



JULY 28, 2023

TO: **PLUMAS COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
1834 EAST MAIN STREET
QUINCY, CA 95971**

ATTN: **ROB THORMAN, ASSISTANT DIRECTOR, PLUMAS COUNTY PUBLIC WORKS DEPARTMENT**

SUBJECT: **PLUMAS COUNTY WATERSHED FORUM FULL PROPOSAL – SYNERGISTIC SIERRA VALLEY GROUNDWATER RECHARGE AND IRRIGATION EFFICIENCY PROJECT**

Dear Mr. Thorman and the Watershed Forum Technical Advisory Committee (TAC):

The Sierra Valley Groundwater Management District (SVGMD) presents this full proposal in response to the invitation to submit during the June 2, 2023, meeting of the Plumas Watershed Forum TAC and Watershed Core Group.

The full proposal for the Sierra Valley Subbasin aligns with the priorities described in the Feather River Watershed Management Strategy and implements synergistic¹ Type 2 First Tier projects involving groundwater recharge and design and implementation of more water efficient irrigation methods and irrigation management.

The information requested within the Feather River Watershed Management Strategy detailed proposal instructions is provided below.

- 1. PROJECT NAME** - Synergistic Sierra Valley Groundwater Recharge and Irrigation Efficiency Project
- 2. COUNTY** - Plumas County
- 3. PROJECT NUMBER** - *to be determined, note, proposal instructions stated to leave this blank*
- 4. PROJECT SPONSOR** - Sierra Valley Groundwater Management District (SVGMD)

¹ Defined in the Feather River Watershed Management Strategy as “the success of one goal is needed to ensure the success of another” where restoration will result in multiple resource benefits.

5. DATE - 07-28-2023

6. SPONSOR'S PHONE NUMBER - 530-249-4520

7. APPLICANT CAPABILITY - The SVGMD has been working since its establishment in 1980 to implement practices aimed at better management of groundwater resources in Sierra Valley. Furthermore, the SVGMD began monitoring groundwater extraction from agricultural wells throughout Sierra Valley in 1989 thus providing historic data that is helpful to characterize groundwater use and levels. The SVGMD worked in coordination with Plumas County to develop the Groundwater Sustainability Plan (GSP) for the Sierra Valley Subbasin (DWR Basin # 5-12.01) ranked a Medium-Priority Basin under the California's 2014 Sustainable Groundwater Management Act (SGMA). As such, the SVGMD has a comprehensive understanding of the conditions in the Basin and of the communities and its priorities and what is needed to ensure the sustainability of the region with respect to supporting residents, agriculture, and wildlife habitats. Therefore, the SVGMD is uniquely qualified to develop and implement the groundwater recharge and irrigation efficiency project included in this proposal. Further, the SVGMD will be supported in this effort by a technical consultant team who has the qualifications and is familiar with the SVGMD and the GSP implementation efforts.

8. SPONSOR'S EMAIL - sierravalleygmd@sbcglobal.net

9. PROJECT LOCATION - This proposal focuses on the Little Last Chance Creek Recharge area in the northeastern region of the Sierra Valley Subbasin as shown in **Attachment 1 (Project Location)**.

9.a. National Forest – Plumas National Forest

9.b. Forest Service District – Beckwourth Ranger District

9.c. State/Private/Other Lands Involved – as shown in **Attachment 1**, there are approximately 12 private parcels and 1 federal parcel in the project area.

9.d. Legal Location: Township, Range and Section – These are shown in **Attachment 1**.

10. JUSTIFICATION, GOALS AND OBJECTIVES - The Sierra Valley experiences periods of intensive drought that impact agricultural practices, drinking water resources, and the health and sustainability of groundwater dependent ecosystems (GDEs). Climate change is predicted to intensify drought conditions across California, particularly in the Sierra Nevada, and exacerbate overall precipitation variability and intensity (Pierce et al., 2018)². In the face of current and future climate change impacts, it is crucial for the Sierra Valley to conserve and enhance groundwater resources for the sustainability of human and wildlife ecosystems.

Groundwater levels in the Valley are largely influenced by two variables: supply, generally from snowmelt or seasonal precipitation, and consumption from groundwater pumping.

One promising opportunity to improve groundwater supply in the Sierra Valley is to implement a combination of conjunctive use—maximizing surface water irrigation when possible—and of diversion of excess surface water flow—water not owned for irrigation or other purposes—from

² Pierce, D. W., Kalansky, J. F. & Cayan, D. R. Climate, drought, and sea level rise scenarios for California's fourth climate change assessment. Calif. Energy Comm. Calif. Nat. Resour. Agency (2018).

streams and into infiltration basins or alluvial fans, (i.e., regions comprised of highly permeable sediments conducive to high water infiltration rates into the groundwater aquifer).

Notably, diversions for groundwater recharge are only enabled when river flows exceed an allowable threshold during storm events in the winter season, to avoid causing undue burdens on local ecosystems or habitats that largely depend on this water flow. Diversions for recharge will target the non-irrigation season flows from October to mid-March and conditions when Frenchman Reservoir is predicted to fill to avoid conflicts with decreed water rights.

Recharge can enhance availability of groundwater for both the deep aquifer used for agriculture and the shallow aquifer which is feeding the wetlands. In addition, irrigation efficiency practices can reduce the net consumption of groundwater from the system. Therefore, in conjunction with enhancing recharge to this region, improving irrigation efficiency should reduce the demand on groundwater resources.

The primary goal of the proposed project is to synergistically:

- 1) **conduct a managed aquifer recharge (MAR) demonstration to evaluate the potential for groundwater recharge to improve groundwater levels in agriculturally dependent regions, and**
- 2) **evaluate and improve irrigation efficiency practices of ranches that are in close proximity to the Little Last Chance Creek Recharge area.**

11. PROJECT DESCRIPTION - The Feather River Watershed Management Strategy under the Watershed Restoration Priorities identifies the Sierra Valley groundwater basin as the highest priority for 'Groundwater Condition' restoration projects.

This combined approach groundwater recharge and improved irrigation efficiency practices will provide insight on the possible extent of groundwater level improvement for an agriculturally dependent region like the northeastern portion of Sierra Valley and the impacts of irrigation efficiency practices and conjunctive use on the availability of water resources for recharge to support the wetlands and other wildlife habitat. Furthermore, this on-the-ground, dual purpose implementation project corresponds to the **Feather River Watershed Management Strategy as a Type 2 First Tier Project**. Objectives for this project support several goals of the Monterey Settlement, namely, to **improve groundwater retention and storage in major aquifers** as well as **improve upland vegetation management**.

The leading use of groundwater resources in the Sierra Valley watershed occurs via agriculture irrigation practices (estimated at 80-90% of groundwater use in the Basin; SV GSP Section 2.2.1-6³). The regional geology includes fault zones that result in significant differences between the eastside and westside of the Valley terrains. The west side is steeper and more forested while the east side has broad valley floors that are subject to more loss of riparian and upland vegetation. Unlike other basins in the Feather River Watershed, the Sierra Valley is unique in that regional geology, specifically the presence of a thick impermeable clay layer in the central part of the Valley, prevents excess water used for irrigation from readily moving from the shallow to the deep aquifer. Therefore, excess groundwater pumped for irrigation does not readily recycle back into the aquifer system as recharge. Reducing excess groundwater pumping for irrigation is therefore essential to maintaining groundwater levels and storage in the Sierra Valley. Numerous irrigation efficiency measures can be employed to reduce recoverable losses (tailwater and deep percolation) and irrecoverable losses (transpiration, evaporation, and wind drift). Employing these on-the-

ground implementation measures is essential to preserving water resources for agricultural use and domestic users, as well as GDEs.

The motivation for recharge implementation in addition to irrigation efficiency development is to improve water availability to the system amidst challenges associated with climate change such as drought. Increased climate-induced warming is anticipated to cause increased precipitation in the form of rain rather than snow during winter months, resulting in decreased formation of snowpack in the upstream mountain regions during the wet season. Melt from snowpack is an important water supply to this region; therefore climate-driven shifts in precipitation will likely limit water resources during the peak growing season. Diversion of excess winter surface flow into a recharge basin will ultimately increase the long-term availability of groundwater to the system, especially during spring and summer months when melt from snowpack becomes increasingly limited.

To date, no recharge projects have yet been implemented in the Sierra Valley to improve groundwater storage in the long-term. With that said, SVGMD is currently in discussions with the California Department of Fish and Wildlife (CDFW) to possibly implement a recharge project in the southeastern portion of the Sierra Valley Subbasin near Smithneck Creek.

Several irrigation efficiency demonstration projects have been implemented since 2018, with two spans of MESA (medium elevation spray application) equipped pivots converted to LESA (low energy spray application) sprinkler systems, one on the Grandi Ranch in 2018 and the other on the Goodwin Ranch in 2019. In addition, an ongoing, multi-year LEPA (low energy precision application) demonstration project is being conducted on the Roberti Ranch (located centrally in Sierra Valley) in implementation of the Sierra Valley GSP. The proposed project will build on these recent efforts and will explore other avenues for improved irrigation efficiency, including investigation of sprinkler types, evaluation of optimal irrigation system operations, exploring the needs for specific farms based on local practices, weather, soil type and land slope variation and crop conditions.

The Synergistic Sierra Valley Groundwater Recharge and Irrigation Efficiency Project is a unique opportunity to gain insight on the mutual and multiple resources benefits of enhanced groundwater recharge and improved irrigation practices.

12. COORDINATION OF PROJECT WITH OTHER RELATED PROJECTS ON ADJACENT LANDS - There are no known related projects on adjacent lands that would be impacted by the proposed project.

13. HOW THE PROJECT MEETS THE PURPOSES OF THE MONTEREY SETTLEMENT - This project fulfills the goals in the Monterey Settlement to **improve upland vegetation management** and **improve groundwater retention and storage in major aquifers**. Notably, irrigation efficiency and recharge components of this project will work in synergy with one another to both increase supply of and decrease demand on water resources in the northeastern quadrant of the Sierra Valley. Restoration priorities listed in the Feather River Watershed Management Strategy also identify the eastside of the watershed as a priority region for restoration projects, and model results included in the Sierra Valley GSP support this finding. The Little Last Chance Creek in the eastside of the Basin holds substantial potential to increase both shallow and deep groundwater storage in the watershed, and proposed irrigation efficiency demonstrations and evaluations for this project hold the potential to substantially improve upland vegetation management in this agricultural region of the Sierra Valley.

The proposed project also meets the priorities of the Feather River Watershed Management Strategy by targeting a high priority area, namely the eastern agricultural region of the Sierra Valley, while focusing on restoration interventions that could offer substantial anticipated beneficial impacts to groundwater resources and storage. The Feather River Watershed Management Strategy notes that investigation into enhanced recharge in the eastern Sierra Valley groundwater basin should be a distinct priority for managing drought depletions.

14. PROJECT TYPE - The proposed synergistic groundwater recharge and irrigation efficiency project is a **Type 2 First Tier Project**, because it involves **groundwater recharge and design and implementation of more water efficient irrigation methods and irrigation management**.

15. MEASURE OF PROJECT ACCOMPLISHMENTS/EXPECTED OUTCOME - The expected outcome of the project is to determine the feasibility of groundwater recharge in the project area and to augment availability of water for recharge through reduced water use on local farms. Water use, flow used for recharge, and change in groundwater levels will be used to measure the project accomplishments. It is estimated that approximately 250 acre-ft/year would be available for recharge, and possibly scaled up if conditions are favorable. In addition, an improvement in irrigation efficiency of 15-20% is expected through implementation of this project.

16. ESTIMATED START DATE 01-01-2024

17. ESTIMATED COMPLETION DATE 06-01-2026

18. PROPOSED METHODS OF ACCOMPLISHMENT – Monitoring to evaluate reductions in water usage, flow used for recharge and changes in groundwater levels will be used to determine if the project goals have been accomplished.

19. ANTICIPATED PROJECT COSTS - To conduct the Synergistic Sierra Valley Groundwater Recharge and Irrigation Efficiency Project as described above, the budgeted estimated cost is \$1,300,000. A more detailed description of the budget is provided in Worksheet 2 – Project Cost Analysis.

20. IDENTIFY SOURCES OF OTHER FUNDING FOR PROJECT IDENTIFIED ABOVE - The SVGMD is currently applying for DWR's SGMA Round 2 Implementation funding and funding for other groundwater recharge projects through the CDFW. In addition, this project builds on the initial irrigation efficiency projects implemented during initial GSP development and funded through DWR Proposition 68 grant funds for GSP development.

Currently, there are no secured funding sources for the tasks specified in this project proposal.

Stakeholders in the Sierra Valley are increasingly concerned about groundwater resources and the impact of drought on their agriculture practices, access to drinking water, and overall livelihood. Local funding is limited but extremely critical for the future of communities, ecosystems, and agriculture in the Sierra Valley.

By applying for multiple grant opportunities, the goal of the SVGMD is to layer funding to obtain the needed resources to implement the GSP and its numerous projects and management actions including restoration efforts.

21. MONITORING PLAN - Monitoring will be optimized to assess the effect of recharge on groundwater retention and storage in the aquifer, as well as the effect of irrigation efficiency on improving upland vegetation management. For the recharge component of this project, initial monitoring will be required during construction of recharge facilities, and will include diversion gaging, as well as water table and vadose zone monitoring at infiltration facilities. Monitoring during implementation of the recharge project will occur at stream gauges both upstream and downstream of the proposed diversion points throughout the study period, and enhanced monitoring will be conducted on a bi-weekly basis during the proposed diversion interval from December 1st through March 31st. Groundwater table elevations will be measured at a minimum of 2-3 groundwater monitoring sites and all monitoring results for the recharge component of this project will be reported on a quarterly basis.

The irrigation efficiency component of this project will involve flow meter monitoring at pivot heads, and monitoring of soil moisture before and after system conversion using soil moisture systems. Data on crop yield will also be collected, and water use and crop yields will be contrasted with baseline conditions (pre-existing irrigation systems). Soil moisture monitoring will allow for comparison of moisture content and retention using LEPA and LESA systems relative to conventional MESA systems.

22. FAILURE TO COMPLY WITH TERMS OF THE AGREEMENT - SVGMD has been working since its establishment in 1980 to implement practices aimed at better management of groundwater resources in Sierra Valley. SVGMD was established as a groundwater sustainability (GSA) in 2017. Working with the Plumas County GSA, SVGMD submitted a groundwater sustainability plan as required for a medium priority Subbasin in January 2022. As such SVGMD has the experience and knowledge of the project area needed to complete the proposed project. In addition, SVGMD has been working with contractors with substantial experience with the development of groundwater recharge and irrigation efficiency projects. This experience includes recharge projects for the Scott Valley Irrigation District (Siskiyou County), Omochumne-Hartnell Water District (Sacramento County) and Dunnigan Water District (Yolo County). In addition, SVGMD and its contractors have worked directly with farmers in the Sierra Valley to conduct initial irrigation efficiency demonstration projects as part of the GSP implementation effort. This effort would be built on under this project to expand the use of systems **designed to more efficiently manage irrigation water (LESA/LEPA systems) in Sierra Valley**.

SVGMD will use this previous experience in managing and executing project and the resources provided by contractors with the same level of experience to ensure the project is completed. If unforeseen delays are encountered SVGMD will communicate promptly with the grant/project manager to address any issues that may result.

23. DETAILS OF LANDOWNER AGREEMENTS - Landowner agreements will be prepared for the sites selected for infiltration and monitoring and will include obtaining access and utilization agreements for stream gages, water conveyance routes, infiltration sites, monitoring well sites, water rights assessment, and legal descriptions.

In closing, thank you for the opportunity to present this concept proposal. Should you need additional information or have clarifying questions, please feel free to contact me at (530) 249-4520 or sierravalleygmd@sbcglobal.net or Laura Foglia, LWA, at (530) 753-6400 x240 or lauraf@lwa.com.

Sincerely,

Jenny Gant

Jenny Gant
SVGMD Board Clerk

Directors: Dwight Ceresola

Dave Goicoechea
Einen Grandi
Greg Ramelli
Jim Roberti
Paul Roen
Don Wallace

WORKSHEET 1 – STATUS OF PROJECT PLANNING

As described below, permits will be obtained, if needed, as part of the recharge project development (**Task 4 of the Project Work Plan in Attachment 2**).

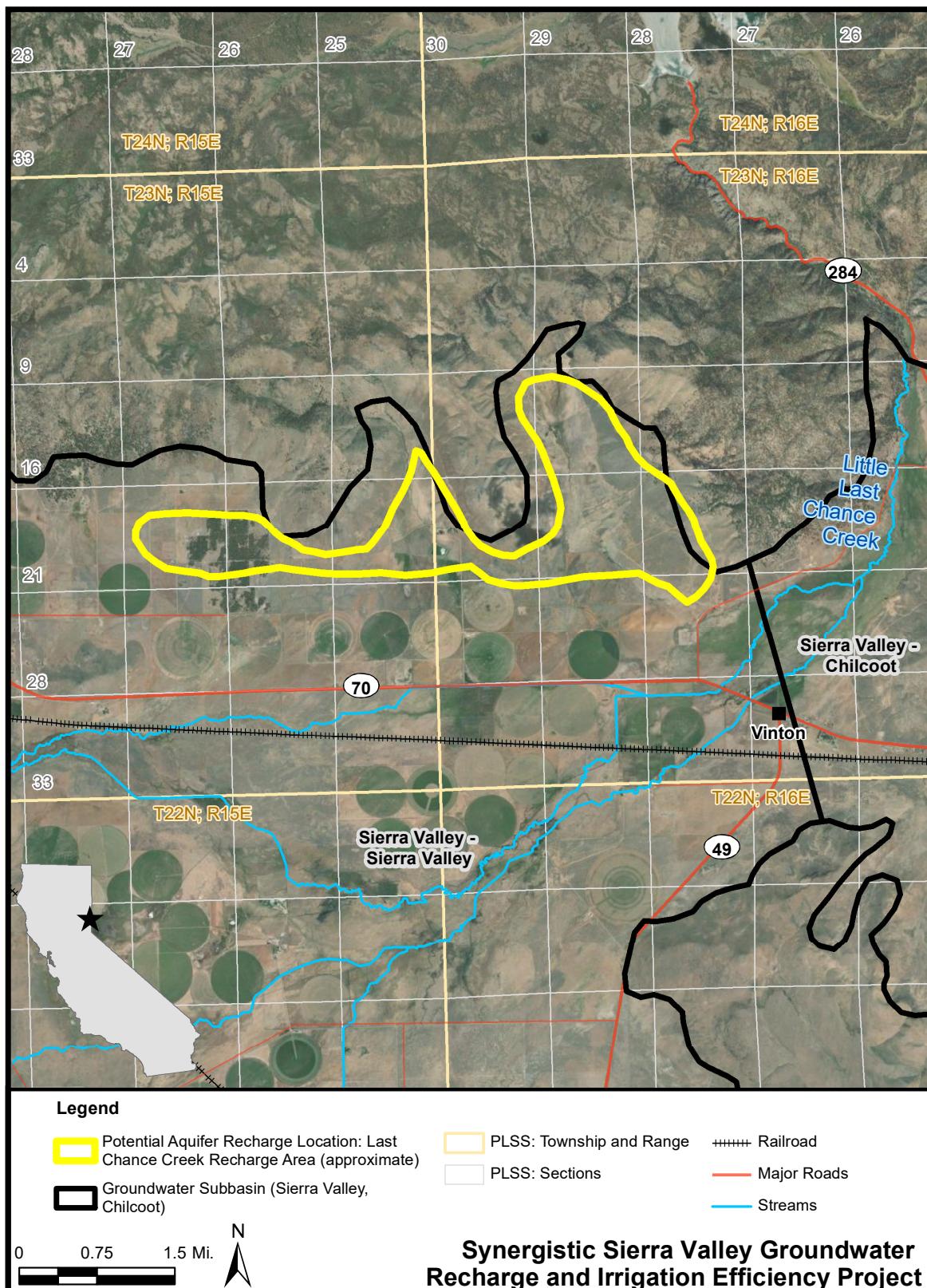
- a. NEPA / CEQA complete – CEQA/NEPA has not been completed. It is expected that a CEQA Notice of Exemption (NOE) will be filed. NEPA is not expected to be needed.
- b. Estimated date of completion - Notice of Exemption (NOE) expected within 6 months of project initiation.
- c. NMFS ESA consultation - This project is not expected to have adverse effects on wildlife but the need for consultations with NMFS will be determined and conducted as needed
- d. USFWS ESA consultation - This project is not expected to have adverse effects on wildlife but the need for consultations with USFWS will be determined and conducted as needed
- e. RWQCB/CDFG Permits - A Streamlined or Temporary water right permits to divert water from Little Last Chance Creek for groundwater recharge will be obtained from the State Water Board. In addition, SVGMD will serve as the CEQA lead agency and will work with Sierra County and the State Water Board as needed to issue the CEQA Notice of Exemption (NOE) needed for the temporary water rights permit.
- f. RWQCB/COE 401/404 Fill/Removal Permit Obtained - The need for permits associated with construction (i.e., 401/404 permit) will be determined during project design.
- g. SHPO Concurrence Received - SHPO concurrence has not been obtained but the need for this will be determined during project development.
- h. Project Designs Completed - Project design will be completed as part of Tasks 5 and 6
- i. FEMA/National Flood Insurance Program (NFIP) Compliance - FEMA compliance is not expected to be needed.
- j. Local/Regional Permits and Regulatory Compliance - The need for local/regional permits and regulatory compliance will be determined during project development. Permits from the Plumas County Environmental Health Department may be required.

WORKSHEET 2 – PROJECT COST ANALYSIS

To conduct the Synergistic Sierra Valley Groundwater Recharge and Irrigation Efficiency Project, as described above, the budgeted estimated cost is \$1,300,000.

Task	Equipment Budget Estimate	Professional Services Budget Estimate	Budgeted Estimated Cost	Estimated Schedule
Task 1 – Administration and Management	--	\$30,000	\$30,000	Ongoing
Task 2 – Stakeholder Outreach	--	\$50,000	\$50,000	Ongoing
Task 3 – Farm Assessments	\$40,000	\$20,000	\$60,000	2024
Task 4 – Preliminary Design and Permitting of MAR Project	\$100,000	\$300,000	\$400,000	2024-2025
Task 5 – Construction of MAR Facilities at Little Last Chance Creek	\$350,000	\$120,000	\$470,000	2025
Task 6 – MAR Performance and Monitoring	\$10,000	\$50,000	\$60,000	2025-2026
Task 7 – Irrigation Efficiency Demonstration, LEPA & LESA Conversions	\$170,000	\$60,000	\$230,000	2024
TOTAL	\$670,000	\$630,000	\$1,300,000	2024-2026

ATTACHMENT 1 – PROJECT LOCATION



ATTACHMENT 2 - PROJECT WORK PLAN

The project will be conducted according to the following tasks:

Task 1: Administration and Management

The Sierra Valley Groundwater Management District will conduct administration and management tasks for this project in coordination with and in support of efforts by other applicable and affiliated Forum groups.

Deliverables for Task 1 monthly project status reports and invoices. The budget for Task 1 is \$30,000, and will cover this effort throughout the duration of the project.

Task 2: Stakeholder Outreach

An early task in this project will be to reach out to ranchers and property owners in the project area to describe the project and its benefits to agriculture and groundwater resources. This will be done through direct communication with the property owners and will build on existing relationships established through previous work. In addition, with the goal of building additional stakeholder support, the project will be publicized using the SVGMD and County website and a presentation at the SVGMD Board meeting. The proposed project has been previously discussed at Board meetings and is described in the GSP and other publicly available technical reports developed for SVGMD.

Following up on initial outreach, in coordination with the FCWCD and the Forum, the SVGMD will host a meeting with ranchers to establish willingness to participate in a synergistic recharge/irrigation efficiency project. This more focused outreach will be to ranchers in the vicinity of the proposed recharge areas, focusing on the Little Last Chance Creek Recharge Area. The initial meeting will involve sharing information on the proposed recharge sites, as well as discussing design feasibility and the proposed approach to both recharge and irrigation efficiency implementation projects. During the meeting, the SVGMD will describe the mutual economic benefits to both ranchers and Plumas County, as well as seek feedback on components to consider prior to implementation. Ranchers interested in participation will be contacted for a follow-up meeting about project participation in ranch assessments.

After the first year of project implementation, a follow-up workshop for participating ranchers will be held by the SVGMD to share preliminary results and progress of the project, as well as collect feedback and consider next steps for implementation.

At the end of the project period, a final workshop will be held to present results to stakeholders, discuss overall benefits, and discuss possible future projects across the Sierra Valley.

Deliverables for Task 2 will include reports drafted and made publicly available on the County Website after each meeting, for a total of three reports, to summarize the status of the project. The reports will incorporate feedback and suggestions from ranchers and the general public on project implementation. Additionally, a final memo will be drafted at the end of the project to describe the effectiveness of outreach efforts in enhancing the project goals and implementation. This final memo will also include copies of all farm assessments conducted across the project region.

The budget for Task 2 is \$50,000 and will span the full period of project implementation.

Task 3: Farm Assessments

Funds will be provided to the UC Cooperative Extension to conduct farm audits for farmers that express interest in participation in this project during the original stakeholder outreach meetings described in Task 2. Each farm audit will entail monitoring and will provide a detailed report for the corresponding farm on ways to improve irrigation efficiency in the future.

Deliverables for Task 3 will be a compilation of all farm audits that will be included in Task 2. The budget for Task 3 is \$60,000.

Task 4: Preliminary Design and Permitting of Managed Aquifer Recharge (MAR) Project

During the first stage of Task 4, the MAR component of this project will require landownership discussions and both access and utilization agreements for stream gages, water conveyance routes, infiltration sites, monitoring well sites, water rights assessment, and legal descriptions. Two stream gages will be installed and will require routine maintenance and operational review throughout the project period. Identifying potential infiltration facilities will require updated hydrogeologic characterizations via numerical flow models, area-specific geophysics, phase I borings to confirm lithologies at prospective locations, and refinement of the numerical flow models to complete a mounding assessment and to assess the efficacy of the proposed work. The next phase of site assessment will require geotechnical investigations, including upper soil profiles for proposed sites, phase 2 borings to the water table to characterize unsaturated zone soils at planned infiltration sites, and small basin flooded infiltration test measurements at planned bottom depths of infiltration basins, galleries or dry wells. Once geotechnical investigations are complete, the Precipitation Runoff Modelling System (PRMS) model will be updated based on preliminary stream gauge data, and 1-yr, 10-yr and 100-yr runoff event flows will be determined. Preliminary design of the MAR infiltration system will be developed sufficient to advance water rights application and CEQA for the project implementation.

The water rights applications will comprise the final phase of Task 4. Initially the SVGMD will pursue a diversion permit through the State Water Board's Streamlined Processing for Standard Groundwater Recharge Rights. This type of permit allows for diversion of streamflow to recharge points between December 1st and March 31st, when flows in the waterbody reach or exceed thresholds that trigger flood controls actions, and when streamflow is above the 90th percentile. Diversions with this permit are limited to 20% of total streamflow, and therefore are not expected to adversely impact fish and wildlife. The SVGMD has completed step one of the streamlined permitting process by confirming eligibility of the project. The next step involves completing an application that describes the project's source, place of use, purpose, point(s) of diversion and quantity of water to be diverted. Upon acceptance of the application (decisions are expected within 30 days of submission), the permit must be environmental reviewed under CEQA and the State Water Board must determine whether both unappropriated water is available for the project and whether the permit is in the public interest. This process involves a short processing period, thereby allowing the SVGMD to begin the diversion and recharge process as soon as possible.

Once Streamlined Recharge Rights are acquired, the SVGMD will proceed to apply for a 180-Day Temporary Diversion Permit. This process will involve similar steps of environmental review relative to the Standard Streamlined Permit application. The SVGMD will seek input from the Division of Water Rights for consultation on the application prior to submission.

Deliverables for Task 4 will be a report of both MAR design and permitting progress for water diversions and recharge as well as results of numerical model scenarios. The budget for Task 4 is \$400,000.

Task 5: Construction of MAR Facilities at Little Last Chance Creek

Facilities required for the MAR Project will be constructed, including diversion works, conveyance systems, and infiltrations facilities. Part of this construction will require diversion gaging and water table and vadose zone monitoring at infiltration facilities. Subtasks for Task 5 include completion of the engineering design, securing necessary construction permits, bidding the project to select a contractor, construction with inspection services, and start-up testing and documentation of constructed facilities.

Deliverables for Task 5 include a memo detailing all costs and progress incurred during construction and will include initial monitoring data at infiltration facilities. The budget for Task 5 is \$470,000.

Task 6: MAR Performance and Monitoring

Monitoring of MAR performance will be conducted across two-years, until the end of the grant period. Performance evaluation will include bi-weekly monitoring during the diversion period, likely spanning approximately 4 months from December 1st through March 31st. Monitoring will also include regular quarterly reporting. Task 6 will also require standard minor basin and infrastructure maintenance each year. Groundwater level monitoring will be conducted separately as part of the GSP Monitoring Program.

Monitoring will be optimized to assess the effect of recharge on groundwater retention and storage in the aquifer, as well as the effect of irrigation efficiency on improving upland vegetation management. For the recharge component of this project, initial monitoring will be required during construction of recharge facilities, and will include diversion gaging, as well as water table and vadose zone monitoring at infiltration facilities. Monitoring during implementation of the recharge project will occur at stream gauges both upstream and downstream of the proposed diversion points throughout the study period, and enhanced monitoring will be conducted on a bi-weekly basis during the permitted diversion interval from December 1st through March 31st. Groundwater table elevations will be measured at 2-3 groundwater monitoring sites and all monitoring results for the recharge component of this project will be reported on a quarterly basis.

Deliverables for Task 6 will include a summary of the regular (bi-weekly) monitoring reports. The budget for Task 6 is \$60,000.

Task 7: Irrigation Efficiency Demonstration, LEPA & LESA Conversions

As the first step in the irrigation efficiency component of this project, Task 7 will involve the conversion of conventional MESA systems to LEPA systems and LESA equipment with the flexibility of including multiple options, as described below.

First, collaboration with willing ranchers and 2-3 volunteer farmers on 3 center pivot fields and 2 additional baseline fields to convert 3 conventional MESA systems to LEPA systems, which release a reduced volume of water closer to crop level in an effort to reduce water loss from evaporation and wind drift and reduce overall energy and pumping required for irrigation. LEPA implementation will require the installation of 5 flow meters at pivot heads and 5 soil moisture systems, to evaluate both pivot water use and soil moisture before and after system conversion.

In addition to the LEPA demonstration, this project will also convert 2 additional center pivots from the MESA systems to LESA equipment, in order to assess the efficiency of LESA in improving agricultural irrigation relative to one baseline field. LESA applies water more uniformly than LEPA (Peters et al., 2016)³, and may have different benefits or drawbacks that will be assessed for the northeast region of the Sierra Valley. LESA demonstration will require 1 to 2 volunteer farms, and installation of 2 LESA systems, 3 flow meters and 3 soil moisture systems.

Monitoring will involve flow meter monitoring at pivot heads, and monitoring of soil moisture before and after system conversion using soil moisture systems. Combined, flow meters will provide information on water use during the study interval, and soil moisture monitoring will allow for comparison of moisture content and retention using LEPA and LESA systems relative to conventional MESA systems.

Deliverables for Task 7 will include a compilation of monitoring data, before and after LEPA and LESA conversions, for the annual irrigation report detailed in Task 2. The budget for Task 7 is \$230,000, based on the cost for 1-2 LEPA conversions and 1 LESA conversion.

³ Peters, T., Neibling, H., Stroh, R., Molaei, B., and Mehanna, H., 2016, Low Energy Precision Application (LEPA) and Low Elevation Spray Application (LESA) Trials in the Pacific Northwest, p. 3.
<http://irrigation.wsu.edu/Content/Fact-Sheets/LEPA-LESA.pdf>