducted to evaluate their utility in encouraging surface water usage. Monitoring may include additional outreach to irrigators and landowners, which would be used to refine the program design and encourage additional adoption.

The benefit of utilizing additional surface water for in-lieu recharge on sustainability indicators in the Red Bluff Subbasin (groundwater levels, groundwater storage, interconnected surface water, and land subsidence) will be monitored using the monitoring network sites and monitoring practices described in the GSP.

#### 4.4.4.4. Benefits and Costs

The primary anticipated benefit of the project is reduction of groundwater pumping resulting from in-lieu groundwater recharge. As described previously, reduction in groundwater pumping is expected to primarily benefit groundwater levels and groundwater storage in the Red Bluff Subbasin. The project would also help to prevent potential depletions of interconnected surface water or land subsidence, to the extent that these are connected to changes in groundwater levels and groundwater storage in and around the project area. These benefits are expected throughout program implementation, beginning the second or third year of project implementation (Table 4-16). These benefits will be monitored as described in the operation and monitoring section, above.

The expected in-lieu groundwater recharge benefits of this project are summarized in Table 4-18. Benefits to the groundwater system were modeled in the Tehama IHM by simulating potential deliveries of CVP supplies to irrigated lands in PWD and TCWD, up to the maximum contract quantity. Based on model results, the simulated reduction in groundwater pumping attributed to this project is approximately 1,640 AF/yr over the projected future water budget period. While changes in water availability may impact the extent of project benefits and program participation from year to year, the program is anticipated to continue every year that additional CVP supplies are available. A more detailed assessment of project benefits would be completed during GSP implementation, as additional information is available.

The primary project cost of this project would be the incentives offered to irrigators to encourage expanded use of available CVP supplies. A detailed assessment of the project incentive structure and associated costs is beyond the scope of this initial project investigation for the GSP. Project planning costs and program incentives will be identified through further project development and will be reported through GSP annual reports and periodic evaluations when known.

It is anticipated that the costs of the project would primarily be recovered through GSA assessments as all water users in the Red Bluff Subbasin will realize regional benefits through this project. Other potential funding sources include grants, and loans.

**Table 4-18. Estimated Average Reduction in Groundwater Pumping Resulting from the Expanded Use of CVP Contract Supplies in Proberta Water District and Thomes Creek Water District (2022-2072).**

| DISTRICT | ESTIMATED AVERAGE ANNUAL REDUCTION IN GROUNDWATER PUMPING, 2022-2072 (AF/WATER YEAR) |
|---|---|
| Proberta Water District | 810 |
| Thomes Creek Water District | 830 |
| **Total** | **1,640** |

### 4.4.5. El Camino Restoration Project

#### 4.4.5.1. Overview

The El Camino Restoration Project is proposed by the El Camino Irrigation District to monitor and reduce groundwater use within the district. The El Camino Irrigation District was formed in 1921 to provide water for irrigation and domestic needs and uses. The primary water source supplied to irrigators in the district is groundwater pumped from district-owned wells.

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.

#### 4.4.5.2. Implementation

This project is proposed for implementation in the El Camino Irrigation District. The district plans to replace the most inefficient pumps in its system, replace concrete pipelines with PVC pipelines, replace hub gates, and install flow meters. The precise location and configuration of these improvements are not specified at this time but would be determined and reported following further evaluation.

The project would provide in-lieu groundwater recharge benefits to the Red Bluff Subbasin by monitoring and reducing groundwater use within the district.

##### *4.4.5.2.1 Implementation Schedule*

This project is currently in the early, conceptual planning phase. The start and completion dates for this project are not reported at this time but will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years following improvements to the system, potentially beginning the first year of project implementation.

This project would be implemented and monitored with respect to groundwater conditions. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin

##### *4.4.5.2.2 Notice to Public and Other Agencies*

The public and other agencies will be notified of planned project implementation activities through outreach and communication channels identified in the GSP.

##### *4.4.5.2.3 Construction Activities and Requirements*

This project will require:

- Installation of new pumps to replace the most inefficient pumps,
- Installation of PVC pipelines to replace concrete pipelines,
- Replacement of hub gates, and
- Installation of flow meters on each discharge pipe from every pump.

##### *4.4.5.2.4 Water Source*

This project would not directly use water supplies but would improve management and utilization of groundwater supplies in the Red Bluff Subbasin within sustainable conditions, as defined according to the sustainable management criteria.

#### *4.4.5.2.5 Circumstances and Criteria for Implementation*

This project is currently in the early, conceptual planning phase. The project is planned for future implementation pending funding and changes in future groundwater conditions in the Red Bluff Subbasin. The GSA will monitor groundwater levels in the Subbasin through the monitoring plan in this GSP. If groundwater levels decline near or below minimum thresholds, this project may be prioritized to support in-lieu recharge in those areas where undesirable results may occur. El Camino Irrigation District may also decide to implement this project at an earlier time to support groundwater sustainability in the Subbasin or other district objectives.

Ongoing implementation of the El Camino restoration project does not depend on the implementation or performance of other projects or activities. While operation of this program is not expected to terminate, any future changes will be made to align with the GSA's and district's goals and the overall Subbasin sustainability goal.

#### *4.4.5.2.6 Legal Authority, Permitting Processes, and Regulatory Control*

Districts have the authority to plan and implement projects. Required permitting and regulatory review will depend on the precise configuration of the project and will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include but is not limited to: the County of Tehama, DWR, SWRCB, the Regional Water Board, and others.

### 4.4.5.3. Operation and Monitoring

This project is currently in the early planning stage. Thus, the expected timeline and operation of this this project are not reported at this time but will be reported in GSP annual reports and five-year updates when known.

Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development.

All benefits to sustainability indicators in the Red Bluff Subbasin will be evaluated through groundwater monitoring and water quality monitoring at nearby monitoring sites, identified in the GSP.

### 4.4.5.4. Benefits and Costs

The primary anticipated benefit of the project is reduction of groundwater pumping resulting from reducing losses in the distribution system and better monitoring of the volumes pumped. The project would also help to prevent potential depletions of interconnected surface water or land subsidence, to the extent that these are connected to changes in groundwater levels and groundwater storage in and around the project area. Benefits are expected to accrue in all years following improvements to the system, potentially beginning the first year of project implementation. Benefits will be monitored as described in the operation and monitoring section, above.

This project is currently in the early planning stage. Thus, the expected yield and anticipated cost of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. It is anticipated that El Camino Irrigation District would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments.

### 4.4.6. Elder Creek Non-Native, Invasive Species (NIS) Plant Control

#### 4.4.6.1. Overview

The Tehama County Resource Conservation District has previously initiated efforts to remove non-native, invasive plant species (NIS plants) from riparian zones throughout Tehama County. This project would initiate a similar effort to first identify and then strategically remove NIS plants in the Elder Creek watershed, with a focus on giant reed (Arundo donax) and salt cedar (Tamarisk). On account of the levee systems along Elder Creek near Gerber, CA, this project would require permitting and regulatory control processes through the Army Corps of Engineers (ACOE).

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.

It is anticipated that follow up treatments would be required as part of this project to assure control of invasive species and ensure healthy functioning of the watershed. Once formerly infested sites are free of infestations, native plants may also need to be reestablished in order to expedite the development of the Creek's riparian corridor. This project could also be implemented to enhance existing riparian habitat by filling-in fragmented areas with native species, controlling erosion along creek banks, implementing riparian fencing, and/or obtaining conservation easements to protect riparian resources.

#### 4.4.6.2. Implementation

Implementation of the Elder Creek NIS plant control project would occur in phases, with periodic follow-up after project initiation. This project will be implemented or coordinated by the Tehama County Resource Conservation District, with potential support from other agencies in the Subbasin.

Project work entails the identification and removal of NIS plants species along the riparian corridor, particularly giant reed (Arundo donax) and salt cedar (Tamarisk). The amount and extent of NIS plant growth would first be identified, followed by strategic removal. Due to the growth characteristics of Arundo donax and Tamarisk in particular, follow up treatments are expected to be required in order to achieve control of infested sites and to treat missed areas of infestation. At appropriate intervals, additional sites for removal would be identified, with refinement according to lessons learned from earlier project implementation.

Once formerly infested sites are free of infestations, native plants may also need to be reestablished in order to expedite the development of the Elder Creek riparian corridor and to prevent erosion of creek banks. The project may identify fragmented riparian areas that need to be filled-in, and where riparian fencing and conservation easements would be beneficial. This would be followed by the appropriate actions for each location: planting of native species, obtainment of proper permitting, and construction of riparian fencing. The GSA would work with appropriate authorities to obtain permissions where necessary.

Benefits to groundwater demand reduction and wetland habitat improvement would be analyzed, reported, and used to inform later, phases of project implementation.

#### 4.4.6.2.1 Implementation Schedule

At this time, the project has been developed at an investigative, planning level. Thus, the implementation and termination dates of the ongoing follow-up portion have yet to be determined. Criteria for implementation will depend on the availability of funding, regrowth of invasive species and other factors. The precise timeline for implementation will be reported in GSP annual reports and periodic evaluations when known.

#### 4.4.6.2.2 Notice to Public and Other Agencies

The public and other agencies will be notified of planned project implementation activities through outreach and communication channels identified in the GSP.

#### 4.4.6.2.3 Construction Activities and Requirements

If deemed appropriate for specific locations along Elder Creek, riparian fencing could be constructed as part of this project. Requirements for such construction would include permission from landowners, identification of location for fence posts, and installation of posts and fencing.

Appropriate permits will be obtained for work around and near the surface water infrastructure described in this project. While mechanical means may be used to remove trees and transport them to an appropriate disposal facility, this project does not involve any major construction activities.

#### 4.4.6.2.4 Water Source

This project would not directly use water supplies but would reduce demand for shallow groundwater consumed by non-native, invasive species in the Red Bluff Subbasin. Reduction in groundwater demand will support achievement and maintenance of sustainable groundwater conditions, as defined according to the sustainable management criteria.

#### 4.4.6.2.5 Circumstances and Criteria for Implementation

The circumstances for implementation of this project will depend on the availability of funding, regrowth of invasive species, timing of required permitting activities, and other factors.

#### 4.4.6.2.6 Legal Authority, Permitting Processes, and Regulatory Control

GSAs, Districts, and individual project proponents have the authority to plan and implement projects. The County has a permitting role for this demand management project. This project would also require permitting and regulatory control processes through the Army Corps of Engineers (ACOE), particularly related to the levee systems along Elder Creek near Gerber, CA. This project may require an environmental review process under CEQA. If required, this project would need either an Environmental Impact Report and Negative Declaration or Mitigated Negative Declaration.

### 4.4.6.3. Operation and Monitoring

Expert knowledge will be required to identify and mark invasive species for removal. Both herbicide and manual removal methods would be employed. Monitoring will occur over the course of project implementation. Periodic follow-up will take place through visual inspection and will follow the same procedure.

Sustainability indicators that are expected to benefit from this project include increased groundwater levels and groundwater storage, as well as reduction in depletions of interconnected surface water. All benefits to sustainability indicators in the Red Bluff Subbasin will be evaluated through groundwater monitoring and water quality monitoring at nearby monitoring sites, identified in the GSP.

#### 4.4.6.4. Benefits and Costs

There are multiple expected benefits of this project. Through the control of NIS plants, the threat of their spreading into the Sacramento River's main stem is reduced as is their impacts on those portions of the Creek's riparian zone which now contain infestations. The project is also expected to improve surface water infrastructure conveyance and decrease groundwater demand in riparian zones. This project is currently in the early conceptual stage. Thus, the expected yield of this project has yet to be determined and will be reported in annual reports when known.

Restoration of the natural riparian habitat around Elder Creek has multiple expected benefits as well. Filling-in fragmented areas with native species, controlling erosion along creek banks, implementing riparian fencing, and/or obtaining conservation easements to protect riparian resources will increase recharge potential along Elder Creek. Improved native habitat may increase the ability of the area surrounding the creek to reduce flood water velocity and to recharge flood water into the groundwater while simultaneously assisting with erosion control and sediment trapping (NRCS, 1996). Recycling of nutrients and other chemical reactions within the riparian zone may also improve groundwater quality through absorption of chemicals and nutrients.

Evaluation of benefits will be quantified through post project monitoring. Post project monitoring will be compared to pre-project data as a means of quantifying the benefit. Post project monitoring may include but is not limited to: flow measurement consistent with state regulations, consumptive use analysis, reductions in groundwater use, well monitoring, determination of infiltration rates, water balance analysis, as-built drawings, and stream gaging.

This project is currently in the early conceptual stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in annual reports when known. Potential funding sources are being evaluated as project planning continues; they include, but are not limited to, the following: grants, loans, bonds, assessment fees, and cost-sharing programs. Potential funding sources will be reported in annual reports when known.

### 4.4.7. Tehama West Non-Native, Invasive Species (NIS) Plant Control

#### 4.4.7.1. Overview

This project would identify and strategically remove non-native, invasive plant species (NIS plants) from riparian zones in watersheds originating in the western edge of Tehama County (the Tehama West watersheds), with the exception of the Elder Creek watershed which is covered in the previous project.

Most components of the proposed project are similar to the Elder Creek NIS plant control project, except that the Elder Creek project would require additional permitting and regulatory control processes through the Army Corps of Engineers (ACOE) on account of the levee systems along Elder Creek near Gerber, CA.

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.

It is anticipated that follow up treatments would be required as part of this project to assure control of invasive species and ensure healthy functioning of the watershed. Once formerly infested sites are free of infestations, native plants may also need to be reestablished in order to expedite the development of the riparian corridors. This project could also be implemented to enhance existing riparian habitat by filling-in fragmented areas with native species, controlling erosion along creek banks, implementing riparian fencing, and/or obtaining conservation easements to protect riparian resources.

#### 4.4.7.2. Implementation

Like the Elder Creek NIS plant control project, implementation of the Tehama West NIS plant control project would occur in phases, with periodic follow-up after project initiation. This project will be implemented or coordinated by the Tehama County Resource Conservation District, with potential support from other agencies in the Subbasin.

Project work entails the identification and removal of NIS plants species along riparian corridors, particularly giant reed (Arundo donax) and salt cedar (Tamarisk). The amount and extent of NIS plant growth would first be identified, followed by strategic removal. Due to the growth characteristics of Arundo donax and Tamarisk in particular, follow up treatments are expected to be required in order to achieve control of infested sites and to treat missed areas of infestation. At appropriate intervals, additional sites for removal would be identified, with refinement according to lessons learned from earlier project implementation.

Once formerly infested sites are free of infestations, native plants may also need to be reestablished in order to expedite the development of the riparian corridors and to prevent erosion of creek banks. The project may identify fragmented riparian areas that need to be filled-in, and where riparian fencing and conservation easements would be beneficial. This would be followed by the appropriate actions for each location: planting of native species, obtainment of proper permitting, and construction of riparian fencing. The GSA would work with appropriate authorities to obtain permissions where necessary.

Benefits to groundwater demand reduction and wetland habitat improvement would be analyzed, reported, and used to inform later, phases of project implementation.

##### *4.4.7.2.1 Implementation Schedule*

At this time, the project has been developed at an investigative, planning level. Thus, the implementation and termination dates of the ongoing follow-up portion have yet to be determined. Criteria for implementation will depend on the availability of funding, regrowth of invasive species and other factors. The precise timeline for implementation will be reported in GSP annual reports and periodic evaluations when known.

##### *4.4.7.2.2 Notice to Public and Other Agencies*

The public and other agencies will be notified of planned project implementation activities through outreach and communication channels identified in the GSP.

#### 4.4.7.2.3 Construction Activities and Requirements

If deemed appropriate for specific locations along the Tehama West creeks, riparian fencing could be constructed as part of this project. Requirements for such construction would include permission from landowners, identification of location for fence posts, and installation of posts and fencing.

Appropriate permits will be obtained for work around and near the surface water infrastructure described in this project. While mechanical means may be used to remove trees and transport them to an appropriate disposal facility, this project does not involve any major construction activities.

#### 4.4.7.2.4 Water Source

This project would not directly use water supplies but would reduce demand for shallow groundwater consumed by non-native, invasive species in the Red Bluff Subbasin. Reduction in groundwater demand will support achievement and maintenance of sustainable groundwater conditions, as defined according to the sustainable management criteria.

#### 4.4.7.2.5 Circumstances and Criteria for Implementation

The circumstances for implementation of this project will depend on the availability of funding, regrowth of invasive species, timing of required permitting activities, and other factors.

#### 4.4.7.2.6 Legal Authority, Permitting Processes, and Regulatory Control

GSAs, Districts, and individual project proponents have the authority to plan and implement projects. The County has a permitting role for this demand management project. This project may also require permitting through the Army Corps of Engineers (ACOE). This project may require an environmental review process under CEQA. If required, this project would need either an Environmental Impact Report and Negative Declaration or Mitigated Negative Declaration.

### 4.4.7.3. Operation and Monitoring

Expert knowledge will be required to identify and mark invasive species for removal. Both herbicide and manual removal methods would be employed. Monitoring will occur over the course of project implementation. Periodic follow-up will take place through visual inspection and will follow the same procedure.

Sustainability indicators that are expected to benefit from this project include increased groundwater levels and groundwater storage, as well as reduction in depletions of interconnected surface water. All benefits to sustainability indicators in the Red Bluff Subbasin will be evaluated through groundwater monitoring and water quality monitoring at nearby monitoring sites, identified in the GSP.

### 4.4.7.4. Benefits and Costs

There are multiple expected benefits of this project. Through the control of NIS plants, the threat of their spreading into the Sacramento River's main stem is reduced as is their impacts on those portions of the riparian zone which now contain infestations. The project is also expected to improve surface water infrastructure conveyance and decrease groundwater demand in riparian zones. This project is currently in the early conceptual stage. Thus, the expected yield of this project has yet to be determined and will be reported in annual reports when known.

Restoration of the natural riparian habitat around the Tehama West watersheds has multiple expected benefits as well. Filling-in fragmented areas with native species, controlling erosion along creek banks, implementing riparian fencing, and/or obtaining conservation easements to protect riparian resources will increase recharge potential along waterways. Improved native habitat may increase the ability of the area surrounding the creek to reduce flood water velocity and to recharge flood water into the groundwater while simultaneously assisting with erosion control and sediment trapping (NRCS, 1996). Recycling of nutrients and other chemical reactions within the riparian zone may also improve groundwater quality through absorption of chemicals and nutrients.

Evaluation of benefits will be quantified through post project monitoring. Post project monitoring will be compared to pre-project data as a means of quantifying the benefit. Post project monitoring may include but is not limited to: flow measurement consistent with state regulations, consumptive use analysis, reductions in groundwater use, well monitoring, determination of infiltration rates, water balance analysis, as-built drawings, and stream gaging.

This project is currently in the early conceptual stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in annual reports when known. Potential funding sources are being evaluated as project planning continues; they include, but are not limited to, the following: grants, loans, bonds, assessment fees, and cost-sharing programs. Potential funding sources will be reported in annual reports when known.

### 4.4.8. Demand Management

#### 4.4.8.1. Overview

The GSA on April 15, 2024 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 withing the Subbasin warrant further management actions.

#### 4.4.8.2. Implementation

The Program includes measures in two broad categories: those for immediate implementation and those consideration and phased implementation. The measures intended for immediate implementation are voluntary and focus on reducing groundwater demand through agricultural best practices, water conservation, land repurposing, dryland farming, fallowing and other strategies. The measures for consideration and phased implementation include well restrictions, pumping restrictions, and water trading or fee structures. A detailed listing of measures to be included in the Program can be found in the agreement text (see **Appendix 4-B**). Many of these measures are also detailed in following sections of this GSP. Demand management measures will likely be implemented in targeted areas based on local conditions. Thessien Polygons around each RMS represent Zones that may be used to differentiate the type of and degree of demand management measures to prioritize management and to best address Subbasin conditions at those locations. The potential Demand Management Zones within the Subbasin are depicted in **Figure 4-2**.

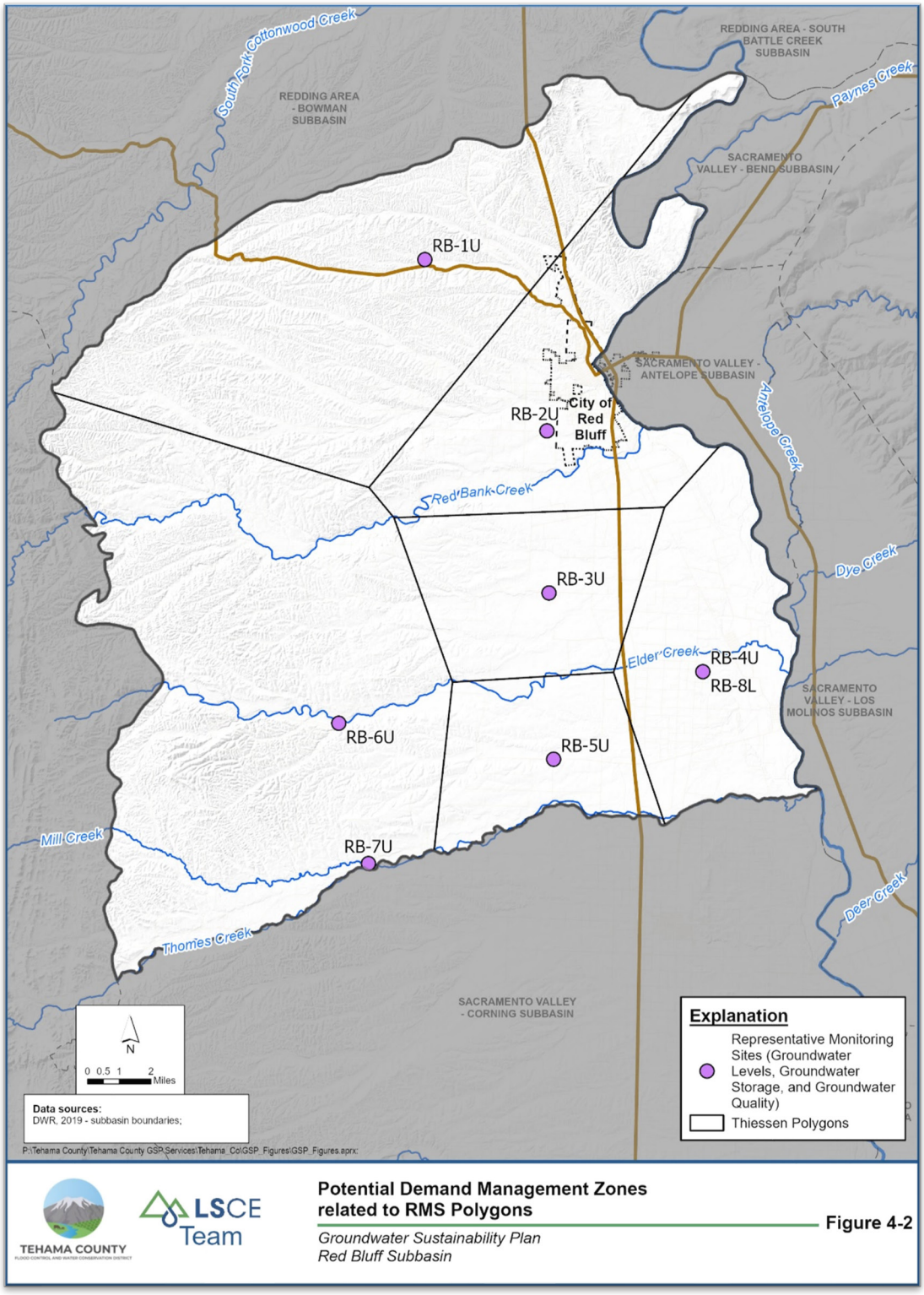


**Figure 4-2. Potential Demand Management Zones related to RMS Polygons**

#### 4.4.8.2.1 Implementation Schedule

Demand reduction measures will be implemented in two categories. The first category will be voluntary and will be implemented immediately upon the start of the Program on January 1, 2027. The details of the measures in the second category will begin development immediately upon the start of the Program and the measures will be implemented in response to groundwater conditions. The Program will remain in place in perpetuity unless otherwise directed by the GSA.

#### 4.4.8.2.2 Notice to Public and other Agencies

The public and other agencies will be notified of planned project implementation activities through outreach and communication channels identified in the GSP.

#### 4.4.8.2.3 Construction Activities and Requirements

There are no anticipated construction activities to be carried out by the Program related to the voluntary measures outlined in the Program. Any construction activities would be conducted by individual water users. Construction activities for phased implementation measures may include the installation of flow meters on agricultural groundwater production wells and some infrastructure to facilitate water transfers.

#### 4.4.8.2.4 Water Source

While there is no water source directly used in this program, the Demand Management Program will instead promote the conservation and efficient use of groundwater and encourage the use of existing surface water supplies.

#### 4.4.8.2.5 Circumstances and Criteria for Implementation

Voluntary measures in the Program will be implemented immediately upon the Program start date and will continue indefinitely. Measures for phased implementation will be implemented in response to existing groundwater conditions and may be removed as conditions improve.

#### 4.4.8.2.6 Legal Authority, Permitting Processes, and Regulatory Control

The Program will be implemented under the authorities of the GSA to regulate groundwater resources in the Subbasin.

### 4.4.8.3. Operation and Monitoring

The GSA will be the main proponent for the operation and monitoring of the Program. The details of the phased implementation measures will be developed by a committee to be established by the GSA. The GSA will be the approving authority to implement measures based on current groundwater conditions.

### 4.4.8.4. Benefits and Costs

The main benefit of the Program will be the long-term sustainability of the Subbasin's groundwater resources. Estimated costs for the Program are expected to range from $1-2 million for the first three years of the program and $0.5-1 million for ongoing Program administration for all following years. For a more detailed cost estimate, see the Program agreement text in **Appendix 4-B**.

## 4.4.9. Well Mitigation Program

#### 4.4.9.1. Overview

The GSA is fully committed to upholding the Human Right to Water (CWC § 106.3), and are sincere in their commitment to sustainably managing groundwater in the Subbasin for all beneficial uses and users, including domestic and municipal well owners. In its ongoing efforts to uphold these commitments, the GSA has proceeded with coordination and focused planning efforts to develop a Well Mitigation Program (Program), including the development of a resolution committing the GSA to take action (see **Appendix 4-C**). 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.

#### 4.4.9.2. Implementation

As currently envisioned, well owners seeking mitigation would submit a dry well report through the DWR Dry Well Reporting System. From there, Tehama County Environmental Health would be notified and can assist the well owner with setting up a temporary water delivery solution through the North Valley Community Foundation. Staff will then review the dry well report, and potentially perform a physical inspection of the well to determine the most appropriate course of action to permanently remediate the well. Permanent remediation strategies may include: setting the well pump to a lower depth, connection to small water system or municipal water system, installation of residential water treatment equipment, or well replacement.

##### *4.4.9.2.1 Implementation Schedule*

At this time the GSA is continuing to develop the Program eligibility criteria, terms, and conditions and is preparing to move forward with Program implementation, as needed. The GSA will continue to develop and refine the roles and responsibilities of the Program in the coming months, although initiation of the Program will occur pending further analysis and identification of specific needs for Program implementation, but no later than January 1, 2027. It is expected that the Program will operate through the GSP implementation period, as needed. Program implementation would continue until groundwater sustainability is achieved. After 2040, groundwater levels will stabilize at or above established Measurable Objectives, avoiding undesirable results for groundwater uses and users. At this time, the Program would be discontinued.

##### *4.4.9.2.2 Notice to Public and Other Agencies*

The public and other agencies will be notified of planned project implementation activities through outreach and communication channels identified in the GSP.

##### *4.4.9.2.3 Construction Activities and Requirements*

Construction activities related to the implementation of the program will be carried out in accordance with the guidelines to be developed by the GSA.

##### *4.4.9.2.4 Water Source*

The water source for wells to be mitigated will be determined during the inspection and evaluation of the well. In most cases, remediation will consist of lowering a well pump, deepening a well or completing a

new well to draw water from a deeper portion of the aquifer. In some cases where it will be most cost effective and/or reliable, remediation may consist of connection to a nearby municipal or small water system.

#### 4.4.9.2.5 Circumstances and Criteria for Implementation

As currently envisioned, the Program will work to mitigate the effects of declining water levels which impact production or water quality as they occur. Impacted wells will be mitigated under the program when groundwater conditions caused by groundwater level declines since 2015 adversely impact groundwater production or quality. Importantly, the Program is intended to mitigate well issues which are caused by regional groundwater conditions and not issues related to normal degradation of well structures and pump equipment over time. A physical inspection of the well will determine whether or not the well is eligible for remediation under the Program.

#### 4.4.9.2.6 Legal Authority, Permitting Processes, and Regulatory Control

The Program will be authorized under the resolution enacted by the GSA which is included in this GSP as **Appendix 4-C**. Permitting of new wells approved for construction by the Program would be carried out in the same manner as permitting other wells by Tehama County Environmental Health. Any wells to be completed under the Program will be required to meet the same requirements as other wells of the same type constructed in the Subbasin and will be constructed in such a way as to ensure operation of the well if MT conditions are experienced again in the future. Permits associated with the program would be expedited to help speed up the mitigation process.

### 4.4.9.3. Operation and Monitoring

The GSA will oversee administration of the Program but will rely on technical expertise from hydrogeological and engineering consultants and licensed well drillers for well evaluation and remediation.

### 4.4.9.4. Benefits and Costs

4.4.10. As detailed in the resolution (Appendix 4-C) the GSA anticipates the potential for up to 150 dry wells across the Corning, Red Bluff, Antelope, and Los Molinos Subbasins based on historic dry well reports and the current well completion dataset. This is only an estimate of potential dry wells, as the current well completion dataset for the Subbasin contains shallow wells which are very likely no longer in service. Assuming an average remediation cost of $20,000 per dry well, the total cost of the program is currently estimated at $3 million. As the GSAs complete the well registration program in the Subbasin and continue to develop the Well Mitigation Program this estimated cost is expected to be revised.

## County Well Permitting Ordinance

### 4.4.10.1. Overview

Through this management action, Tehama County is currently revising existing well permitting ordinances to maintain sustainable groundwater conditions in the Subbasin. As needed, county ordinances will be updated to follow the latest DWR-recommended well standards (described in DWR Bulletin 74). The management action will also improve the well permitting and installation program to help protect water quality, allow for better screening, and avoid interference or impacts of pumping on neighboring wells.

#### 4.4.10.2. Implementation

This management action will be implemented throughout Tehama County. Updates to the well permitting ordinance are currently under development, but all updates will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Subbasin and protection of all beneficial users of groundwater.

##### *4.4.10.2.1 Implementation Schedule*

The well ordinance is currently being revised and is expected to be finalized and implemented by early 2025.

##### *4.4.10.2.2 Notice to Public and Other Agencies*

Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification.

##### *4.4.10.2.3 Construction Activities and Requirements*

Construction activities related to the implementation of the program will be carried out in accordance with the guidelines to be detailed in the updated well permitting ordinance.

##### *4.4.10.2.4 Water Source*

This management action would not directly use water supplies but would improve management and utilization of groundwater supplies within the sustainable yield of the Subbasin.

##### *4.4.10.2.5 Circumstances and Criteria for Implementation*

Updates to the county well permitting ordinance are currently underway. Upon adoption of the updated well ordinance, it is anticipated that the new requirements of the ordinance will remain in place indefinitely, unless otherwise directed.

##### *4.4.10.2.6 Legal Authority, Permitting Processes, and Regulatory Control*

The GSA, Districts, and individual proponents have the authority to plan and implement management actions. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but are not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB.

#### 4.4.10.3. Operation and Monitoring

The main proponent for well permitting within the Subbasin is Tehama County Environmental Health. It is expected that this agency will implement and ensure compliance with the updated ordinance.

#### 4.4.10.4. Benefits and Costs

While reviewing and updating County well permitting ordinances may be beneficial to supporting ongoing operation of the Subbasin within its sustainable yield, there are no anticipated direct benefits to specific sustainability indicators.

This well permitting ordinance is currently in development. The expected cost of development of the new well ordinance will be on the order of $50,000 and the additional cost of permitting analysis of new non-exempt wells under the ordinance will likely be between $1,000 and $5,000.

## 4.5. Portfolio of Other Potential Projects and Management Actions

In addition to the PMAs developed for implementation, the GSA has identified a portfolio of other potential PMAs that could provide benefits with respect to one or more of the sustainability indicators. These PMAs are still under development and require additional information that would be determined through future monitoring and evaluation, and as the GSA continues to identify and collect additional data. This section provides descriptions for these other potential PMAs that could be selected for future implementation in the Red Bluff Subbasin if needed to maintain sustainability.

The GSA has planned an adaptive management strategy that will be informed by continued monitoring of groundwater conditions throughout GSP implementation. If monitoring indicates that established measurable objectives (MOs) cannot be maintained and/or that minimum thresholds (MTs) are being approached, one or more of these potential PMAs could be evaluated and selected for implementation to ensure that the sustainability goal is achieved and that undesirable results do not occur.

The portfolio of potential PMAs is summarized below, organized according to PMA type. “Projects” generally refer to structural features or activities that may require construction and related permitting activities (e.g., recharge basins, Flood-MAR). “Management actions” are typically non-structural programs, policies, or efforts that serve to change behaviors and practices around groundwater use designed to support sustainable groundwater management (e.g., education programs, well ordinances). Per 23 CCR §354.44(b)(2), the potential management actions include demand management efforts that could be rapidly implemented and scaled if the Red Bluff Subbasin is approaching minimum thresholds specified in the GSP. Projects and management actions are expected to benefit specific groundwater sustainability indicators through their implementation, for example improving groundwater levels, groundwater storage, or water quality. “Other” activities are also proposed that do not directly benefit specific groundwater sustainability indicators but are still beneficial for effectively implementing the GSP. Examples of other activities include studies, monitoring, and improvements in modeling to better understand groundwater conditions in the Subbasin.

Potential PMAs are described at a reconnaissance-level of detail relative to the PMAs described in Section 4.4, above. However, PMA information is still reported in accordance with 23 CCR §354.44(b). The required information is summarized in a table following a brief description of each potential PMA.

### 4.5.1. Potential Projects

This section describes potential projects that would be implemented if determined to be necessary, pending future conditions in the Red Bluff Subbasin. **Table 4-19** lists the potential projects described in the subsections that follow.

**Table 4-19. List of Potential Projects Proposed for the Red Bluff Subbasin**

| PROJECT | PRIMARY PROJECT TYPE(S)[1] |
|---|---|
| Direct Groundwater Recharge of Stormwater and Flood Water | Direct Groundwater Recharge |
| Stormwater Management Improvements | Direct Groundwater Recharge |
| Levee Setback and Stream Channel Restoration | Direct Groundwater Recharge |
| Recycled Water Projects | Direct Groundwater Recharge, In-Lieu Groundwater Recharge |
| Invasive Plant Removal from Creeks and Irrigation Conveyance Canals | Groundwater Demand Reduction |
| Inter-Basin Surface Water Transfers or Exchanges | Surface Water Supply Augmentation |
| Water Supply Reservoir Construction, Renovation, or Conversion | Surface Water Supply Augmentation |
| Enhanced Boundary Flow Measurement | Additional Monitoring |
| Well Metering | Additional Monitoring |

[1]The primary function of the project as conceptualized, although during implementation projects may be used for multiple functions to support groundwater sustainability.

#### 4.5.1.1. Direct Groundwater Recharge of Stormwater and Flood Water

This project would recharge groundwater using excess surface water available in wet years. Additional recharge during wet years provided by this project would offset increased demand for groundwater during drier years (23 CCR §354.44(b)(9)). It is anticipated that this project would primarily use floodwater and stormwater, diverted directly from waterways, or delivered to recharge areas through existing conveyance infrastructure. Recharge may occur through conveyance structures such as unlined canal and laterals, natural drainages such as creek beds, recharge basins, agricultural fields, and aquifer storage and recovery (ASR) wells. Specific recharge areas are not yet identified but should have characteristics that are suitable for recharge (e.g., suitable surficial geology, low enough water levels to support recharge, and access to surface water). A summary of the project is provided in **Table 4-20.**

**Table 4-20. Direct Groundwater Recharge of Stormwater and Flood Water: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation in areas of the Subbasin that have access to stormwater and/or flood water. The precise location would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. The project would provide direct groundwater recharge to the aquifer. This project may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years when stormwater and flood water is available, potentially beginning the first year of project implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This project would use flood water and stormwater when available along creeks, streams, and channels in and adjacent to the Red Bluff Subbasin. See Section 4.8 for additional information regarding water available for projects in the Red Bluff Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments. |

#### 4.5.1.2. Stormwater Management Improvements

This project would improve stormwater management efforts to enhance groundwater recharge during periods when stormwater is available. Improvements to existing facilities may include maintenance and repairs of pumps and holding basins to ensure they have adequate capacity to manage and retain anticipated stormwater. Improvements to the watershed and landscape may include restoration of areas affected by wildfires and of unused grazing land to reduce runoff and improve recharge. A summary of the project is provided in **Table 4-21**.

#### 4.5.1.3. Levee Setback and Stream Channel Restoration

This project would restore stream channels and levee setbacks in the Subbasin to increase groundwater recharge of surface water along waterways. The project is also expected to provide other benefits to environmental water users, providing wildlife habitat, and improving the overall riparian ecosystem. A summary of the project is provided in **Table 4-21**

**Table 4-21. Stormwater Management Improvements: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation in areas of the Subbasin with existing stormwater management infrastructure, and in wildfire-affected areas or grazing land that may contribute to undesirable stormwater runoff characteristics. The precise location of the project would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. The project would provide direct groundwater recharge to the aquifer by reducing runoff and by improving or increasing the recharge potential of stormwater detention facilities. This project may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years when stormwater flows occur, potentially beginning the first year of project implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water source & reliability (§354.44(b)(6))** | This project would use stormwater when available along creeks, streams, and channels in and adjacent to the Red Bluff Subbasin. See Section 4.8 for additional information regarding water available for projects in the Red Bluff Subbasin |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| | groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments. |

**Table 4-22. Levee Setback and Stream Channel Restoration: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation along stream channels in and surrounding the Subbasin boundaries. The precise location of the project would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. The project would provide direct groundwater recharge to the aquifer by restoring channel and levee characteristics, with additional benefits for environmental water users. This project may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years stream flows occur, potentially beginning the first year of project implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This project would not directly use water supplies but would improve management and conveyance of existing flows along stream channels in and surrounding the Red Bluff Subbasin. See Section 4.8 for additional information regarding water available for projects in the Red Bluff Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **(§354.44(b)(5))** | and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments. |

#### 4.5.1.4. Rain-MAR

This project would modify on-field conditions and infrastructure to capture and hold precipitation, taking water that would have otherwise drained from the field through runoff and instead supplying that to the groundwater system through rainfall managed aquifer recharge (Rain-MAR). Rain-MAR would provide distributed groundwater recharge throughout the Subbasin, operating through voluntary grower participation. Besides groundwater recharge, Rain-MAR can also provide benefits to flood risk reduction by decreasing runoff, and to ecosystem enhancement for birds and other wildlife. A summary of the project is provided in **Table 4-23**.

**Table 4-23. Rain-MAR: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation in agricultural areas of the Subbasin, particularly those with soil and slope characteristics suitable for retaining runoff and supplying recharge to the aquifer. The precise location would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. The project would provide direct groundwater recharge to the aquifer. This project may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years when precipitation and runoff occurs, potentially beginning the first year of project implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water source & reliability** | This project would capture precipitation on-field, preventing runoff and using that water to recharge the aquifer instead. Precipitation may be available in all years, with additional |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **(§354.44(b)(6))** | precipitation in wetter years. See Section 2.3 for the Subbasin water budget, including average annual precipitation over the projected water budget period. This project increases subbasin recharge only in wet years when precipitation volume is high, such that some precipitation flows out of the subbasin, |
| **Legal authority, permitting processes, and regulatory control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments. |

#### 4.5.1.5. Recycled Water Projects

Recycled water projects would identify and facilitate use of recycled water of suitable quality in the Subbasin. Recycled water could be used for groundwater recharge, urban or agricultural irrigation, or other purposes. Potential sources of recycled water include treated wastewater or treated process water from agricultural facilities. To generate additional supply, the projects may also explore enhancements to wastewater treatment facilities to supply tertiary-treated Title-22 effluent for irrigation. Projects may also explore construction of wetlands as a discharge site for treated wastewater, modeled after the completed Rio Alto Water District Wastewater Treatment Plant & Constructed Wetlands Project. Constructed wetlands may provide groundwater recharge benefits while also enhancing habitat for waterfowl and wildlife and provide other educational and recreational opportunities for the community. A summary of the projects is provided in **Table 4-24**.

**Table 4-24. Recycled Water Projects: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation in all areas of the Subbasin with access to recycled water of suitable quality. The precise location of the project would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. Depending on how and where recycled water is used, the project could |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| | provide direct groundwater recharge (e.g., when used to create wetlands) and in-lieu groundwater recharge (e.g., when used for irrigation) benefits. This project may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years recycled water is available, potentially beginning the first year of project implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This project would use available recycled water supplies of suitable quality. This project is currently in the early planning stage. Precise sources and reliabilities of recycled water would be identified if/when the project is evaluated and selected for implementation. Those will be reported in GSP annual reports and five-year updates when known. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments. |

### 4.5.1.6. Invasive Plant Removal from Creeks and Irrigation Conveyance Canals

This project would remove invasive plants from creeks and irrigation conveyance canals (e.g., Arundo donax, tamarisk, Himalayan blackberry). Many small tributaries in the watersheds of Tehama County have decreased conveyance, high levels of siltation, and diminished flood-carrying capacity due to invasive vegetation overgrowth. Debris-clearing is a challenge due to environmental permitting restrictions. Removal of these plants along other waterways would reduce conveyance issues, reduce non-beneficial consumptive use of shallow groundwater and surface water, and restore conditions for GDEs and native riparian species. A summary of the project is provided in **Table 4-25**.

**Table 4-25. Invasive Plant Removal: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation along stream channels and irrigation conveyance canals in the Subbasin. The precise location of the project would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. The project would reduce groundwater demand of those invasive species removed, with additional benefits for other environmental water users. This project may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue beginning the first year of project implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | While there is no water source directly used by this project, removal of invasive plants species will reduce non-beneficial consumptive use of shallow groundwater and surface water, preserving an equal volume of water for other uses in the Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| | measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments. |

### 4.5.1.7. Inter-Basin Surface Water Transfers or Exchanges

This project would promote inter-basin transfers or exchanges of underutilized surface water supplies from other subbasins in Tehama County. As part of this project, incentives for surface water use could also be explored to encourage in-lieu groundwater recharge. Potential opportunities for transfers and exchanges include, but are not limited to:

- Transfers of treated wastewater from the City of Red Bluff
- Trout Unlimited Groundwater substitution transfers, and
- Other Groundwater substitution transfers.

A summary of the project is provided in **Table 4-26**.

**Table 4-26. Inter-Basin Surface Water Transfers or Exchanges: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation in all areas of the Subbasin with access to surface water supplies, particularly along irrigation conveyance canals or channels that could be used to transfer water. The precise location of the project would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. The project would augment surface water supplies available to users in the Subbasin, which could be used for direct groundwater recharge and/or in-lieu groundwater recharge, depending on how and where the water is used. This project may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue beginning the first year of project implementation, pending potential transfers or exchanges. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| | meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This project would use surface water supplies procured through potential transfers or exchanges from other agencies in Tehama County. This project is currently in the early planning stage. Precise sources and reliabilities of surface water transfers or exchanges would be identified if/when the project is evaluated and selected for implementation. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments. |

### 4.5.1.8. Water Supply Reservoir Construction, Renovation, or Conversion

This project would explore opportunities to construct, renovate, or convert flood control facilities to a water supply reservoir. Additional surface water storage would augment available surface water supplies for use in the Subbasin, with potential direct recharge or in-lieu recharge benefits depending on how or where the surface water is used. A summary of the project is provided in **Table 4-27.**

**Table 4-27. Water Supply Reservoir Construction, Renovation, or Conversion: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation at existing flood control facilities in the Subbasin, or potentially at other locations identified as suitable for construction of a new water supply reservoir. The precise location of the project would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. The project would augment surface water supplies available to users in the Subbasin, which could be used for direct groundwater recharge and/or in-lieu groundwater recharge, depending on how and where the water is used. This project may be implemented and would be monitored and quantified |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| | with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to begin following reservoir construction, renovation, or conversion. Benefits are expected to accrue in all years when stormwater flows occur, potentially beginning the first year of project operation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This project would augment surface water supply resources by managing and storing flood flows along stream channels in and surrounding the Red Bluff Subbasin. See Section 4.8 for additional information regarding water available for projects in the Red Bluff Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments. |

#### 4.5.1.9. Enhanced Boundary Flow Measurement

**This project would enhance measurement of boundary outflows from lands in the Subbasin. Outflows of interest include surface water outflows from canals and drains, and distributed outflows from irrigated lands, such as precipitation runoff and irrigation return flows. Distributed outflows, in particular, are believed to be a substantial component of the water budget but are largely unquantified at this time. Improved understanding of boundary outflows, which vary substantially from year to year, can facilitate, capture, and use the water for in-lieu recharge. A summary of the project is provided in Table 4-28.Table 4-28Table 4-28. Enhanced Boundary Flow Measurement: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation at locations where surface water outflows occur (e.g., measurement sites at the ends of canals and drains), or at locations where surface water outflows can be estimated more accurately (e.g., measurement sites at strategic locations along streams and creeks). The precise location of the project would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. The project would help to improve management of existing surface water supplies in the Subbasin, allowing this water to be captured and used for in-lieu recharge or other beneficial uses. This project may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue beginning the first year of project operation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This project would not directly use water supplies but would improve management and utilization of existing surface water supplies in the Red Bluff Subbasin. See Section 4.8 for additional information regarding water available for projects in the Red Bluff Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | While enhanced boundary flow measurement is beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| | project costs as part of project development. These may include grants, fees, loans, and other assessments. |

### 4.5.1.10. Well Metering

This project would enhance monitoring of groundwater extractions in the Subbasin by installing meters on larger agricultural wells. The data collected through this project would help the GSA to better manage continued sustainability of the Subbasin within its sustainable yield and improve management of pumping for in-lieu recharge benefits. A summary of the project is provided in **Table 4-29.**

**Table 4-29. Well Metering: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This project is proposed for implementation at larger agricultural wells in the Subbasin. The precise location of the project would be determined through further evaluation if/when the project is selected for implementation, depending on the characteristics of the chosen project configuration. Data collected through this project would help to manage continued operation of the Subbasin within its sustainable yield and allow better management of pumping for in-lieu recharge benefits. This project may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This project is currently in the early planning stage. Thus, the start and completion dates for this project have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue beginning the first year of project operation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This project would not directly use water supplies but would improve management and utilization of groundwater supplies in the Red Bluff Subbasin within the sustainable yield of the Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual project proponents have the authority to plan and implement projects. Required permitting and regulatory review will be project-specific and initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | While well metering is beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators. This project is currently in the early planning stage. Thus, the expected yield of this project has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-project measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This project is currently in the early planning stage. Thus, the anticipated costs of this project have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The project proponent would identify funding sources to cover project costs as part of project development. These may include grants, fees, loans, and other assessments. |

### 4.5.2. Potential Management Actions

This section describes potential management actions that would be implemented if determined to be necessary, pending future conditions in the Red Bluff Subbasin. **Table 4-30** lists the potential management actions described in the subsections that follow.

**Table 4-30. List of Potential Management Actions Proposed for the Red Bluff Subbasin.**

| MANAGEMENT ACTION | MANAGEMENT ACTION TYPE(S)[1] |
|---|---|
| Assistance and Incentives for On-Farm Irrigation Infrastructure Improvements | Education/Outreach,<br>In-Lieu Groundwater Recharge |
| Incentives for Residential and Municipal Water Use Efficiency Improvements | Groundwater Demand Reduction |
| Demand Management | Groundwater Demand Reduction |
| Incentives for Use of Available Surface Water and Recycled Water | In-Lieu Groundwater Recharge |
| Water Market for Surface Water and Groundwater Exchange | In-Lieu Groundwater Recharge |
| Tehama County Domestic Well Tracking and Outreach Program | Additional Monitoring,<br>Programs to Support Wells |
| Well Deepening or Replacement Program | Programs to Support Wells |
| Review of County Well Permitting Ordinances | Well Permitting Ordinances |

[1]The primary function of the management action as conceptualized, although during implementation management actions may be used for multiple functions to support groundwater sustainability.

#### 4.5.2.1. Assistance and Incentives for On-Farm Irrigation Infrastructure Improvements

This management action would provide growers assistance with on-farm irrigation infrastructure improvements, especially capital improvements that support groundwater sustainability and allow growers to convert to dual-source irrigation systems. Dual-source irrigation systems support in-lieu groundwater recharge by allowing growers to use both surface water and groundwater for drip irrigation of orchards and other crops. Typical components required for a dual-source system are a surface water irrigation "turnout" or point of delivery to the field, a pipeline or ditch to convey water from the turnout to a pump station, a pump or pumps for pressurization, and filtration. Other improvements to water conveyance infrastructure may also support on-farm irrigation using surface water, including installation of regulating reservoirs, filters or treatment, and pressurization equipment.

Implementation of this management action together with the planned grower education program (Section 4.4.2) would further encourage on-farm practices that support groundwater sustainability. A summary of the management action is provided in **Table 4-31.**

**Table 4-31. Assistance and Incentives for On-Farm Irrigation Infrastructure Improvements: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This management action is proposed for implementation in irrigated areas of the Subbasin that have access to surface water supplies (e.g., surface water supplier service areas, areas with surface water rights adjacent to waterways). The precise location would be determined through further evaluation if/when the management action is selected for implementation. The management action would provide in-lieu groundwater recharge by encouraging and incentivizing use of surface water for irrigation when available. This management action may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This management action is currently in the early planning stage. Thus, the start and completion dates for this management action have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years when surface water is available and used by participants in-lieu of groundwater, potentially beginning the first year of implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This management action would use existing surface water supplies when available in the Red Bluff Subbasin. See Section 4.8 for additional information regarding water available for projects in the Red Bluff Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control** | The GSA, Districts, and individual proponents have the authority to plan and implement management actions. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **(§354.44(b)(3); §354.44(b)(7))** | consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, depletion of interconnected surface water, and potentially water quality. This management action is currently in the early planning stage. Thus, the expected yield of this management action has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This management action is currently in the early planning stage. Thus, the anticipated costs of this management action have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The proponent would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

#### 4.5.2.2. Incentives for Residential and Municipal Water Use Efficiency Improvements

This management action would offer incentives for urban, residential, and commercial projects that improve water use efficiency. Residential and municipal water in the Subbasin is primarily supplied by groundwater. Improvements in residential and municipal water use efficiency thus support in-lieu groundwater recharge. Potential incentives and offers through this management action may include rebates for high efficiency appliances and incentives for lawn removal, low-water landscape installation, rain barrels, graywater reuse, or other activities that offset groundwater demand. Among these, only incentives for lawn removal and low-water landscape installation are expected to impact the Subbasin water budget, although all would offset some groundwater demand. This management action may also evaluate municipal water system operations and losses for other opportunities to reduce municipal water demand. A summary of the management action is provided in **Table 4-32**.

**Table 4-32. Incentives for Residential and Municipal Water Use Efficiency Improvements: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This management action is proposed for implementation in residential areas and municipal service areas in the Subbasin. The precise location would be determined through further evaluation if/when the management action is selected for implementation. The management action would reduce groundwater demand by reducing residential and urban water demands, which are mainly met by groundwater in the Subbasin. This management action may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This management action is currently in the early planning stage. Thus, the start and completion dates for this management action have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years beginning the first year of implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This management action would not directly use water supplies but would improve management and utilization of groundwater supplies in the Red Bluff Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement management actions. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This management action is currently in the early planning stage. Thus, the expected yield of this management action has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This management action is currently in the early planning stage. Thus, the anticipated costs of this management action have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The proponent would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

| | |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

#### 4.5.2.3. Incentives for Use of Available Surface Water and Recycled Water

This management action would incentivize the use of surface water and/or recycled water for irrigation whenever those water sources are available. Incentivized pricing structures and conveyance infrastructure improvements that enhance the utility of these water supply sources are expected to reduce groundwater demand among growers who irrigate with groundwater for reasons of cost and convenience. By offsetting groundwater demand with a like volume of surface water or recycled water, this management action is expected to provide in-lieu groundwater recharge benefits to the Subbasin. A summary of the management action is provided in **Table 4-33**.

#### 4.5.2.4. Water Market for Surface Water and Groundwater Exchange

This management action would create a water market for growers and other water users in the Red Bluff Subbasin, allowing them to exchange surface water and groundwater. A surface water and groundwater exchange would allow for flexibility in water use to meet irrigation demands, while maintaining

groundwater extraction within the overall sustainable yield of the Subbasin. A summary of the management action is provided in **Table 4-33.**

**Table 4-33. Incentives for Use of Available Surface Water and Recycled Water: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This management action is proposed for implementation in irrigated areas of the Subbasin that have access to surface water supplies (e.g., surface water supplier service areas) and/or areas adjacent to waterways and conveyance infrastructure that could be used to convey recycled water. The precise location would be determined through further evaluation if/when the management action is selected for implementation. The management action would provide in-lieu groundwater recharge by encouraging and incentivizing use of surface water and/or recycled water for irrigation when available. This management action may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This management action is currently in the early planning stage. Thus, the start and completion dates for this management action have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years beginning the first year of implementation, depending on availability of surface water and recycled water. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This management action would use surface water supplies and available recycled water supplies of suitable quality. See Section 4.8 for additional information regarding water available for projects in the Red Bluff Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement management actions. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This management action is currently in the early planning stage. Thus, the expected yield of this management action has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Costs (§354.44(b)(8))** | This management action is currently in the early planning stage. Thus, the anticipated costs of this management action have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The proponent would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

**Table 4-34. Water Market for Surface Water and Groundwater Exchange: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This management action is proposed for implementation in irrigated areas of the Subbasin. The precise location would be determined through further evaluation if/when the management action is selected for implementation. The management action would provide flexibility to water users to manage the use of groundwater within the sustainable yield of the Subbasin. This management action may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This management action is currently in the early planning stage. Thus, the start and completion dates for this management action have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years beginning the first year of implementation, depending on participation and availability of surface water. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This management action would use surface water supplies and manage use of groundwater supplies within the sustainable yield of the Subbasin. See Section 4.8 for additional information regarding water available for projects in the Red Bluff Subbasin. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement management actions. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | The sustainability indicators expected to benefit are groundwater levels, groundwater storage, and depletion of interconnected surface water. This management action is currently in the early planning stage. Thus, the expected yield of this management action has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This management action is currently in the early planning stage. Thus, the anticipated costs of this management action have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The proponent would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

### 4.5.2.5. Tehama County Domestic Well Tracking and Outreach Program

This management action would create a system for tracking groundwater conditions at domestic wells across Tehama County. The centralized information in this system would allow the County to better manage and focus assistance and resources for domestic well owners in areas where monitoring indicates that groundwater levels have dropped, or in areas where wells are reported to have water quality impacts or have gone dry. This management action would also provide domestic well owners with resources and funding for well testing, inspection, and replacement, especially in areas where the tracking system indicates that wells have gone dry or that water quality concerns exist. Together, these actions will allow the County to be more proactive in supporting beneficial use of groundwater by domestic well users throughout GSP implementation. A summary of the management action is provided in **Table 4-35**.

**Table 4-35. Tehama County Domestic Well Tracking and Outreach Program: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This management action is proposed for implementation throughout Tehama County. The management action would track dry domestic wells and offer outreach and assistance services to all domestic well users to support their ongoing beneficial use of groundwater. This management action may be implemented and would be monitored and quantified with respect to groundwater conditions, as needed, if sustainable levels are not reached following implementation of other PMAs. This will be done in the context of Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This management action is currently in the early planning stage. Thus, the start and completion dates for this management action have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years beginning the first year of implementation, depending on participation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This management action would not directly use water supplies but would improve management and utilization of groundwater supplies in the Red Bluff Subbasin within the sustainable yield of the Subbasin. |
| **Legal authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement management actions. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | While domestic well tracking and outreach are beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators. |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| | This management action is currently in the early planning stage. Thus, the expected yield of this management action has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This management action is currently in the early planning stage. Thus, the anticipated costs of this management action have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The proponent would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

### 4.5.3. Potential Other Activities

This section describes other potential activities that could be implemented if determined to be necessary, pending future conditions in the Red Bluff Subbasin. These potential "other" activities are not expected to directly benefit specific groundwater sustainability indicators but are still beneficial for effectively implementing the GSP. Examples of other activities include studies, monitoring, and improvements in modeling to better understand groundwater conditions in the Subbasin

**Table 4-36** lists the potential other activities described in the subsections that follow.

| | |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**Table 4-36. List of Potential Other Activities Proposed for the Red Bluff Subbasin**

| OTHER ACTIVITY | OTHER ACTIVITY TYPE(S)[1] |
|---|---|
| Coordination and Development of Public Data Portals | Coordination and Data Sharing |
| Additional Studies of GDEs and Groundwater - Surface Water Interactions | Additional Monitoring |
| Expanded Subbasin Monitoring and Aquifer Testing | Additional Monitoring |
| Install Additional Agroclimate Stations | Additional Monitoring |
| Maintain and Expand Groundwater Level Monitoring Network | Additional Monitoring |
| One-Time Groundwater Quality Snapshot and Evaluation | Additional Monitoring |
| Tehama County Well Inventory and Registration Program | Additional Monitoring |

[1]The primary function of the activity as conceptualized, although during implementation actions may be used for multiple functions to support groundwater sustainability.

#### 4.5.3.1. Coordination and Development of Public Data Portals

This activity would maintain ongoing coordination and information sharing among water purveyors and agencies in the Tehama County subbasins and neighboring subbasins. As part of this activity, agencies may develop shared public data portals to track and monitor groundwater sustainability indicators. Coordination would determine the types of data and data formats available, and establish standard methods for receiving, storing, and sharing data with the public, DWR, other agencies. Coordination would also foster relationships with neighboring Subbasins, land use planning entities, and relevant local, state, and federal agencies and organizations. A summary of this activity is provided in **Table 4-37.**

**Table 4-37. Coordination and Development of Public Data Portals: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This activity would foster joint coordination and information sharing among agencies in the Tehama County subbasins and neighboring subbasins. Information sharing may include development of shared public data portals to track and monitor groundwater sustainability indicators. This activity may be initiated to support GSP implementation if determined to be necessary or useful for maintaining ongoing sustainability in the Red Bluff Subbasin, pending future conditions. The details of this effort would be determined through further evaluation if/when the action is selected for implementation. Implementation will be done in the context of the Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This activity is currently in the early planning stage. Thus, the start and completion dates for this activity have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years beginning the first year of implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This activity will not directly use water supplies. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement coordination and data sharing efforts. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | While coordination and data sharing are beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators<br>This activity is currently in the early planning stage. Thus, the expected yield of this activity has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This activity is currently in the early planning stage. Thus, the anticipated costs of this activity have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The County and/or other proponents would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

#### 4.5.3.2. Additional Studies of GDEs and Groundwater - Surface Water Interactions

This activity would investigate the relationship between groundwater levels and access to surface water supplies on the health of groundwater dependent ecosystems (GDEs). Supporting analyses may consider a combination of surface water data, shallow groundwater level data, and remote sensing data related to vegetative cover to improve the understanding of how GDEs are affected by conditions in the groundwater aquifer accessed by pumping. Findings of these analyses may be used to refine how GDEs and their water supply needs are monitored and protected during GSP implementation. This activity would also evaluate the need for additional studies or monitoring of groundwater-surface water interactions to address potential data gaps, as needed. A summary of this activity is provided in **Table 4-38**.

#### 4.5.3.3. Expanded Subbasin Monitoring and Aquifer Testing

This activity would expand monitoring efforts across the Subbasin to improve understanding of existing groundwater conditions, monitor changes in groundwater conditions throughout GSP implementation, and improve simulation of the Subbasin water budget within the Tehama IHM. Specific monitoring efforts may include:

- Aquifer testing to improve the understanding of aquifer conditions, particularly the level of confinement, connectivity between depths, connectivity with surface water bodies, and hydraulic properties.
- LIDAR (Light Detection and Ranging) data collection and analysis across the Subbasin to support monitoring of all sustainability indicators.
- Identification of locations in the Subbasin that are potentially vulnerable to damage from subsidence.

A summary of this activity is provided in **Table 4-39**.

**Table 4-38. Additional Studies of GDEs and Groundwater - Surface Water Interactions: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This activity would analyze the water supplies used to support GDEs and evaluate the need for additional studies or monitoring of groundwater-surface water interactions to improve overall understanding of GDEs and address potential data gaps, as needed. This activity may be initiated to support GSP implementation if determined to be necessary or useful for maintaining ongoing sustainability in the Red Bluff Subbasin, pending future conditions. The details of this effort would be determined through further evaluation if/when the action is selected for implementation. Implementation will be done in the context of the Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This activity is currently in the early planning stage. Thus, the start and completion dates for this activity have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years beginning the first year of implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This activity will not directly use water supplies. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement studies. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | While studies of GDEs and groundwater-surface water interactions are beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators.<br>This activity is currently in the early planning stage. Thus, the expected yield of this activity has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This activity is currently in the early planning stage. Thus, the anticipated costs of this activity have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The County and/or other proponents would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

**Table 4-39. Expanded Subbasin Monitoring and Aquifer Testing: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This activity would expand monitoring efforts across the Subbasin (e.g., aquifer testing, LIDAR data collection) to improve understanding and modeling of groundwater conditions and address potential data gaps, as needed. This activity may be initiated to support GSP implementation if determined to be necessary or useful for maintaining ongoing sustainability in the Red Bluff Subbasin, pending future conditions. The details of this effort would be determined through further evaluation if/when the action is selected for implementation. Implementation will be done in the context of the Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This activity is currently in the early planning stage. Thus, the start and completion dates for this activity have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years beginning the first year of implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This activity will not directly use water supplies. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement monitoring and data collection efforts. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | While Subbasin-wide monitoring and data collection efforts are beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators. This activity is currently in the early planning stage. Thus, the expected yield of this activity has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This activity is currently in the early planning stage. Thus, the anticipated costs of this activity have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The County and/or other proponents would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

### 4.5.3.4. Install Additional Agroclimate Stations

This activity would install additional "agroclimate stations" that monitor agriculture-related weather and climate parameters. Data collected by these stations would help to inform agricultural water use practices and potentially enhance water conservation efforts through strategic irrigation scheduling. These data may also improve the accuracy of the Tehama IHM. A summary of this activity is provided in **Table 4-40.**

**Table 4-40. Install Additional Agroclimate Stations: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This activity would install additional stations that monitor agriculture-related weather and climate parameters to inform agricultural water use practices, improve modeling of groundwater conditions, and address potential data gaps, as needed. This activity may be initiated to support GSP implementation if determined to be necessary or useful for maintaining ongoing sustainability in the Red Bluff Subbasin, pending future conditions. The details of this effort would be determined through further evaluation if/when the action is selected for implementation. Implementation will be done in the context of the Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This activity is currently in the early planning stage. Thus, the start and completion dates for this activity have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years beginning the first year of implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This activity will not directly use water supplies. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement monitoring and data collection efforts. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | While monitoring and data collection efforts are beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators. This activity is currently in the early planning stage. Thus, the expected yield of this activity has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Costs (§354.44(b)(8))** | This activity is currently in the early planning stage. Thus, the anticipated costs of this activity have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The County and/or other proponents would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

#### 4.5.3.5. Maintain and Expand Groundwater Level Monitoring Network

- Maintenance of wells in the existing monitoring network
- Identification of existing wells in the Subbasin that may be incorporated into the groundwater level monitoring network
- Identification of new monitoring wells that may be added to the groundwater level monitoring network.

• Ongoing coordination with other monitoring entities to support the use of identified monitoring locations as part of the monitoring network and to share relevant collected data.

- Maintaining and improving the monitoring network would improve the understanding of groundwater conditions in the Subbasin. Additional wells may be used to fill data gaps and improve understanding of aquifer conditions and dynamics, and groundwater conditions related to GDEs and surface water depletions.

A summary of this activity is provided in **Table 4-41**.

#### 4.5.3.6. One-Time Groundwater Quality Snapshot and Evaluation

This activity would conduct a one-time sampling of groundwater quality parameters over a wide range of wells in Tehama County, providing a "groundwater quality snapshot" in Tehama County. The data collected through this effort would improve understanding of groundwater quality conditions in the Subbasin and provide a basis for refinement of the groundwater quality monitoring network. Evaluation of these data can also inform the selection of groundwater quality monitoring options that better characterize both widespread groundwater quality conditions and localized groundwater quality concerns.

A summary of this activity is provided in **Table 4-42.**

**Table 4-41. Maintain and Expand Groundwater Level Monitoring Network: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This activity would maintain and expand the Subbasin groundwater level monitoring network to improve understanding of aquifer conditions and dynamics, and groundwater conditions related to GDEs and depletions of interconnected surface water. Monitoring will address potential data gaps, as needed, and improve modeling of groundwater conditions throughout GSP implementation. This activity may be initiated to support GSP implementation if determined to be necessary or useful for maintaining ongoing sustainability in the Red Bluff Subbasin, pending future conditions. The details of this effort would be determined through further evaluation if/when the action is selected for implementation. Implementation will be done in the context of the Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This activity is currently in the early planning stage. Thus, the start and completion dates for this activity have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue in all years beginning the first year of implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This activity will not directly use water supplies. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement monitoring and data collection efforts. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | While monitoring and data collection efforts are beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators. This activity is currently in the early planning stage. Thus, the expected yield of this activity has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This activity is currently in the early planning stage. Thus, the anticipated costs of this activity have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The County and/or other proponents would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

**Table 4-42. One-Time Groundwater Quality Snapshot and Evaluation: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This activity would conduct and evaluate a one-time sampling of groundwater quality parameters over a wide range of wells in Tehama County. The data collected in this study will improve understanding of groundwater quality conditions and provide a basis for refinement of the Subbasin monitoring network. This activity may be initiated to support GSP implementation if determined to be necessary or useful for maintaining ongoing sustainability in the Red Bluff Subbasin, pending future conditions. The details of this effort would be determined through further evaluation if/when the action is selected for implementation. Implementation will be done in the context of the Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This activity is currently in the early planning stage. Thus, the start and completion dates for this activity have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue following evaluation of data collected in the one-time groundwater quality snapshot. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This activity will not directly use water supplies. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement monitoring and data collection efforts. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation methodology (§354.44(b)(5))** | While monitoring and data collection efforts are beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators.<br>This activity is currently in the early planning stage. Thus, the expected yield of this activity has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This activity is currently in the early planning stage. Thus, the anticipated costs of this activity have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The County and/or other proponents would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

### 4.5.3.7. Tehama County Well Inventory and Registration Program

This activity would create a county-wide well inventory to compile all available information on active wells in Tehama County and improve understanding of well distribution, construction, and hydrogeologic characteristics. The inventory would be useful for identifying and filling monitoring data gaps. Complementary to the inventory, Tehama County could also create a well registration program to collect well locations, screening information, and pumping data for use in GSP updates.

A summary of this activity is provided in **Table 4-43.**

**Table 4-43. Tehama County Well Inventory and Registration Program: Summary (23 CCR §354.44(b)).**

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| **Implementation (§354.44(b)(1)(A); §354.44(b)(6))** | This activity would create an inventory and registration program for all wells in Tehama County. Data collected through this program would improve understanding of well distribution, construction, and hydrogeology, and support ongoing Subbasin modeling and GSP implementation. This activity may be initiated to support GSP implementation if determined to be necessary or useful for maintaining ongoing sustainability in the Red Bluff Subbasin, pending future conditions. The details of this effort would be determined through further evaluation if/when the action is selected for implementation. Implementation will be done in the context of the Sustainable Management Criteria to ensure sustainable operation of the Red Bluff Subbasin. |
| **Timeline (§354.44(b)(4))** | This activity is currently in the early planning stage. Thus, the start and completion dates for this activity have yet to be determined and will be provided in GSP annual reports and five-year updates when known. Benefits are expected to accrue beginning the first year of implementation. |
| **Notice to Public and Other Agencies (§354.44(b)(1)(B))** | Public and/or Inter-Agency Noticing will be facilitated through GSA board meetings, GSA and/or cooperating agency website(s), GSA and/or cooperating agency newsletters, inter-basin coordination meetings, agency governing body public meetings, GSP annual reports and five-year updates, public scoping meetings and environmental/regulatory permitting notification. |
| **Water Source & Reliability (§354.44(b)(6))** | This activity will not directly use water supplies. |
| **Legal Authority, Permitting Processes, and Regulatory Control (§354.44(b)(3); §354.44(b)(7))** | The GSA, Districts, and individual proponents have the authority to plan and implement monitoring and data collection efforts. Required permitting and regulatory review will be initiated through consultation with applicable governing agencies. Governing agencies for which consultation will be initiated may include, but is not limited to: DWR, SWRCB, CDFW, Flood Board, Regional Water Boards, USFWS, NMFS, LAFCO, County of Tehama, and CARB. |
| **Benefits and Benefit Evaluation Methodology (§354.44(b)(5))** | While monitoring and data collection efforts are beneficial to GSP implementation and supporting Subbasin sustainability, there are no anticipated direct benefits to specific sustainability indicators. This activity is currently in the early planning stage. Thus, the expected yield of this activity has yet to be determined and will be reported in GSP annual reports and five-year updates when known. Evaluation of benefits will be based on analysis of pre- and post-action measurements supported by modeling. |

| ITEM IN GSP REGULATIONS | DESCRIPTION |
|---|---|
| | Measured parameters will include surface water deliveries, groundwater levels, and others to be determined. Modeling will be done with the Tehama IHM model used for GSP development. |
| **Costs (§354.44(b)(8))** | This activity is currently in the early planning stage. Thus, the anticipated costs of this activity have yet to be determined and will be reported in GSP annual reports and five-year updates when known. The County and/or other proponents would identify funding sources to cover costs as part of development. These may include grants, fees, loans, and other assessments. |

## 4.6. Project Financing

## 4.7. The details of project financing are in development. However, as currently envisioned, the projects and management actions detailed in the preceding sections will be financed by a combination of private landowner funding, fees or assessments collected by the GSA, and grant funding. GSA Coordination

### 4.7.1. Goals, Policies, and Ordinances

The Tehama County Flood Control and Water Conservation District (District) GSA is the exclusive GSA for the Red Bluff Subbasin. As a county-wide agency, the District was established in 1957 by legislation to, among other functions, provide for the control and conservation of flood and storm waters; the protection of watercourses and watersheds; and for the acquisition, retention, conservation, and distribution of drainage, storm, flood, and other waters for beneficial uses in Tehama County. These goals are aligned with the goals of other agencies within the Subbasin, and with GSAs in neighboring subbasins in Tehama County, many of which are also exclusively managed by the District GSA.

The District Board of Directors is composed of members of the Tehama County Board of Supervisors, who are responsible for passing ordinances and policies related to well permitting, groundwater aquifer protection, and groundwater use in the Subbasin. This overlapping organizational structure facilitates direct coordination of policies and ordinances that are directly aligned with the subbasin sustainability goal established by the GSA and the PMAs described in this GSP.

Specific policies and ordinances that may be reviewed during GSP implementation include:

- Well permitting ordinances to align well construction recommendations with DWR Bulletin 74, as needed, and/or to help protect water quality, allow for better screening, and avoid interference or impacts of pumping on neighboring wells. Efforts could be designed to be protective of domestic wells.
- Ordinances to regulate or limit groundwater use, export, and illegal diversion of surface water

### 4.7.2. Well Owner Outreach and Education

Education and outreach efforts to well owners about proper well protection, maintenance, and monitoring will benefit individual well owners and all groundwater beneficial users. Wellhead protection efforts can help protect groundwater quality from impacts from surface activities. Regular well maintenance and monitoring will maximize the life of a well and its pumping equipment. Monitoring of well performance and groundwater conditions in a well will keep well owners aware of well or groundwater conditions that may impact the reliability or quality of water produced by their well. Well monitoring and reporting of monitoring information by well owners can also greatly benefit the Subbasin in understanding groundwater conditions, including identification of any groundwater management-related concerns. Outreach and education efforts by the Subbasin can coordinate with well owner outreach content available through other agencies and programs including ILRP, SWRCB, DWR, USGS, and others.

### 4.7.3. Participation in IRWMPs/GMPs/SNMPs/etc.

The GSA's and local stakeholders' continued role and participation in other water resources management efforts occurring with the Subbasin and at a more regional level are important to ensure coordination within and between groundwater subbasins in the area across different levels of water resources management. This involvement includes coordinating in development or updating of the Tehama County Groundwater Management Plan (GWMP), assisting with preparation and implementation of the North Sacramento Valley Integrated Regional Water Management Plan (IRWMP), and participation in other planning efforts involving salt and nutrient management plans, Irrigated Lands Regulatory Program (ILRP) and other groundwater quality related programs.

## 4.8. Subbasin Water Available for Projects

The Red Bluff Subbasin has three primary sources of surface water that could be a supply for groundwater recharge projects: the Sacramento River that is the western boundary of the subbasin, Elder Creek that runs through the subbasin, and Thomes Creek, the southern boundary of the subbasin. The information presented in this section illustrates the analysis that quantifies the potential water available for groundwater recharge projects.

Elder Creek originates in the foothills of the Coastal Ranges in the Mendocino National Forest and flows east to join the Sacramento River. The watershed upstream of the Sacramento Valley is approximately 90 square miles. The United States Geological Survey (USGS) has maintained a gage on Elder Creek from 1948 to present. The Elder Creek gage is located approximately 16 miles west of Highway 5 and 21 miles west of the Sacramento River near where Elder Creek enters the agricultural lands of the Sacramento Valley floor as shown in **Figure 4-3**. The average annual runoff from Elder Creek for the period of observed flows was approximately 72,000 acre-feet per year.

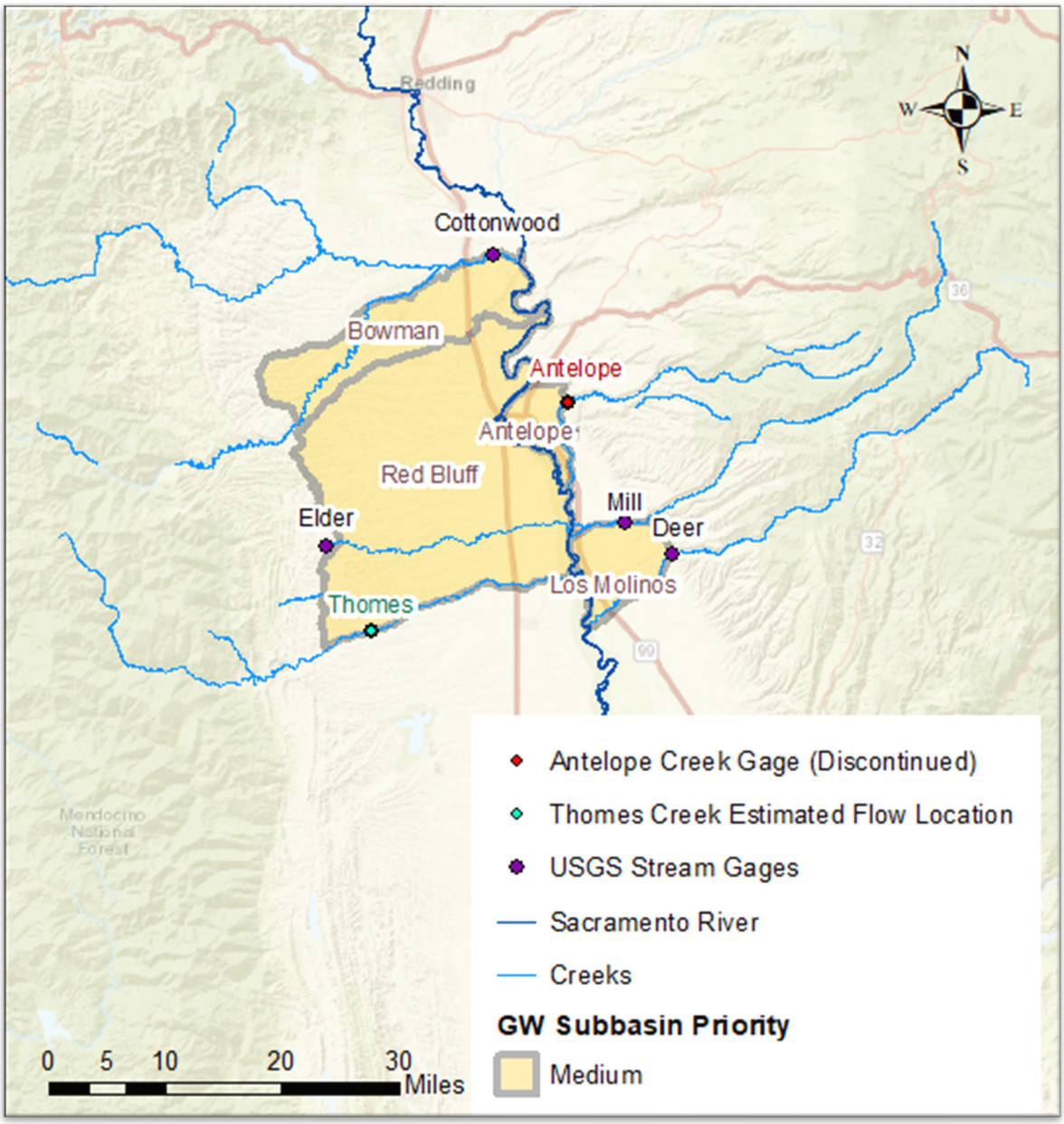


**Figure 4-3. Map of Tehama County with Stream Gages and Groundwater Subbasins**

The gaged daily flows for the period of water year 1949 through 2020 were used as a common period for surface water availability for Tehama County subbasins. **Figure 4-4** shows the monthly flow volume in Elder Creek averaged by water year type with the study period of 1949 -2020. The water year types shown in the figure are defined in the Sacramento Valley Water Year Hydrologic Classification (SWRCB Decision 1641) as shown in **Table 4-44**. The index is the Sacramento Valley unimpaired runoff for the water year.

**Table 4-44. Water Year Classification Defined in Sacramento Valley Water Year Hydrologic Classification**

| CLASSIFICATION | ABBREVIATION | INDEX (MILLIONS OF ACRE-FEET) |
|---|---|---|
| Wet | W | >= 9.2 |
| Above Normal | AN | 7.8 – 9.2 |
| Below Normal | BN | 6.5 – 7.8 |
| Dry | D | 5.4 - 6.5 |
| Critical | C | <= 5.4 |

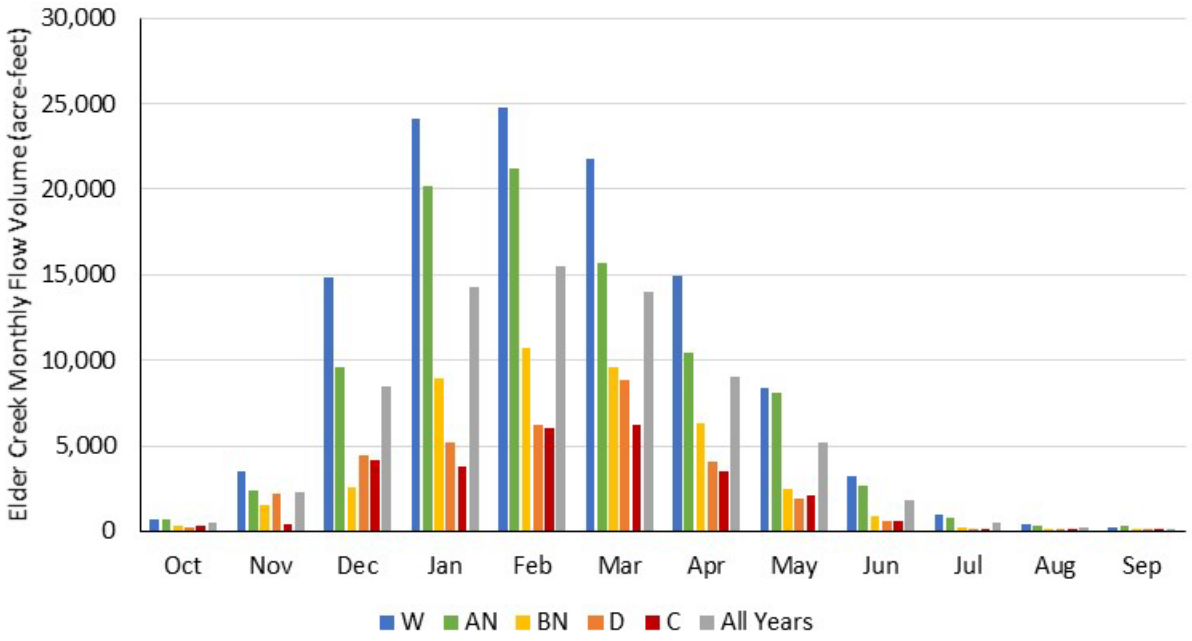


**Figure 4-4. Elder Creek Monthy Flow Volume by Water Year Classification**

**Figure 4-4** shows flow in Elder Creek is higher in wetter years and lower in dry years with the highest monthly flows occurring in the months of January through March.

### 4.8.1. Thomes Creek

Thomes Creek originates in the foothills of the Coastal Ranges in the Mendocino National Forest and flows east to join the Sacramento River. The watershed upstream of the Sacramento Valley is approximately 230 square miles. The United States Geological Survey (USGS) does not have a gage on Thomes Creek, so the streamflow was estimated by prorating streamflow in Elder Creek using the ratio of watershed areas. The watershed area for Thomes Creek is approximately 2.5 times that of Elder Creek, assuming a diversion point close to Flournoy as shown in **Figure 4-3**. This diversion point is located approximately 13 miles west of Highway 5 and 19 miles west of the Sacramento River near where Thomes Creek enters the agricultural lands of the Sacramento Valley floor. The average annual runoff from Thomes Creek for the period of observed flows was approximately 183,000 acre-feet per year.

**Figure 4-5** shows the monthly flow volume in Thomes Creek averaged by water year type with the study period of 1949 -2020. The water year types shown in the figure are defined in the Sacramento Valley Water Year Hydrologic Classification (SWRCB Decision 1641) as shown in **Table 4-44**.

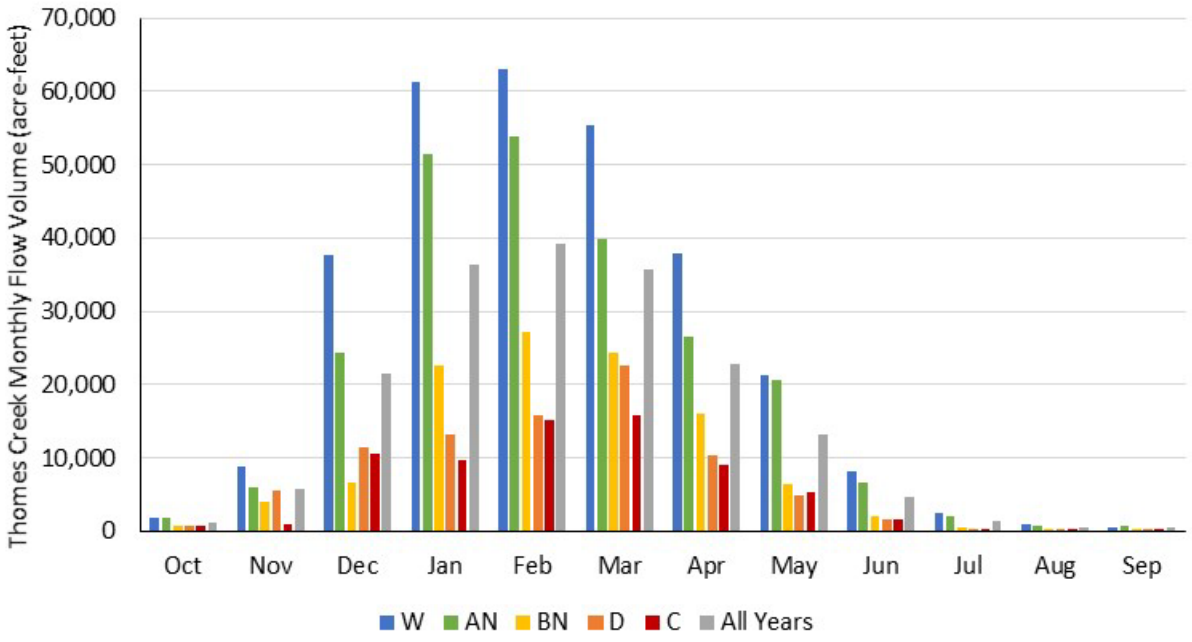


**Figure 4-5. Thomes Creek Creek Monthy Flow Volume by Water Year Classification**

### 4.8.2. Water Right Permits

A water right or permit will be required to divert and store water from Elder and Thomes creeks for groundwater recharge and beneficial uses. The State Water Resources Control Board (SWRCB) issues and administers water rights in California. There are two categories of water right permits available through the SWRCB to divert water for groundwater recharge projects: standard permits and temporary permits. Both permits require an application be filed with the SWRCB. Temporary permits allow for short-term periods of diversion and storage (e.g., 180-days or Five year permits strictly for recharge) but are not water rights. Temporary permits are a conditional approval to divert and use available water.

Standard permits are available through two different application processes: standard and streamlined. A standard water right application is typically more involved and may require significant effort and many years of review and processing by the SWRCB. The streamlined application process is relatively new and was designed to divert water during high flow events to recharge groundwater basins. The goal of te streamlined application process is to help GSAs address SGMA and reduce the impact of groundwater extractions. The GSA can also apply for a temporary permit and a streamlined permit at the same time, as it could take several years for the streamlined permit to get approved.

### 4.8.3. Potential Water Available from Elder Creek for Groundwater Recharge

An analysis of Elder Creek was performed based on the eligibility criteria for streamlined application processing of a standard permit. The following criteria were applied to the observed Elder Creek gage data to determine the water available for potential diversion:

- season of diversion of December 1 through March 31
- flow at the point of diversion is above the 90th percentile for the day based on the gage record
- the diversion rate is limited to no more than 20 percent of the total flow.

The 90th percentile flow for each day was calculated based on the gaged record of flows. The observed daily flow was then compared to the 90th percentile flow for each day to determine when water could be diverted during the December 1 through March 31 period each year. The daily water available was limited to no more than 20 percent of total flow, and further limited based on an assumed diversion and groundwater recharge capacity of 100 cfs. A multi-benefit recharge project on Elder Creek is at a preliminary planning level of development and the actual diversion capacity of existing or new facilities will need to be verified or designed. A recharge capacity of 100 cfs would require approximately 3,500 acres assuming a recharge rate of 0.7 inches/day. This recharge rate is the middle of the range of recently observed rates in Colusa County. **Figure 4-6** shows the potential diversion for flow when above the 90th percentile for the winter of 1998 as an example of the analysis for a wet year.

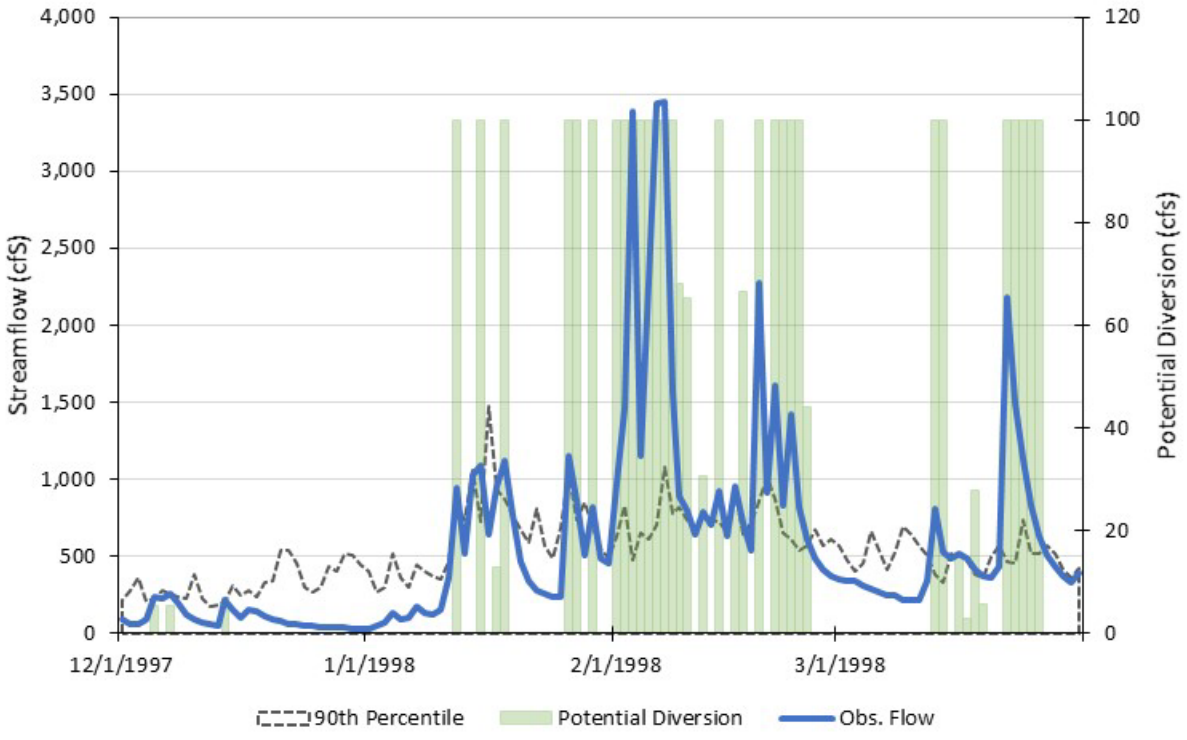


**Figure 4-6. Potential Diversion for Elder Creek in Example Wet Year: Winter 1998 under Streamlined Permit**

In 1998 the estimated flow in Elder Creek went above the 90th percentile for brief period in January, and a more extended period in February and again near the end of March. During these periods, the green shading illustrates potential diversion of 100 cfs under the criteria for a streamlined water right permit. The total volume of diversion for water year 1998 was estimated to be approximately 6,100 ac-ft. **Figure 4-6** illustrates a few key considerations for the use of Elder Creek as a source for groundwater recharge. The relatively "flashy" nature of rain-fed streams like Elder Creek will need projects that can respond quickly to divert and recharge water when available. Additionally, the potential recharge available is dependent on the capacity to divert and recharge the water when it is available.

The analysis illustrated for a single year in Figure 4-6 was performed for each of the 72 years in the period of analysis. **Figure 4-7** shows the average monthly potential diversion by water year type from Elder Creek that could be used for groundwater recharge from December to March.

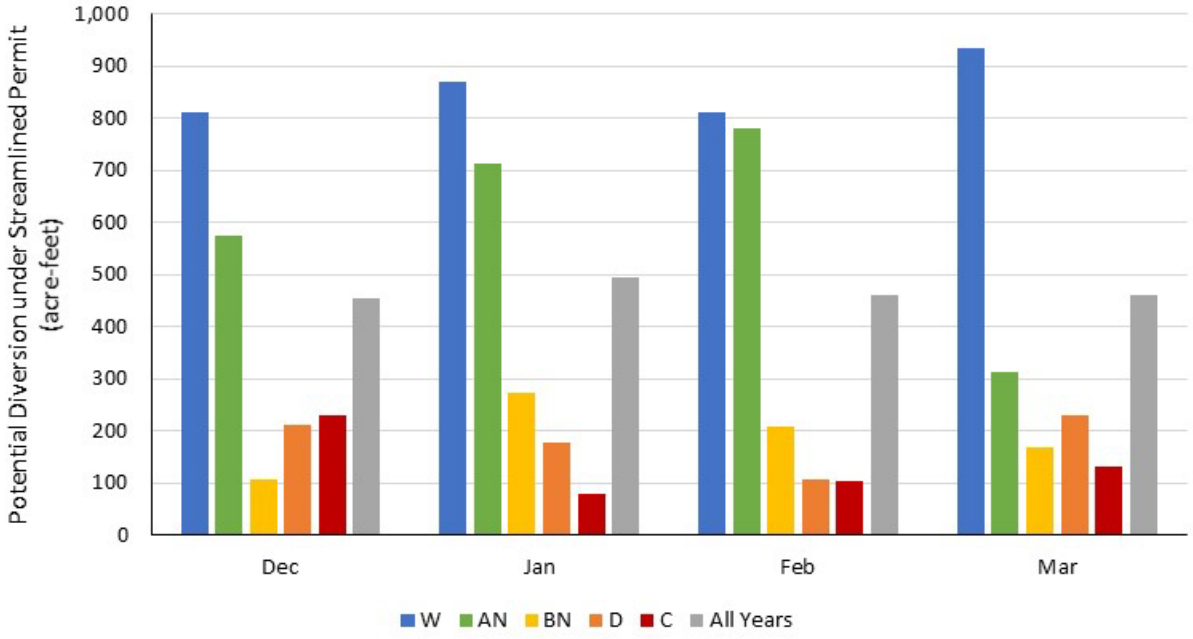


**Figure 4-7. Potential Diversion for Elder Creek under Streamlined Permit by Water Year Classification**

Results summarized in Figure 4-7 show potential diversions of several hundred acre-feet in most months in wet and above normal years and a limited amount of water available in critical years.

The potential water available for groundwater recharge varies depending on the rainfall each year, as shown in **Figure 4-8**. There would have been water available for recharge in 63 of the 72 years studied. The average yearly potential groundwater recharge from Elder Creek is approximately 1,870 acre-feet/year, assuming a diversion and recharge capacity of 100 cfs.

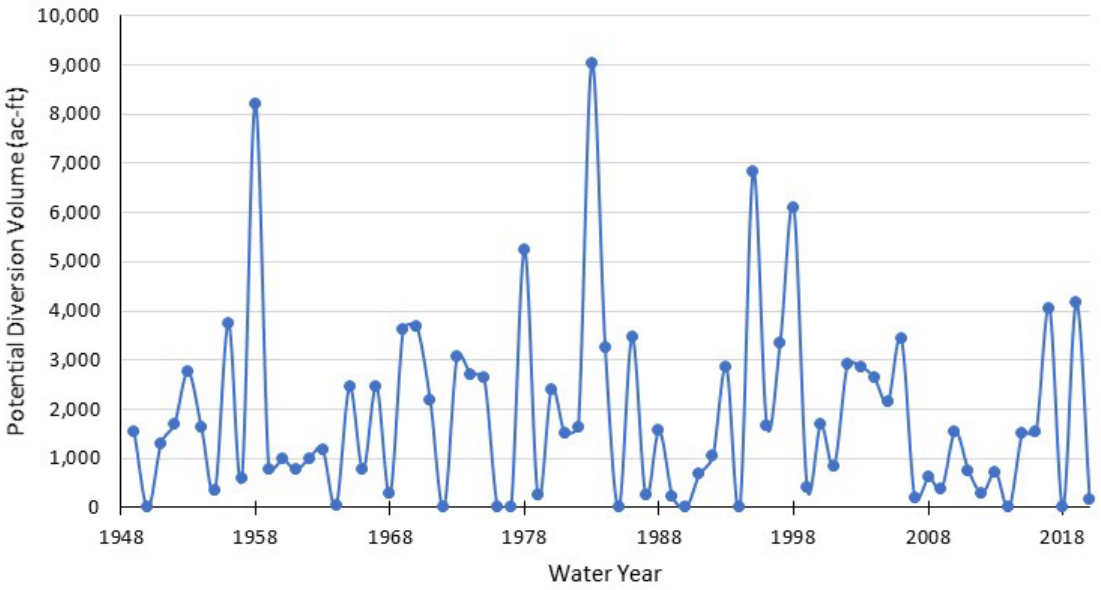


**Figure 4-8. Potential Diversion Volume for Elder Creek for Water Years 1948-2020**

As described above, the water available for groundwater recharge from Elder Creek is dependent on the assumption for the diversion and recharge capacity. A simple sensitivity analysis was performed to understand how the annual average water available for recharge varies based on the assumed diversion/recharge capacity. **Figure 4-9** illustrates the results of this analysis and indicates that a capacity of approximately 200 cfs on Elder Creek would more than provide for the projected storage deficit under current and future land use (1,800 ac-ft/yr and 2,900 ac-ft/year respectfully). The water budget deficit for the Red Bluff Subbasin for the historical period from 1990 to 2018 was approximately 10,600 ac-ft per year. The possible annual potential diversion from Elder Creek reaches its maximum at approximately 4,700 ac-ft even with a recharge capacity of 1,000 cfs as shown in **Figure 4-9**.

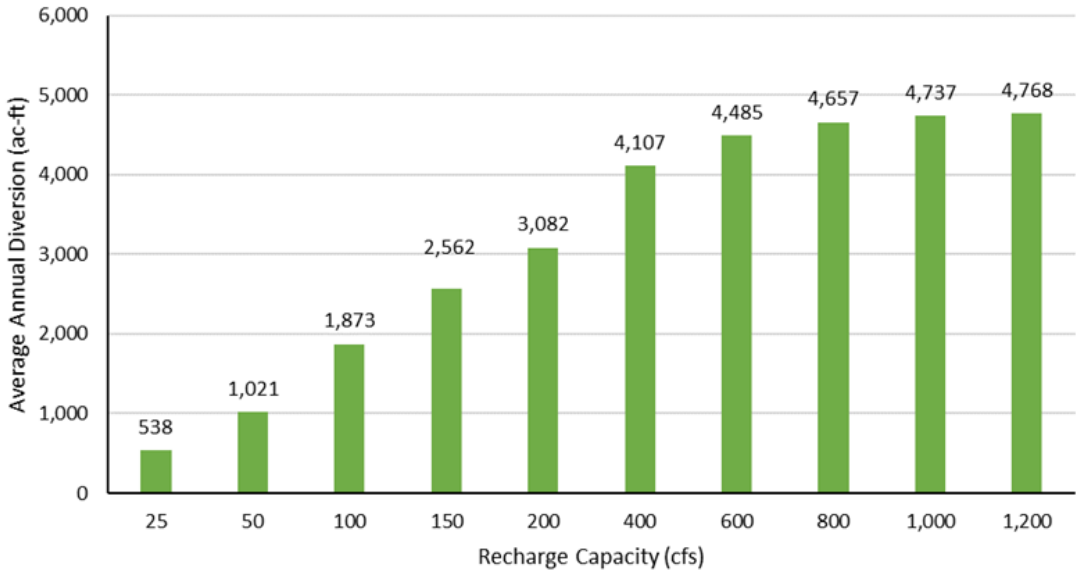


**Figure 4-9. Average Annual Potential Diversion for Elder Creek under Streamlined Permit with varying Recharge Capacity**

### 4.8.4. Potential Water Available from Thomes Creek for Groundwater Recharge

A similar analysis of Thomes Creek was performed based on the eligibility criteria for streamlined application processing of a standard permit. A multi-benefit recharge project on Thomes Creek is at a preliminary planning level of development and the actual diversion capacity of existing or new facilities will need to be verified or designed. A recharge capacity of 100 cfs would require approximately 3,500 acres assuming a recharge rate of 0.7 inches/day. This recharge rate is the middle of the range of recently observed rates in Colusa County. **Figure 4--10** shows the potential diversion for flow when above the 90th percentile for the winter of 1998 as an example of the analysis for a wet year.

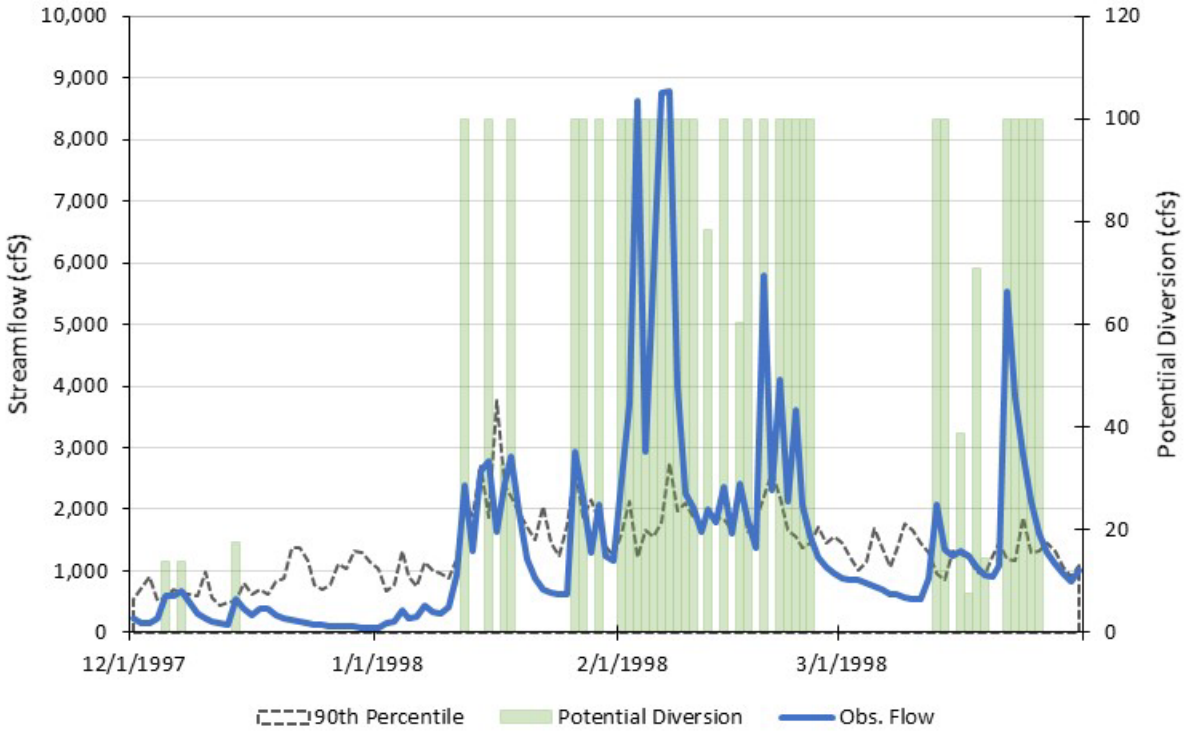


**Figure 4--10. Potential Diversion for Thomes Creek in Example Wet Year: Winter 1998 under Streamlined Permit**

In 1998 the estimated flow in Thomes Creek went above the 90th percentile for brief period in January, and a more extended period in February and again near the end of March. During these periods, the green bars illustrate potential diversion of up to 100 cfs under the criteria for a streamlined water right permit. The total volume of diversion for water year 1998 was estimated to be approximately 6,840 ac-ft. Figure 4--10 illustrates a few key considerations for the use of Thomes Creek as a source for groundwater recharge. The relatively "flashy" nature of rain-fed streams like Thomes Creek will need projects that can respond quickly to divert and recharge water when available. Additionally, the potential recharge available is dependent on the capacity to divert and recharge the water when it is available.

The analysis illustrated for a single year in Figure 4--10 was performed for each of the 72 years in the period of analysis. **Figure 4-9** shows the average monthly potential diversion by water year type from Thomes Creek that could be used for groundwater recharge from December to March.

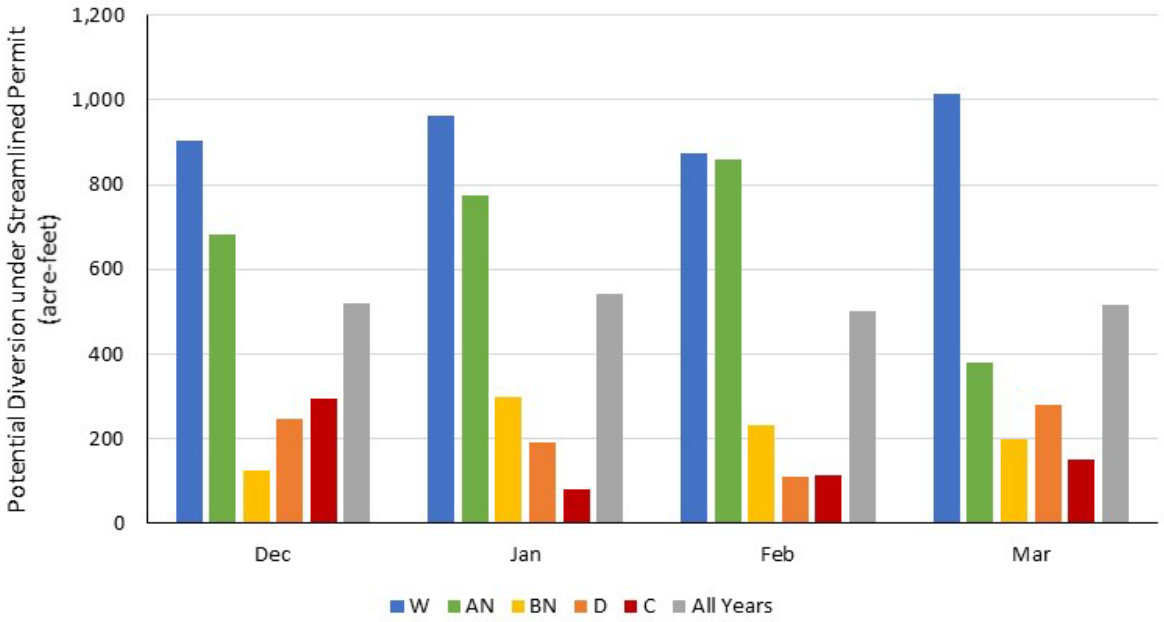


**Figure 4-11. Potential Diversion for Thomes Creek under Streamlined Permit by Water Year Classification**

Results summarized in **Figure 4-9** show potential diversions of several hundred acre-feet in most months in wet and above normal years and a limited amount of water available in critical years.

The potential water available for groundwater recharge varies depending on the rainfall each year, as shown in **Figure 4-11**. There would have been water available for recharge in 63 of the 72 years studied. The average yearly potential groundwater recharge from Thomes Creek is approximately 2,080 acre-feet/year, assuming a diversion and recharge capacity of 100 cfs.

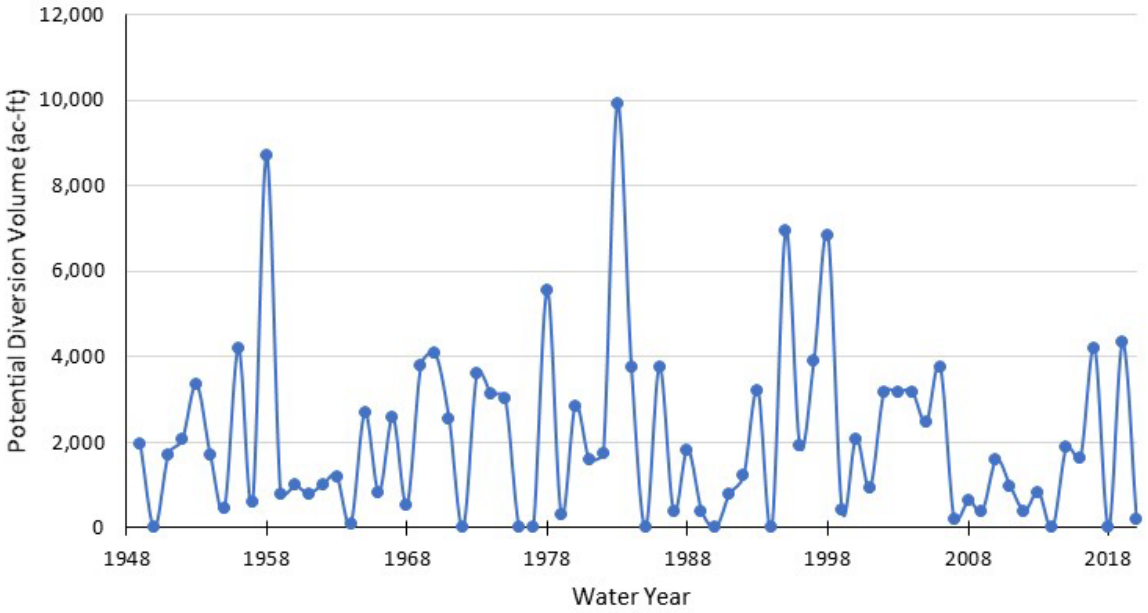


**Figure 4-11. Potential Diversion Volume for Thomes Creek for Water Years 1948-2020**

As described above, the water available for groundwater recharge from Thomes Creek is dependent on the assumption for the diversion and recharge capacity. A simple sensitivity analysis was performed to understand how the annual average water available for recharge varies based on the assumed diversion/recharge capacity**. Figure 4-12** illustrates the results of this analysis and indicates that a capacity of approximately 200 cfs on Thomes Creek would more than provide for the projected storage deficit under current and future land use (1,800 ac-ft/yr and 2,900 ac-ft/year respectfully). The water budget deficit for the Red Bluff Subbasin for the historical period from 1990 to 2018 was approximately 10,600 ac-ft per year. It would require a recharge capacity of approximately 1,100 cfs to provide for a 10,600 ac-ft storage deficit as shown in Figure 4-12. A recharge project of that size would require approximately 38,000 acres. Since there is not a stream gage on Thomes Creek, it is also assumed the streamflow in Thomes Creek is always approximately 2.5 times the streamflow in Elder Creek.

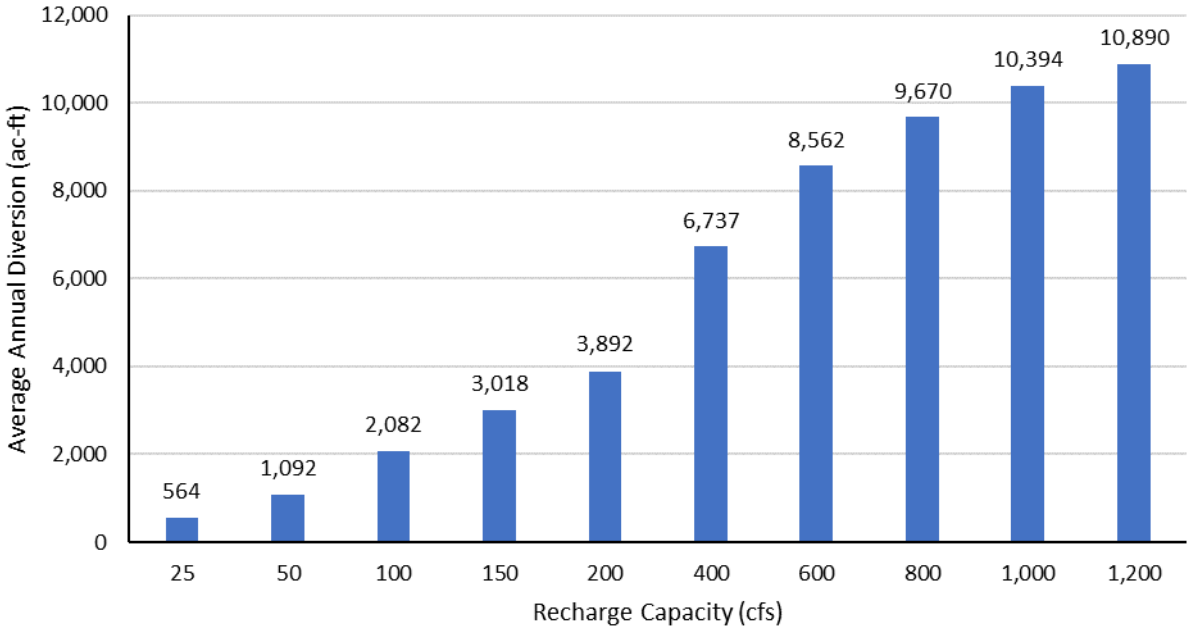


**Figure 4-12. Average Annual Potential Diversion for Thomes Creek under Streamlined Permit with varying Recharge Capacity**

A combination of recharge projects on Thomes and Elder creeks could also provide for the projected storage deficit in Red Bluff. A diversion and recharge capacity of 50 cfs on both Elder and Thomes Creek would provide for the projected storage deficit under current land use (1,800 ac-ft/yr). A diversion and recharge capacity of 100 cfs Elder Creek and 150 cfs on Thomes Creek would provide for the projected storage deficit under future land use (2,900 ac-ft/year). The water budget deficit for the Red Bluff Subbasin was 10,600 ac-ft for the historical period from 1990 to 2018, requiring a recharge capacity of 400 cfs on both creeks as shown in **Figure 4-13**. Two recharge projects of that size would require approximately 27,500 acres combined.

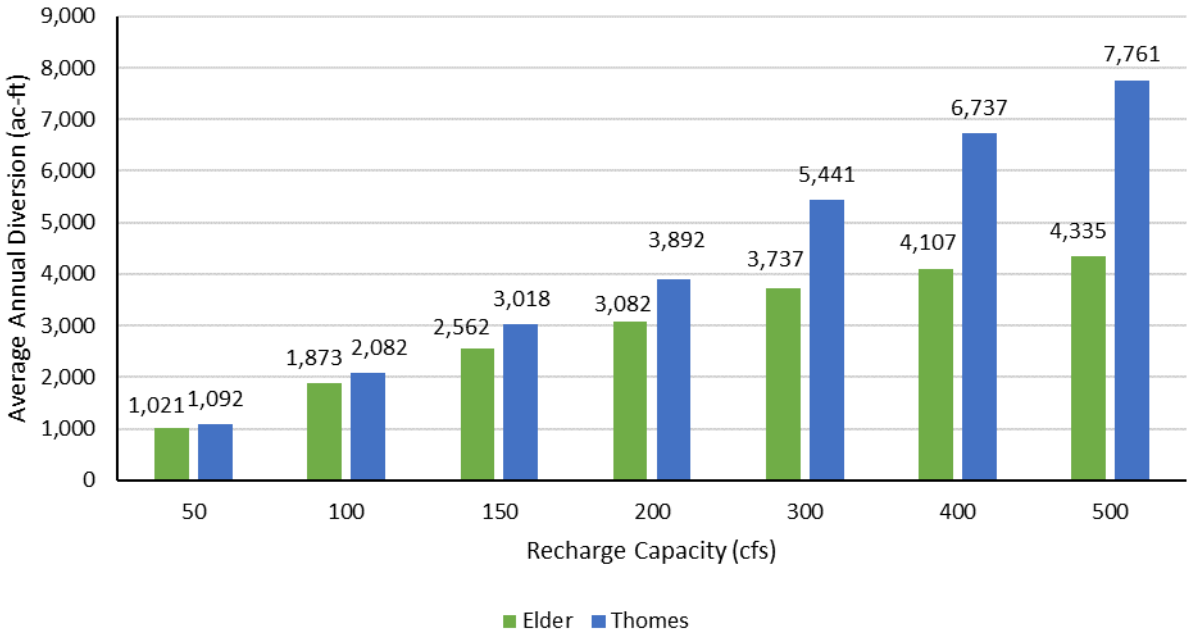


**Figure 4-13. Average Annual Potential Diversion for Thomes and Elder Creeks under Streamlined Permit**

### 4.8.5. Sacramento River

The third source of water for potential recharge within the Red Bluff subbasin is the Sacramento River. There are two water districts within the subbasin, Proberta and Thomes Creek water districts, which hold contracts with the U.S. Bureau of Reclamation (Reclamation) for water from the Central Valley Project (CVP). Reclamation allocates water to these water service contracts each year based on the available water supply and obligations of the CVP. Historical allocations range from 0 to 100 percent of the contract total volume. Proberta Water District currently holds a contract for a total of 3,500 ac-ft. Thomes Creek Water District currently holds a contract for a total of 6,400 ac-ft.

Water is diverted under these two contracts from the Sacramento River at the Red Bluff Pumping Plant and conveyed to the districts through the Corning Canal. Water delivered under these two contracts must be used within the areas identified in the contract which are approximately the boundaries of the districts. Proberta Water District is located entirely within the Red Bluff subbasin while only the portion of Thomes Creek Water District located north of Thomes Creek is within the Red Bluff subbasin.

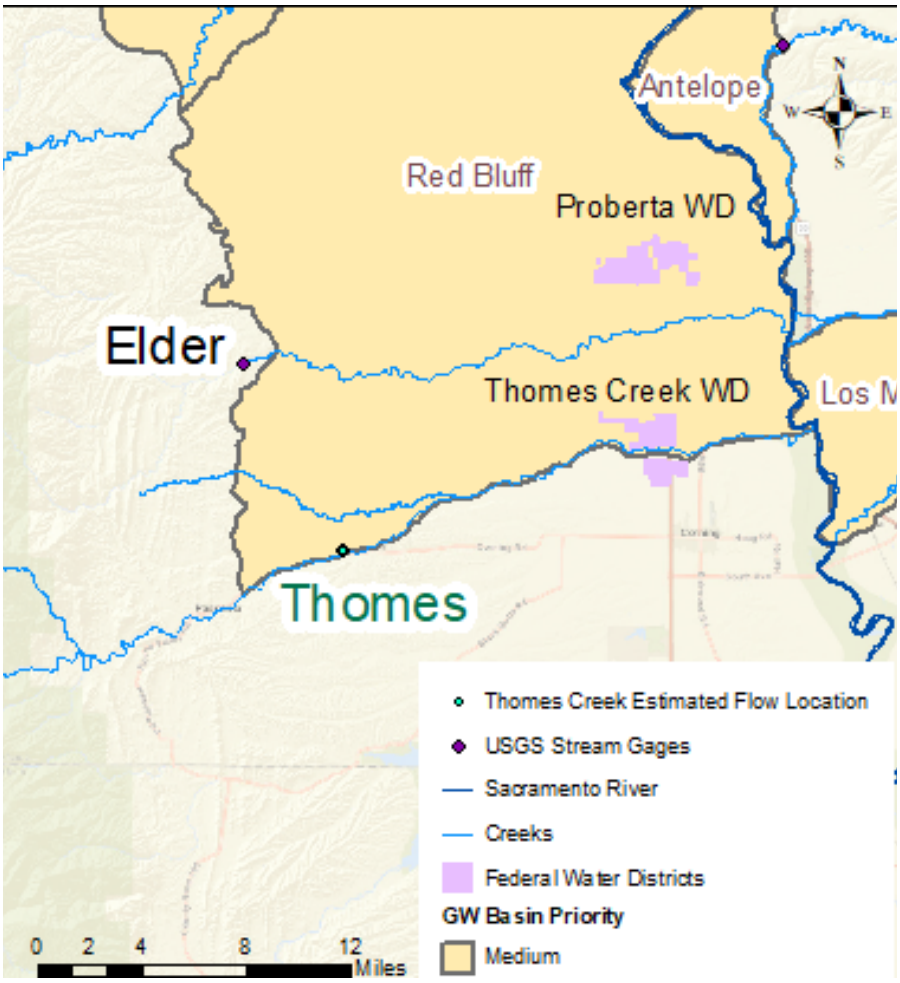


Figure 4-14 shows the locations of these two water districts within the Red Bluff subbasin.

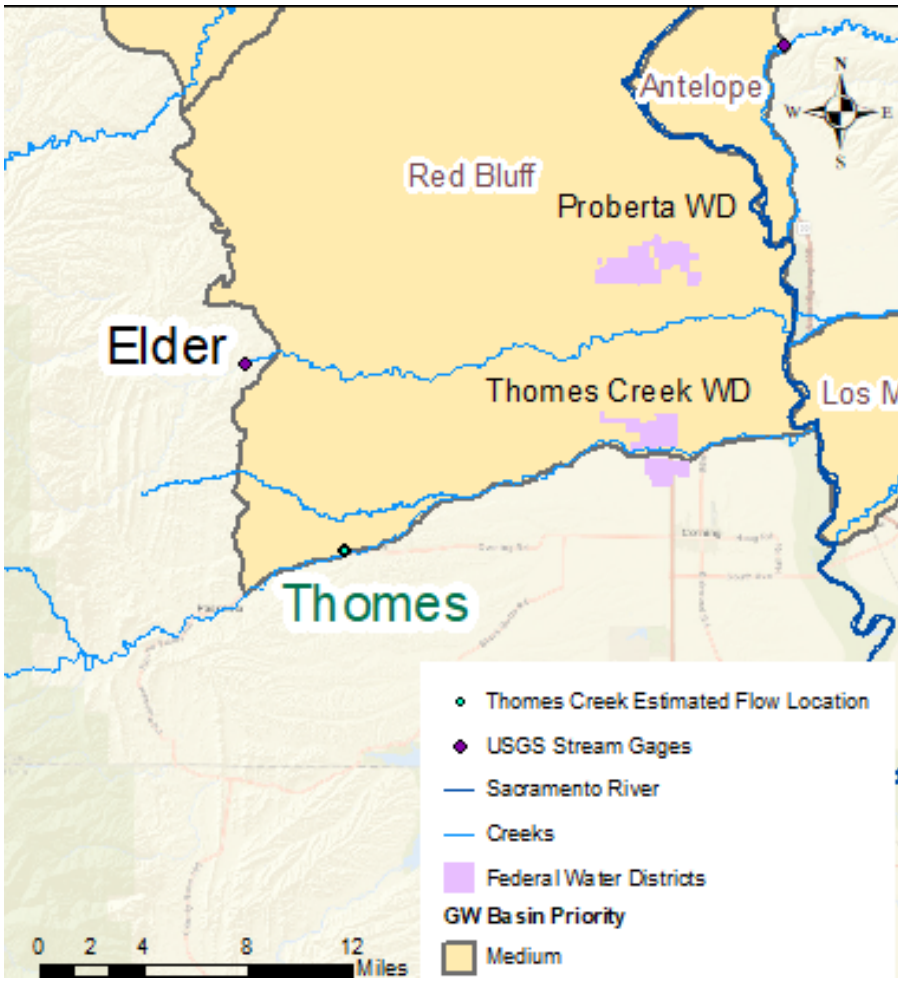


**Figure 4-14 Location of Water Districts with CVP Contracts for Surface Water**

Historically these two districts have not taken delivery of the full volume of water available under their CVP contracts each year, opting instead to rely on groundwater to meet crop demands. There are several reasons for this including the cost of the CVP water, irrigation methods, and infrastructure within the districts. A management action to incentivize the districts to utilize more surface water available under their CVP contracts would assist in addressing the current and projected storage deficit in the subbasin by reducing groundwater pumping. Alternatively, water available under the CVP contracts could be used to recharge the subbasin within the districts. The use of contract water for groundwater recharge would need to be described in the water conservation plan of each district.

An analysis of the historical water available under the CVP contracts and estimates of deliveries to the districts was performed to quantify the potential reduction in groundwater pumping or increase in recharge. The period of analysis was 28 years from 1992 through 2019. Historical CVP allocations for these contractors were downloaded from Reclamation's website for Central Valley Project Operations[5]. Historical allocations were multiplied by the contract totals for both districts to determine the annual

[5] Available at https://www.usbr.gov/mp/cvo/vungvari/water_allocations_historical.pdf

volume of water available to the districts. The historical monthly deliveries from the Corning Canal for the same 28-year period were compiled from monthly water delivery tables for Central Valley Project diversions (Table 21)[6]. The monthly deliveries represent the volume for all contractors who take delivery of water from the Corning Canal. The Corning Water District, with a contract for a total of 18,000 ac-ft, also takes delivery from the Corning Canal. The aggregated deliveries for the Corning Canal were assumed to go to each of the three districts based on the percent of contract total for all districts, e.g., Proberta Water District's contract for 3,500 ac-ft is 12.5 percent of the sum of all three district's contracts. A more detailed analysis based on the actual deliveries to each district could be performed based on the annual water account records kept by Reclamation.

**Table 4-45** is a summary, by water year type, of the average annual water available to each district under the contract and an estimate of the unused water by each district.

**Table 4-45. Annual Water Available and Estimated Unused Water for CVP Water Service Contracts**

| CLASSIFICATION | ANNUAL WATER AVAILABLE (AC-FT) | | ESTIMATED UNUSED WATER (AC-FT) | |
|---|---|---|---|---|
| | PROBERTA WD | THOMES CREEK WD | PROBERTA WD | THOMES CREEK WD |
| Wet | 3,500 | 6,400 | 1,510 | 2,760 |
| Above Normal | 3,500 | 6,400 | 900 | 1,640 |
| Below Normal | 3,500 | 6,400 | 1,440 | 2,630 |
| Dry | 2,625 | 4,800 | 330 | 600 |
| Critical | 735 | 1,344 | 180 | 320 |
| All Years | 2,850 | 5,211 | 960 | 1,760 |

The volumes in Table 4-45 show an annual average of approximately 2,700 ac-ft of unused surface water may be available to these two districts as an alternative supply to groundwater pumping or for recharge. All of the unused water for Proberta Water District could benefit the Red Bluff subbasin. Water available to Thomes Creek Water District may be used within both the Red Bluff and Corning subbasins, both within Tehama County.

In addition to the estimates of unused water quantified above, the two districts with CVP contracts may have received additional supplies under Section 3 (f) of their contracts. The availability of water under Section 3 (f) is determined by Reclamation based on the water supply conditions at the time.

[6] Available at https://www.usbr.gov/mp/cvo/deliv.html