MokeWISE Program Methodology:
Project 4a: Groundwater Banking within the Eastern San Joaquin Groundwater Basin

April 2015

Problem Statement and MokeWISE Stakeholder Interests

This study will determine the basis for and feasibility of groundwater banking within the Eastern San Joaquin Groundwater Subbasin. The ultimate goal of a groundwater banking project is to improve overdraft conditions in the Subbasin and identify the potential to improve reliable water supplies for Eastern San Joaquin County, East Bay Municipal Utility District, and the Upper Mokelumne River Watershed region through groundwater banking. The study will include analysis of various issues, impacts and constraints that may affect project implementation through new and evolving legislation, water supply sources, project concepts and design, governance and stakeholder engagement. Water sources included in feasibility and cost evaluation are Mokelumne River and other surface water, recycled water, stormwater, and conservation. Using lessons learned from the recent San Joaquin County demonstration project and coordinated public outreach, the study will assess groundwater basins, assess supply alternatives, and if determined to be feasible, define and develop a groundwater banking project. A governance framework will be established that guides the operation of the developed project and may include the Groundwater Sustainability Agency. A final report will be developed that summarizes the alternatives developed and provides discussion relative to the benefits and impacts of each. Costs associated with this study are estimated to be $3.605 million.

The environmental stakeholders in the MokeWISE process have an interest in seeing groundwater aquifers effectively and transparently managed and further understand that such aquifers can be utilized as a water storage option. Development of new groundwater storage projects is viewed by many as having an environmental advantage as compared to the development of new surface water storage projects.

Environmental stakeholders support the concept of protecting aquifers as they serve to provide an emergency water reserve during times of severe drought.

Environmental stakeholders are concerned that water withdrawn from the Mokelumne River and banked in the Eastern San Joaquin groundwater basin may not be subject to proper management. Specifically, they view that withdrawals of groundwater is premature until adequate safeguards and controls, including the development and implementation of appropriate monitoring plans, are in place to ensure that any banked or recharged water does in fact recharge the basin and can be withdrawn by agencies or groups participating in the project(s) when needed. Those stakeholders believe that measurement and modeling tools and governance and institutional structures must be in place to assure a clear accounting of the water added to and withdrawn from the basin. There is the fear that banking of water could lead to an expansion of agricultural operations, fostering an even greater dependence on surface and groundwater supplies.

In light of the above concerns, while environmental stakeholders strongly support the concept of conjunctive management of groundwater basins, they desire that the concept of

putting surface water from the Mokelumne River, a resource which should continue to be managed to meet the needs of water interests and in accordance with the public trust, into the Eastern San Joaquin aquifer, be approached cautiously. Environmental stakeholders are concerned that overlying landowners will have unhindered access to groundwater.

Environmental stakeholders also ask that the quantity and timing of Mokelumne diversions for banking in the Eastern San Joaquin groundwater basin be considered as part of project planning. Such project operations have the potential to impact flows in the river that serve important ecological functions.

Environmental stakeholders are interested in the use of independently verifiable data and modeling to determine how much and when water could sustainably be diverted from the Mokelumne River for a groundwater banking project.

Environmental stakeholders are interested in groundwater banking projects and agreements that prioritize arriving at aquifer equilibrium and replenishment before groundwater banking and emphasize clear timelines for when each of those goals will be achieved.

Environmental stakeholders are concerned that unregulated withdrawals of water from the Eastern San Joaquin Basin may in dry years result in increasing saline intrusion into the basin in spite of recharge with Mokelumne water, rendering much of the basin unsuitable for agricultural and potable use.

Some non-government organizations are concerned that the use of water upcountry may have unnecessary significant impacts on the environment that should first be reduced through land use planning and pollution prevention.

Some non-government organizations want to see upcountry district-wide long-term financial planning with meaningful ratepayer involvement by upcountry water utilities prior to any project involving substantial investment for capital, operations, or maintenance.

Some non-government organizations want to ensure that the costs and benefits of this project are equitably shared.

Some non-government organizations want to ensure that water storage and diversion facilities are designed to protect managed public access to the Mokelumne River for recreation, fishing, commerce, and other benefits.

While understanding the desire of some project proponents to keep project details flexible, some non-government entities want the study to result in a project with a certain enough set of components that they can determine whether to support the project following the study.

Some non-government organizations want to know if a successful groundwater banking project is compatible with a wild and scenic designation for 37 miles of the Mokelumne River.

Before the water utilities make further legal commitments, financial commitments, funding applications, or permit applications associated with a groundwater banking project, both the environmental community and San Joaquin County are willing to discuss a Wild and Scenic Designation. It is the desire of both parties that this conversation occur before this time.

Water users and other stakeholders in Eastern San Joaquin County want to ensure that any banking project include the objective to ensure that both overlying groundwater users and project participants have reasonable access to groundwater.

Agricultural interests are concerned that conversion to drip and sprinkler irrigation is not suited for all crop types. Additionally, another common on-farm water conservation method - tail water return systems - may have the unintended consequence of removing a recharge source for groundwater thus not resulting in a supply benefit. Finally, implementing agricultural water conservation in areas overlying an over-drafted groundwater basin may have the unintended consequence of reduced groundwater recharge when using surface water for flood and furlough irrigation.

East Bay Municipal Utility District (EBMUD) has an interest in protecting its water rights and developing cost effective recycled water projects as a way to improve water supply reliability for its customers. If recycled water development results in water that is excess to EBMUD's water rights and downstream needs, then that water could be made available by EBMUD in exchange for equivalent financial or other benefit.

EBMUD also has an interest in protecting its facility operations in order to assure water supply reliability for its customers and to continue to meet any flow obligations as may be in place regarding releases for senior rights holders and or to meet environmental needs. EBMUD has identified the opportunity to work in partnership with San Joaquin County entities to develop a groundwater banking projects. Agreements regarding the development of demonstration projects have recently been entered into, and those agreements outline what must be achieved by the demonstrations in order for any formal project to move forward into an implementation stage.

Overall, EBMUD believes that groundwater banking can provide a mix of water supply and environmental benefits as well as help recharge San Joaquin County's groundwater basin.

Project Information

Project Description

This study will determine the basis for and feasibility of groundwater banking within the Eastern San Joaquin Groundwater Subbasin with the objective of improving reliable water supplies for not only Eastern San Joaquin County, but also the East Bay Municipal Utility District and the Upper Mokelumne River Watershed region. The desired outcomes of a

potential project are improved groundwater levels in the vicinity of the groundwater banking location, the development of a reliable alternative water supply for agencies who rely on Mokelumne River water, and also increased flexibility to provide environmental benefits to the Mokelumne watershed. Consistent with the intent of MokeWISE, the study will also consider impacts and benefits to the environment, conduct an analysis of the feasibility of alternative supplies to the Mokelumne River including stormwater capture, recycled water, and conserved water, and identify climate change adaptation. This document summarizes the approach for analyzing and developing the proposed project concept in the form of a feasibility study.

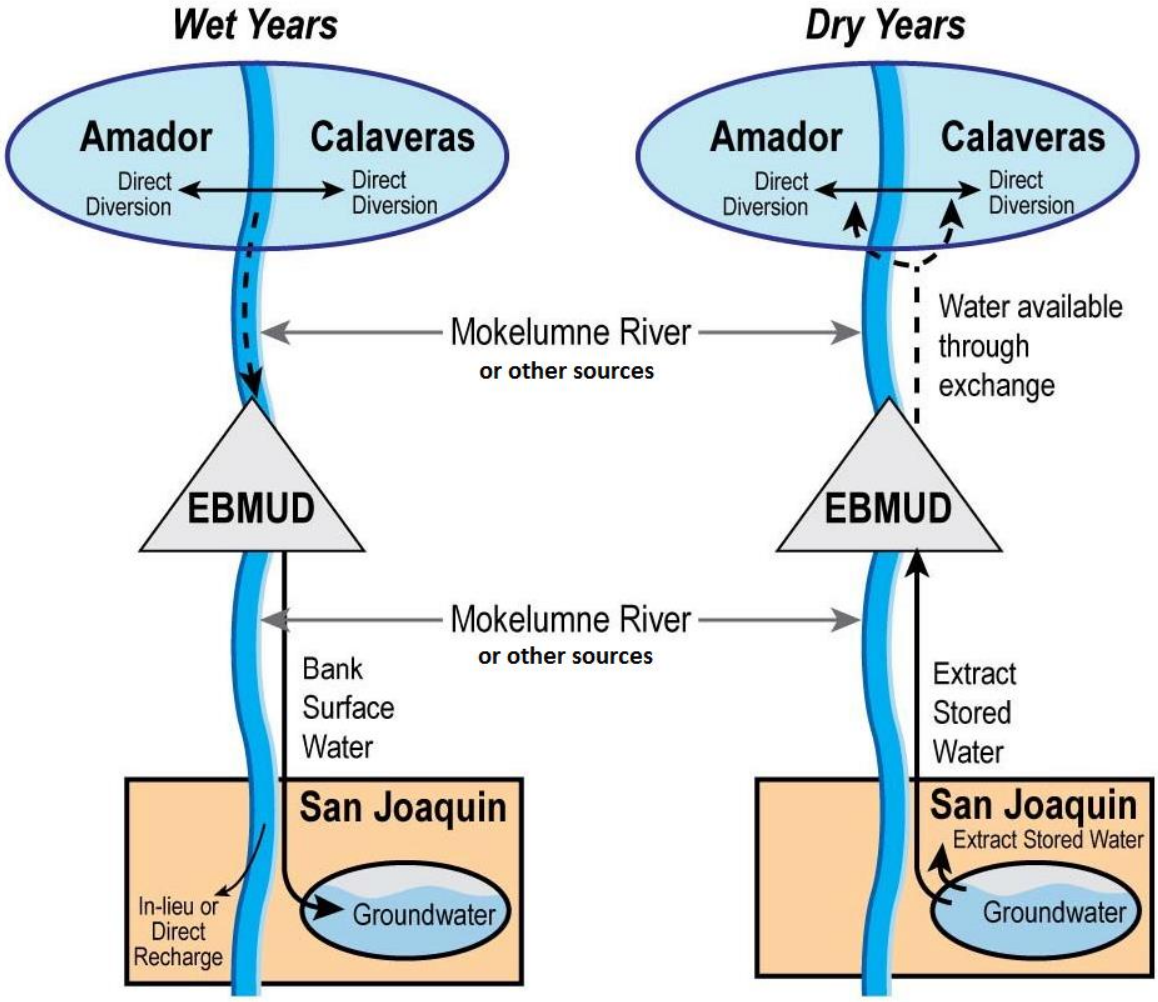
The study will include analysis of various opportunities, impacts and constraints that may affect project implementation through new and evolving legislation, water supply sources, project concepts and design, governance and stakeholder engagement. Operational flexibility is currently maximized by including a variety of potential water sources for banking as described in the MokeWISE Program Water Availability Analysis. Water sources described for feasibility and cost evaluation include the following:

- Mokelumne River and Other Surface Water
- Recycled Water
- Stormwater
- Water Conservation / Demand Management

The MokeWISE Water Availability Analysis found that agricultural drainage and desalination/demineralization supplies are not anticipated to provide a long-term, regional supply for the MokeWISE program. As such, these supply sources are not considered viable supply alternatives and will not be examined at this stage for the groundwater banking project.

Eastern San Joaquin diversions upstream of Pardee Reservoir are not being considered as part of this study. Other upcountry project partners may envision diversions upstream of Pardee as part of a groundwater banking project. See **Figure 1** below.

Figure 1: Potential Groundwater Banking Project Schematic



Project Location

The study is located in the areas overlying the Eastern San Joaquin Groundwater Basin. A potential project or project(s) will be located within the Eastern San Joaquin Groundwater Region within the WID, NSJWCD, City of Lodi, City of Stockton, and SEWD service areas. Specific locations will be identified as part of this scope of work. Additional facilities to facilitate increased direct diversions in the upper Mokelumne River watershed may be required.

Project Sponsor

The Eastern San Joaquin Groundwater Basin Authority (GBA), Calaveras County Water District, and North San Joaquin Water Conservation District are sponsors of the project. The Calaveras Public Utility District is co-sponsoring. East Bay Municipal Utility District, Amador Water Agency, Jackson Valley Irrigation District, and other water right holders in the upper watershed may also participate in groundwater banking.

Scope of Work

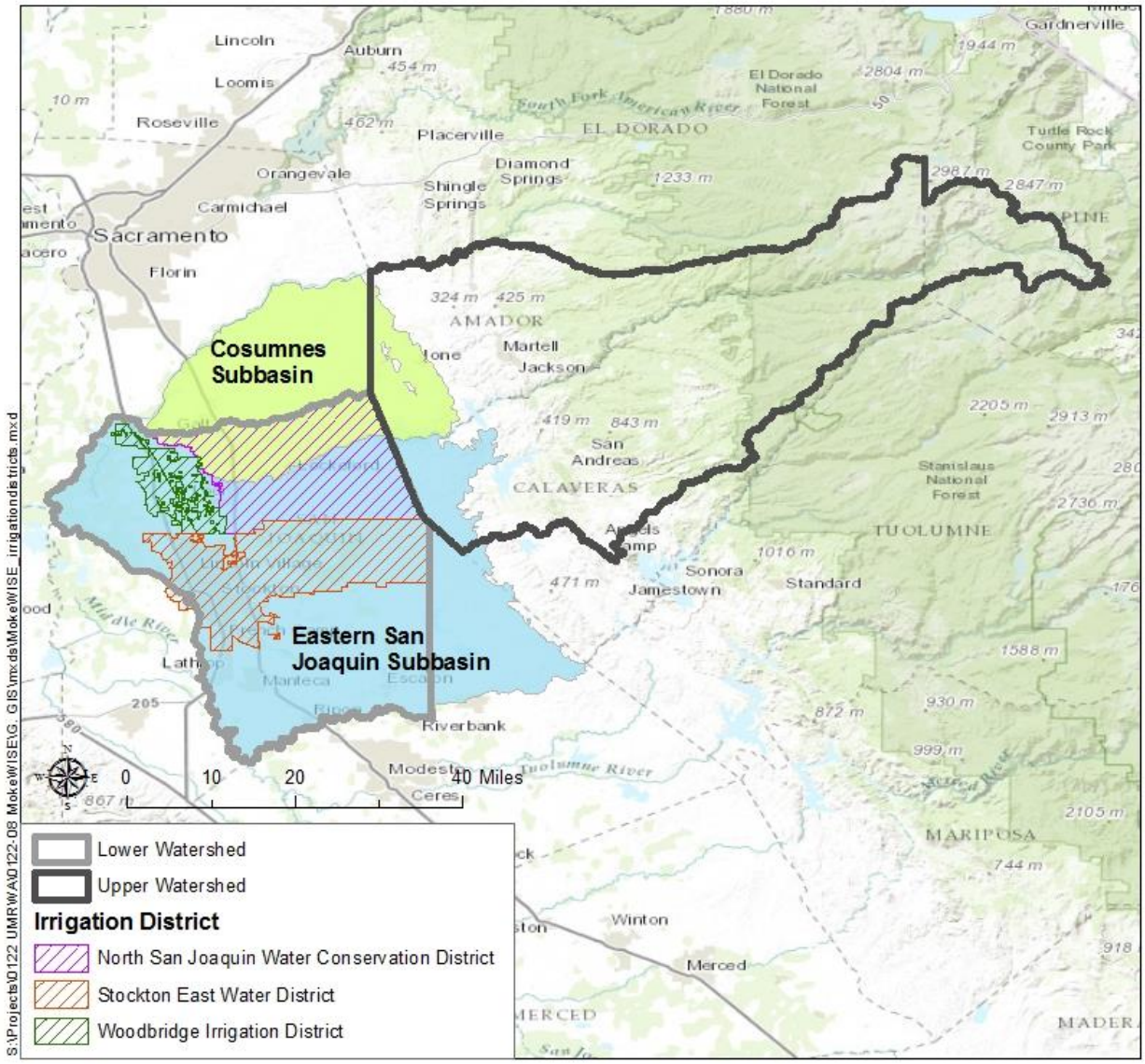
Task 1. Identify Project Study Area

The purpose of this task is to summarize current groundwater basin conditions to develop a basis for quantifying recharge opportunities.

Subtask 1.1 Characterize the Affected Portion of the Eastern San Joaquin Groundwater Basin.

The Eastern San Joaquin Groundwater Basin is identified in DWR's Bulletin 118 and extends under Eastern San Joaquin County and into Calaveras County (**Figure 2**). The basin has been the subject of numerous studies and reports, including the MokeWISE Water Availability Analysis (Jan 2015), the GBA Integrated Regional Water Management Plan 2014 Update, the GBA 2007 IRWMP, the Eastern San Joaquin County Integrated Conjunctive Use Programmatic EIR, and the Freeport Element of the American River Use Strategy Report. These studies should be reviewed and expanded upon, as needed, with the intent of informing the process of creating a groundwater banking program in the region.

Figure 2: Eastern San Joaquin Groundwater Subbasin and Mokelumne Upper and Lower Watersheds



Total agricultural and municipal groundwater pumping in Eastern San Joaquin County is estimated to have averaged 870,000 AFY since the 1970s. The Eastern San Joaquin groundwater subbasin is currently overdrafted at a rate of 70,000 to 80,000 AFY (GBA 2014). Overdraft conditions have created an estimated 1 to 2 million AF of groundwater basin storage which could be used in a groundwater banking or conjunctive use development (GBA 2004). Conjunctive management strategies (i.e. management of groundwater and surface water resources) and groundwater recharge opportunities may help to mitigate groundwater overdraft conditions, as well as serve as a valuable groundwater banking

resource to the region. The extent of overdraft conditions and estimated groundwater banking storage should be confirmed as part of this task.

Long-term groundwater overdraft has also had significant effects on groundwater quality. Groundwater level declines have resulted in steep gradients from the west, causing intrusion of highly saline groundwater. Salt intrusion in the groundwater basin has rendered supplies unusable for urban drinking water needs and crop irrigation in some locations. Studies and monitoring to determine the potential sources and extent of the saline front are limited. Results of a USGS Joint Salinity Study (USGS 2006) indicated several possible sources of saline water including surface water infiltration, dissolution of salts near the Delta margin, contributions from underlying deposits, and possible irrigation return flow. Other contaminants of potential concern in the basin include naturally occurring dissolved solids, iron, arsenic, and nitrate concentrations. This task should identify known plumes or pockets of contamination, sources of saline water infiltration, locations of potential water quality risk if present conditions continue, and potential infiltration or injection locations. Additional water quality testing, hydrogeological investigations, and modeling may be needed in order to identify ideal recharge or injection well locations.

Subtask 1.2 Baseline Data Collection to inform Project Scale

This task is focused on the presently available information including, but not limited to, information from the Eastern San Joaquin Basin Groundwater Management Plan, Eastern San Joaquin County IGSM, Eastern San Joaquin IRWM Plan, and similar recently completed documents or data sources.

Steps to be completed under this task include:

- Data gathering and synthesis;
- Identify demand components;
- Identify possible supply components;
- Identify infrastructure available for water conveyance, including potential constraints and capacities;
- Develop preliminary water balance for the Project Area;
- Use MOCASIM to develop a baseline for comparison of banking alternatives.

Subtask 1.3 Coordination with Groundwater Sustainability Agency

The Sustainable Groundwater Management Act (SGMA) was signed by the Governor in 2014 and includes several mandates related the sustainable management of groundwater basins Statewide. Under the SGMA, local government agencies may elect to become a Groundwater Sustainability Agency (GSA) or join into a larger multi-agency GSA. The declaration by an agency or agencies to become the/a GSA shall occur by June 30, 2017.

The SGMA requires that the GSA develop a Groundwater Sustainability Plan (GSP) by January 31, 2020 for basins in critical groundwater overdraft and by January 31, 2022 for all other high and medium priority basins. A GSP is required to include the following:

1. A description of the physical setting and characteristics of the aquifer system;
    a. Historical conditions to the extent available;
    b. Groundwater levels, quality, subsidence, and surface water interactions;
    c. A general discussion of historical and projected water demands and supplies;
    d. A map of the area of the basin and the boundaries of the GSA or GSA's developing a GSP; and,
    e. A map identifying the areas which contribute to the recharge of the underlying basin.
2. Measureable objectives to achieve the Sustainability Goal;
3. Groundwater Management Activities;
    a. Monitoring and management of groundwater levels;
    b. Groundwater quality degradation, inelastic land subsidence, subsidence, changes in surface water flow or quality;
    c. Mitigation of overdraft;
    d. How recharge areas contribute to the sustainability of the basin;
    e. Surface water supplies used or available for groundwater recharge.
4. A Summary of monitoring sites, frequency of measurement, for levels, quality, flow, precipitation, type of well used and the monitoring well's construction information.
5. Monitoring Protocols;
6. A description of the applicability of county and city general plans and how various GSP's may affect general plans.

The Cosumnes Groundwater Sub-basin is designated as medium priority and the Eastern San Joaquin Groundwater Sub-basin as high-priority.

- Since the bulk of the work for the Cosumnes and Eastern San Joaquin Groundwater Sub-basins will be ultimately determined by the Groundwater Sustainability Agency in accordance with SGMA, the scope of this task is narrowed to include the following: Verify the amount of water needed in the proposed project area to reach the sustainability goal of the GSA, consistent with SGMA.
- Identify the desired range of groundwater levels for the proposed project area as specified in the sustainability goal of the GSA, consistent with SGMA.

Coordination with the GSA entities should be ongoing throughout this project in order to position potential projects for inclusion in the GSP and associated funding.

Task 2: Assess Supply Alternatives

Previous efforts have evaluated the possibility of expanding use of Mokelumne River supplies through arrangements such as an in-river exchange or banking Mokelumne

supplies in the Eastern San Joaquin County. The purpose of this task is to assess what supplies may be potentially available for direct or in lieu recharge in the proposed project area.

Subtask 2.1 Stormwater Assessment and Inventory

The MokeWISE Water Availability Analysis assessed and quantified potential stormwater supplies and locations. Stormwater potentially available for the MokeWISE program comes from both residential areas and from municipal systems in Stockton and Lodi. Stormwater generated in the City of Lodi and in the City of Stockton may be temporarily captured in stormwater basins for flow attenuation and to meet water quality objectives while providing incidental groundwater recharge. Future urban development will be required to meet Low Impact Development Standards requiring additional storage and treatment creating more opportunities for groundwater recharge. Total stormwater potentially available for reuse within the upper and lower watersheds from both sources is estimated to be roughly 15,100 AFY. While the primary purpose of stormwater and flood water management is not for the purpose of providing a groundwater recharge benefit, there are a number of concepts that the feasibility study will explore, which include:

- Modification of the Woodbridge Irrigation District Canal system to increase residence time of stormwater flows generated by the City of Lodi to increase percolation.
- Retrofit of existing stormwater detention basins in Lodi and Stockton to improve percolation rates of local stormwater captured and also to double as recharge basins for Mokelumne Supplies when available.
- Any project alternative contemplated must also be subject to a strict analysis of impacts to the primary purpose of existing facilities designed to meet a strict flood control or water quality standard.

The EBMUD service area was not considered in the Water Availability Analysis and it is not considered to be a viable source of water supply for San Joaquin County; however, EBMUD is currently embarking on a study that will calculate theoretical stormwater supplies available within the EBMUD service area. Results from the EBMUD analysis should be used to summarize potential stormwater sources, at various scales, that could offset the use of Mokelumne supplies in the East Bay in favor of recharge in Eastern San Joaquin County or to provide flexibility in the management of Mokelumne Supplies for the improvement of fish and wildlife.

The stormwater assessment will include the following subtasks:

- **Identify opportunities for stormwater capture and infiltration at various scales.** Inventory stormwater and floodwater management infrastructure which could be used to increase the recharge of local stormwater runoff.
- **Quantify the potential for increased recharge of captured stormwater.**

- **Prioritize stormwater and floodwater conveyance systems for repair, retrofit, or enhancement.**
- **Determine the engineering and financial feasibility of conveying Mokelumne River water to these sites for recharge.**

Subtask 2.2 Recycled Water Assessment

The MokeWISE Water Availability Analysis assessed the potential for developing recycled water supplies to offset Mokelumne River supply or recharge the groundwater basin. Recycled water potentially available for the MokeWISE program is estimated to be 222,500 AFY. However, due to constraints and challenges associated with treating and delivering recycled water, the total available decreases to approximately 169,400 AFY. Future recycled water opportunities within the upper and lower watersheds accounts for roughly 6,500 AFY of the total recycled water potentially available, with the remainder comprised of recycled water generated within the EBMUD service area.

Despite the significant concerns that exist with the use of recycled water supplies for recharge of the San Joaquin groundwater basin through direct recharge or irrigation of agricultural lands overlying the groundwater basin, this task will include an evaluation of the potential concerns to the use of recycled water based on the source, quality, and end use. These concerns include:

- Impacts to agriculture: some major distributors will not purchase crops irrigated with recycled water; using recycled water for irrigation could therefore result in adverse economic impacts to growers.
- Salt and nitrate loading: using recycled water for recharge and / or irrigation of lands in Eastern San Joaquin County could increase salt and nitrate loading to the basin. Nitrates in runoff leaving agricultural land is regulated by the Regional Water Quality Control Board through the Irrigated Lands Program.
- Public health: depending upon the level of treatment provided, use of recycled water for direct recharge or irrigation of lands overlying the San Joaquin groundwater basin could result in introduction of contaminants of emerging concern (CECs) to the groundwater basin.
- Downstream impacts: use of recycled water could decrease this source for downstream users, thereby potentially decreasing the amount of water available for downstream users.
- Economic and environmental feasibility: piping and pumping recycled water can be prohibitively expensive and environmental impacts extensive.

However, recycled water should not be overlooked as a potential source of recharge provided that the concerns above are addressed.

The feasibility study will specifically evaluate the potential for the City of Lodi to provide recycled water for the purposes of groundwater recharge both direct and in-lieu. There may also be opportunities to evaluate small scale projects, such as using winery wastewater

for in-lieu applications. With the primary benefit of such small scale projects are driven by the need to make waste disposal more affordable, the study will explore the potential quantity of the secondary benefit of using non-potable water made available by creative waste disposal techniques.

A feasibility analysis for utilizing recycled water as a localized resource to offset other current water supply sources making those supplies available for groundwater banking, both in-lieu and recharge will be conducted through implementation of the following subtask.

- **Assess recycled water availability and evaluate potential recycled water project opportunities.** In this task, potential project opportunities will be identified by performing feasibility analyses for use of recycled water sources to offset use of other supplies that could then be used to recharge the groundwater basin through infiltration and direct injection, as well as in-lieu recharge by irrigating agricultural lands overlying the groundwater basin that would otherwise use groundwater. The concerns listed above should provide the basis for the evaluation.
- **Evaluate the amount of recycled water and the cost of the City of Lodi's options to provide recycled water to growers in a locally acceptable manner.**

Subtask 2.3 Water Conservation / Demand Management Assessment

The MokeWISE Water Availability Analysis assessed water conservation and efficiency as a method for increasing regional water supplies. Results from that analysis should be used to summarize potential water conservation measures that can serve to free up other water supply sources for use in a groundwater recharge project.

Cities, agencies and districts throughout the project area are implementing aggressive conservation programs as outlined in their 2010 UWMPs and Agricultural Water Management Plans (AWMPs). For example, Woodbridge Irrigation District (WID) recently implemented a drip irrigation conversion program. Through this program, WID has made available 6,000 acre-feet per year (AFY) of Mokelumne River supply to the City of Lodi at a cost of $200/AF. Conserved water can provide up to a direct one-to-one offset of potable supplies. This task will be implemented through the following subtasks. Recent modeling conducted for MokeWISE specifically modeled impacts to Mokelumne River flows at varying levels of urban and agricultural conservation; such results could be used to frame the impacts and benefits assessment.

- **Identify water conservation projects and BMPs with the potential for water savings throughout the region.** In this task, BMPs and conservation projects identified in the Water Availability Analysis will be evaluated for their potential to increase supplies for groundwater banking. Both urban and agricultural BMPs and water conservation projects will be evaluated. This task will incorporate relevant work performed as part of the Urban Water Conservation Program (MokeWISE

Project 5a), Agriculture Water Conservation Program (MokeWISE Project 5b), and other conservation programs throughout the region.

- **Identify impacts and constraints of expanding water conservation in the region.** This task will identify potential impacts and constraints to downstream river flows, domestic water supply, regional politics, legal issues, the environment, economics, and recreation. Analysis will be performed to evaluate the economic feasibility of the preferred projects and BMPs.
- **Identify gainsharing opportunities so that a portion of conserved water is considered for in-stream use.**
- **Identify the potential for other agriculture demand reduction strategies, including the lease or sale of land for groundwater recharge purposes.**

Particular attention will be paid to conservation measures that result in a net benefit to the groundwater basin.

Subtask 2.4 Surface Water Assessment

The MokeWISE Water Availability Analysis assessed Mokelumne River supplies, as well as Delta water supplies available for both short-term and long-term transfer. The amount of unallocated Mokelumne River water is highly variable depending on the location along the River and the hydrologic year type. Generally, there is more unallocated water downstream and less upstream and generally more in normal and below normal years than in dry and critically dry years. Results from that analysis should be used to describe potential surface water sources for groundwater recharge, identify existing and future infrastructure needed to convey and utilize surface water, and perform a feasibility analysis for utilizing surface water as a source for groundwater banking including preliminary environmental, economic, legal and other constraints. This task will assess potentially available surface supplies through implementation of the following subtasks.

- **Perform feasibility analysis for non-Mokelumne River water surface supplies**. Long-term transfer arrangements and conveyance of non-Mokelumne River surface water supplies using infrastructure such as EBMUD Freeport facilities are outlined in the MokeWISE Water Availability Analysis. This task will further analyze potential non-Mokelumne surface water supply opportunities and potential conveyance alternatives and summarize the costs and benefits of each alternative. Urban Water Management Plans (currently being updated) may provide new or updated information on potential water transfer opportunities. Additionally, this task will identify partners necessary to realize water supply transfers and conveyance and provide guidance on partnership-building.
- **Continue MOCASIM modeling efforts.** Identified new or modified water diversions will continue to be modeled using MOCASIM to assess environmental, water supply, geomorphic and other potential impacts caused by diverting Mokelumne River water for the proposed groundwater banking project. This will be done as a collaborative process including interested former members of the Mokelumne Collaborative

Group (MCG) and will represent a continuation of the analysis currently being completed in the MokeWISE program with the goal of identifying operational parameters that may provide a groundwater banking benefit while minimizing impacts or providing benefits to the environment.

- **Evaluate water rights.** Assuming the sources of water identified in the Water Supply Availability Analysis, a more detailed assessment of related water rights issues will be conducted under this task. This analysis will identify key water rights issues associated with each source, including restrictions on the potential supplies and/or limitations to infrastructure required for water diversion and/or conveyance. This task would also involve identifying partners to apply for a new water right or modify an existing right, if needed to support the preferred operating condition. This task will assess the legal feasibility of and options for allowing CCWD, CPUD, Amador Water Agency, and/or Jackson Valley Irrigation District to apply for and assign all or a portion of their area of origin reservations on the Mokelumne River. Evaluation of beneficial uses and potential constraints will be evaluated accordingly in subsequent tasks.
- **Identify impacts and constraints of utilizing surface water for groundwater banking.** This task will identify potential impacts and constraints to river flows, domestic water supply, regional politics, legal issues, the environment (both species-related and geomorphic), economics, and recreation. The results of this task will be used to inform the groundwater banking project development and identification of preferred alternatives processes.
- **Identify existing and future infrastructure needed to utilize surface water supplies for recharge**. The Mokelumne River has numerous existing diversions and associated canals and pipelines. This task would evaluate the feasibility of utilizing or upgrading existing diversions for conveyance of Mokelumne River water to recharge basins in the Eastern San Joaquin County Groundwater Subbasin. This task would also identify new infrastructure needs and develop preliminary concepts and cost estimates associated with new infrastructure alternatives. Additionally, feasibility of utilizing new surface water allocations for in-lieu groundwater banking will be evaluated. In-lieu banking may also require new or modified infrastructure.
- **Identify gainsharing opportunities to consider that a portion of previously unappropriated water be reserved for in-stream use.**

Task 3. Define Project

Development of a groundwater banking project in Eastern San Joaquin Groundwater Basin will likely require multiple phases or iterations of planning and design. The following tasks describe the project development work that will be completed for the groundwater banking project. Potential water supply sources for the project remain flexible, but must be refined as the preferred alternatives are defined. Information developed as part of the groundwater recharge demonstration project being implemented by EBMUD and San Joaquin County will be utilized to inform project development. Consistent with the intent of MokeWISE, the

proposed project will be designed to be environmentally, economically, and socially acceptable. No aboveground storage reservoir between Salt Springs Reservoir and Pardee Reservoir will be considered in this study.

Subtask 3.1 Data Collection and Review

Many studies have been implemented to develop relevant information on potential recharge opportunities in the Eastern San Joaquin Groundwater Basin. Existing information will be collected and reviewed, serving as a foundation for implementation of subsequent tasks.

Subtask 3.2 Identify Potential Well Locations (and in-lieu recharge areas such as irrigation areas)

As part of the groundwater banking project alternatives development process, it will be important to identify best location candidates for infiltration basins, as well as aquifer storage and recovery (ASR) wells and / or separate injection and extraction wells as appropriate. A series of criteria should be developed to identify preferred locations, as well as areas with possible issues. Criteria for identifying locations for infiltration basins and wells should include:

- Soil type and recharge potential
- Distance from existing infrastructure
- Location of demands
- Existing and planned land use
- For agricultural lands, permanent versus temporary crops

The purpose of this task is to identify potential locations for groundwater replenishment projects for further feasibility analysis and design. Taking agricultural lands out of production will need to be evaluated per County policy and within the context of CEQA.

Subtask 3.3 Identify and Evaluate Project Alternatives

Information about the current conditions of the groundwater basins, potential water supply analyses, and coordination needs will be assessed to develop alternative groundwater banking project scenarios, including infrastructure needs, evaluation of the suitability of selected recharge methods (i.e. field flooding, ponding, injection, flood irrigation, etc.) and define the characterization of potential benefits that could be realized under each scenario. Preferred groundwater banking project alternatives will be developed through MokeWISE participants workshops and other collaborative opportunities. Evaluation criteria will consider, at a minimum, economics, water availability, diversity of sources, degree to which projects contribute to a long term groundwater balance, and environmental benefits (including cold water pools, pulse flows, increased summer flows, and enhanced recreation).

For each project alternative, the study will identify the sources of the water supply, including stormwater, recycled water, and conserved water. It will also identify the timing,

availability, and amount of the proposed water uses. Water uses may include, but are not limited to, irrigation, water banking, aquifer recharge, and in-stream use. For each alternatives, the study will present current and reliable data on the "population to be served" and its future water requirements if water is to be used for municipal purposes. The study will map and identify the land to be irrigated, its acreage, and its irrigation needs, if the project is seeking water for agricultural purposes.

Concept level diagrams of preferred project alternatives will be prepared, along with conceptual level cost estimates. The evaluation will also include a preliminary analysis of the frequency and magnitude of water supply availability for each water supply type described in the sections above.

Subtask 3.4 Prepare an Economic Assessment of Preferred Project Alternatives

An economic assessment of the preferred groundwater banking project alternatives will be completed. This assessment will include:

- Identification of market valuation of potential groundwater banking project water supplies as compared to local, regional, and state-wide urban and agricultural water supplies.
- Identification of conceptual financing options, including identification of potential grants, low interest loan programs, municipal bonds, and private equity financing.
- Identification of potential purchasers and/or program partners interested in incremental water supply and/or water storage/reliability improvements.
- Alternatives comparison based on a range of cost per acre-foot of annual yield.
- Calculation of potential return on investment.

This task may also include a preliminary market assessment on the feasibility of a program that goes beyond local water resources management and to understand the outside market and answer key questions related to pricing and willingness of other agencies to enter into long-term water banking/transfer partnerships.

Subtask 3.5 Prepare a Detailed Project Alternatives Analysis and Preliminary Design

A detailed alternatives analysis will be conducted on the alternatives developed in Task 5.2. These analyses will include the use of MOCASIM, surface water-groundwater model, reservoir operation models, and Decision Support System models (i.e. WEAP) to evaluate the alternatives in a more detailed manner, evaluating a range of water year types and conditions, to identify those alternatives that provide the greatest flexibility and adaptive management opportunities and therefore are best suited to perform under a wider range of potential future hydrologic conditions. Analyses to be conducted in this task include evaluating how the preferred alternatives perform under a range of anticipated future climate changes and possible regulatory frameworks.

For each project alternative, the study will identify the amount, or possible amounts, of water that will stay in-stream to meet recreation, fish, wildlife, and water quality needs in all water year types.

For each project alternative, the study will identify how public access to the Mokelumne River for fishing, recreation, commerce and other benefits is protected or enhanced.

For each project alternative, the study will identify the degree to which the project would contribute to a long-term balance of water supply and demand.

The analyses will also refine the infrastructure needed to deliver water under the preferred alternatives and consider the operation, maintenance and life-span of required infrastructure. Ultimately, the analyses will include a detailed consideration of both capital and O&M costs in determining the overall alternative costs under a variety of hydrologic scenarios.

To the extent feasible, facilities description(s) and conceptual level plans will be prepared for the alternative(s) selected. These descriptions will identify approximate areas of potential effects, construction methods, excavation quantities, truck trips, etc. to support later preparation of the appropriate level of environmental documentation. The study will evaluate the alternatives in the context of existing uses, licenses and permits. The study will evaluate effects on the operation of the alternatives on upstream water users, EBMUD water users, and flood control beneficiaries.

Subtask 3.6 Prepare Preliminary Environmental and Regulatory Analysis

In this task, environmental and regulatory issues that will likely arise as a result of implementation of the preferred alternative(s) will be determined and summarized. The CEQA Initial Study Checklist will be used to guide the environmental evaluation and determine the best CEQA/NEPA approach. Regulatory/institutional considerations will include the blending of different supplies (groundwater, surface water, recycled water and stormwater), the potential for indirect potable reuse of recycled water, and the possible impacts of existing political relationships and state legislative trends.

The study includes consultation with local land use agencies to identify feasible means of reducing impacts of development associated with new water customers anticipated to be served with water resulting from this project. Results of these consultations with any recommendations shall be published in the study.

The study will identify the compatibility of a Wild and Scenic Designation for the Mokelumne River in conjunction with implementation of any groundwater banking projects.

Subtask 3.7 Prepare Preliminary Financing Plan

In this task, a financing plan would be developed for the preferred project alternatives, identifying possible outside funding programs and funding mechanisms, considering varying economic feasibility over time. This plan will include evaluation of short-term bridge loans that may be required in conjunction with State and Federal grants and loans. It will also identify potential funding mechanisms that could supplement or augment state and federal loans and grants, evaluate project agreements with respect to funding, and provide initial pro forma evaluations of each agency's ability to fund/finance their respective share of the project incorporating identified loans and grants.

The study shall identify one or more ways in which the projects' water supply will be shared; and one or more ways the capital, operations, and maintenance costs of the project will be shared. Following the study, but before the water utilities make further legal commitments, financial commitments, funding applications, or permit applications associated with a groundwater banking project, the water utilities will identify water supply and cost sharing options acceptable to the utilities.

Task 4. Establish Governance Framework

This task will develop the governance framework under which the project alternative(s) would operate. This analysis will identify the advantages and disadvantages of the various governance models, identify potential cooperating and participating agencies, recommend a governance framework for implementation and outline the next steps required towards establishing that framework.

Task 5. Implement Outreach and Coordination

Public and stakeholder outreach are critical components of regional water project development. In order to successfully develop a groundwater banking project in the region, many different stakeholders and interested parties will need to be engaged, coordinated with and consulted along the way.

Subtask 5.1 Coordinate with Stakeholders.

In order to ensure success of the proposed groundwater banking project, it is necessary that a stakeholder group be formed and include all interested parties and stakeholders, including former interested members of the Mokelumne Collaborative Group (MCG), which led development of the MokeWISE program. It is recommended that this group be convened at the outset of the project to discuss its purpose, and solidify project goals. Once the groundwater banking project has been defined, the stakeholder group should determine ultimate objectives for the project that will be used to analyze design alternatives. It is understood that in the course of stakeholder coordination, there may be a need to have confidential contract negotiations between agencies and landowners.

Subtask 5.2 Implement Public Outreach

In this task the project team will reach out to City officials, resource agencies, other agency officials, the agricultural community, other interested stakeholders, and the general public to provide information on the program analysis and recommended alternatives consistent with the intent of MokeWISE to create environmentally, socially, and economically acceptable alternatives. This support includes, but is not limited to, development of summary or outreach documents, coordination of meetings with representatives of State and Federal agencies, meeting with water agencies that may participate in the project and presentations to public officials and the general public.

Task 6. Final Report and Documentation

A study report will be prepared summarizing the groundwater banking project alternatives developed, and providing discussion as to the relative feasibility and benefits (e.g., water supply reliability, revenue streams, other economic benefits, other benefits) of each of the identified alternatives and key issues (institutional, regulatory and/or environmental) associated with each alternative. A discussion of the potential return on investment will also be provided, along with recommendations regarding additional detailed analyses needed prior to project implementation.

Budget

The estimated budget for this study is assumed to be $3,605,000, as it includes a wide array of elements, may include some preliminary field investigations, and will require extensive stakeholder coordination, particularly for the Mokelumne supply analyses. Estimated costs associated with the project can be broken down as follows:

- Task 1: $175,000
- Task 2: $930,000
- Task 3: $2,000,000

- Task 4: $100,000
- Task 5: $150,000
- Task 6: $250,000
- **Total Project Cost: $3,605,000**

References

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