

WaterSMART:

Applied Science Grant FY 2023

Notice of Funding Opportunity No. R23AS00446



Grant Proposal for

Marin Municipal Water District

***Climate Adaptation Strategies for Marin Water: A Water
Supply Modeling Initiative***

Submitted by:
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Climate Adaptation Strategies for Marin Water:
A Water Modeling Initiative
FY2023- WaterSMART Applied Science Grant

TITLE PAGE

Project Title: Climate Adaptation Strategies for Marin Water: A Water Supply Modeling Initiative

Applicant Name: Marin Municipal Water District (“District”)

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D. TECHNICAL PROPOSAL AND EVALUATION CRITERIA

D.2.2.2.3 Executive Summary

The Marin Municipal Water District (District or MMWD) provides water to approximately 200,000 customers in the San Francisco Bay Area and serves a vital role in regional water supply and conveyance. The District relies on local runoff as well as an imported water supply, both of which are under threat from climate change. In response, the District has identified the need to improve its operational forecasting in order to reduce drought risk and maintain environmental releases. This project will incorporate software/technology upgrades deployed in concert with a matrix of algorithm-based strategies to influence near-term operational decisions for water managers at the District. Improvements to the District's water supply operations will benefit not only District customers but other users of the regional imported water supply, such as the Cities of Santa Rosa and Rohnert Park, and the North Marin Water District (Figure 1). Fulfilling this project is especially crucial considering the difficulties the District faced in 2021 and 2022 after two successive dry winters with significantly below average rainfall resulting in the District facing a serious risk of running dry altogether. This would have posed grave concerns not only for human health and safety, but also for sensitive aquatic environments to which the District routinely makes mandatory releases, the cessation of which would negatively impact federally- and state-listed threatened and endangered species, including Coho Salmon, steelhead trout, and California freshwater shrimp. Additionally, in 2020, neighboring Sonoma County was engulfed in the Glass Fire- responsible for billions in property damage and catastrophic environmental damage across 67,484 acres. The fire affected Sonoma Water's ability to convey water to its customers including Marin Water resulting in additional withdrawals of local water supplies in Marin. The ability to combat wildfires like the Glass fire depends on available District water resources. WaterSMART Applied Science grant funds will be used to optimize water supply via these three tasks: (a) performing stochastic modeling to evaluate various operational strategies under a range of hydrologic conditions including climate-impacted conditions, (b) technology/software upgrades, and (c) precise collaboration/communication with partners regarding water availability. Upon completion of the project, the District and its partners will have a functional suite of forecasting tools providing simplified answers to regional operators. The purpose of this project is to ensure that the right information is available at the right time to increase resiliency and avoid loss of supply.

The District is ready to proceed with the Project upon entering into a financial agreement, and can complete the study, by December 2026.

This Project is not located on a Federal facility.

D.2.2.2.4 Technical Project Description

For the Marin Municipal Water District (District), a combination of fluctuating reservoir dynamics, increasing stress on its local and imported supplies, environmental release requirements, and increasingly expensive purchased water supply inform the technical aspects and approach to this

project. The District seeks funding from the U.S. Bureau of Reclamation (Reclamation) Applied Science Grants for Fiscal Year 2023 program to produce “*Climate Adaptation Strategies for Marin Water: A Water Supply Modeling Initiative*” (Project) which will be used on a near-daily basis by MMWD’s water management personnel. The District is a **Category A** applicant, operating as an independent special district.

Detailed Project Description

In 2017, the District developed a ‘Water Resources Plan 2040’ assessing the adequacy of water supply. That assessment incorporated the development of a software simulation of MMWD’s complex system including its seven local reservoirs, an imported surface water supply, as well as recycled water and conservation. The simulation known as MarinSim was developed using commercially available GoldSim software and informed the Water Resources Plan by verifying the adequacy of MMWD’s water supply to meet human and environmental needs under historic hydrologic conditions.

However, the intervening years have included sequential years of severe drought, emphasizing the need to consider the increasing drought risk posed by climate change. In response to that need, the District developed a recent ‘Strategic Water Supply Assessment & Roadmap’ (Roadmap) and adopted it in February 2023. The Roadmap identifies the need for additional system improvements which the District is now pursuing and highlights the need to extend the current water supply modeling beyond consideration of historic hydrology:

“If only historical flows are used in a (GoldSim) Monte Carlo analysis the assumption is that future flow ranges will stay within the historical range, which is not true. For example, it is possible that next year the basin experiences record inflows or no flows at all, for that reason, a long-term historical dataset is desirable but in conjunction with climate change flow projections, which could have a range greater than historical values” (Roadmap, 2023).

With (a) fluctuating reservoir dynamics, (b) increasing water demand from regional partners, (c) environmental release requirements, and (d) increasingly expensive purchased water supply in mind, the Project prescribes the following tasks:

TASK 1—PROJECT MANAGEMENT AND MEETINGS. Project Management and Meetings consists of general project management, administration, and meetings to fulfill technical project tasks, reporting, and dissemination of results.

TASK 2—EXPAND MARINSIM MODEL TO INCLUDE FORECAST-INFORMED OPERATIONS AND CLIMATE-IMPACTED HYDROLOGY

Task 2 will extend the existing MarinSim model to allow various operational strategies to be defined and modeled over a multi-decade period, and to allow use of climate-impacted water supplies in the analysis.

Data to be Collected/Reviewed: Projections of future climate conditions are generally performed through global climate models (GCMs) forced with specific global greenhouse gas (GHG) emission scenarios (IPCC 2013). The projections to be included in this analysis rely upon available climate projections using the models and emissions scenarios included in the Coupled Model Intercomparison Project 5 (CMIP5). Twenty individual downscaled GCM projections were selected from ten different GCMs and two different Representative Concentration Pathways (RCPs), RCP4.5 and RCP8.5. The ten GCMs were chosen by the DWR Climate Change Technical Advisory Group (CCTAG) based on a regional evaluation of climate model ability to reproduce a range of historical climate conditions (DWR CCTAG, 2015). The 20 climate projections were downscaled to approximately 6 km (3.75 miles) spatial resolution by Scripps Institution of Oceanography (Pierce et al., 2014) and subsequently further downscaled to a 270-meter resolution by the USGS as part of the Basin Characterization Model (BCM) data set. These projections are consistent with those used in climate applications for the Russian River watershed conducted by Sonoma Water, and were used to develop a consistent hydrological data set for the both the Russian River and Marin watersheds. The model will be validated during this step by matching its results to historic results as appropriate.

Approach: The model will be extended to apply stochastic modeling that will provide probabilistic conclusions regarding performance of a given a given operating strategy under a range of hydrologic conditions drawing upon 100 years of hydrologic history overlaid with synthetic hydrology options reflecting various climate change scenarios.

The current model simulates historic operations for water supply purchase decisions. The model will be extended so that its purchase decisions on a daily basis are based on a configurable operating strategy. An operating will generally involve near-term water supply forecasts accounting for demand and supply variation, over varying planning horizons, e.g., three months, six months, through end of water year. Decision variables include inter-reservoir transfers and imported water supply purchases on a daily basis. Key metrics for evaluation include water supply shortage for human use and environmental release, and water purchase cost.

TASK 3-- STRATEGY TESTING AND EVALUATION

Task 3 uses the model developed in Task 2 to test and evaluate a suite of candidate operating strategies over a range of potential future hydrologic conditions. Summary statistics will be prepared

as part of this task to compare and contrast the performance of the strategies for key metrics including drought risk reduction and cost.

Based on that analysis, an operating strategy will be selected to inform full-scale, real-time operations, also as part of this task. Over the test period (ideally at least one year), the selected strategy will provide daily advice to operations staff, based on its forecasts of water supply. Whether or not operations staff implement the model's advice during the test period, the validity of the model's advice, and its underlying bases such as near-term forecasts, can be assessed.

At the conclusion of the test period, the operating strategy will be refined as needed to serve as the basis for Task 4.

Data to be Collected/Reviewed: Daily recommendations from the model and their basis, i.e., the operational forecasts generated each day by the model. Operational data with which to compare to model projections.

Approach: Collaborative communication between staff and consultant team during this evaluation stage with regular short-reporting shared between stakeholders.

TASK 4- TRAINING AND IMPLEMENTATION AT OPERATOR LEVEL

Task 4 takes the new operating strategy, including its operational forecasting and thresholds, and implements it for day-to-day use. The task includes three elements:

- a. Development of a simple spreadsheet tool for use by operations staff. In this spreadsheet, the operators will provide simple inputs such as current storage in each reservoir and receive specific outputs that inform their decisions including the amount of water to purchase if available.
- b. Training of operations staff. District Distribution System Operations, license class D-2 through D-5, will be responsible for implementing the selected operational strategy.
- c. Use and evaluation of the strategy by Operations staff.

Data to be Collected/Reviewed: Data will be collected throughout the implementation phase of this project. 1) Operators will be expected to interact with the spreadsheet tool on a daily basis inputting current system status. 2) Data regarding outcomes will be collected, including actual versus forecast, recommended water purchase versus actual water purchase, etc..

Approach: The District will host at least 2 in-service field days for operators expected to interact with the platform on a daily basis for training presentations. After training, operators will be observed in the field by both senior District staff and consultant support team to ensure efficacy.

TASK 5-- DISSEMINATION OF RESULTS

Task 5 outlines how the District will share ongoing results of the Project as a decision-making tool for themselves and their partners.

Data to be Collected/Reviewed: Data from the Project in the form of both short and long reports will be run on a near-daily basis and shared as needed with partners, as well as with other agencies that might benefit from similar approaches to optimizing their own systems.

Approach: Partners including Sonoma Water, North Marin Water District, the City of Santa Rosa, and the City of Rohnert Park will already be aware of Project progress through Task 1 (Project Meetings and Management). Dissemination will happen electronically via email, posted on the District website, and shared at stakeholder meetings. Decision makers including relevant Boards, Councils, and Steering Committees of the respective partner organizations will have access to the data along with District staff and support consultant team members.

Goals:

Goals for this project include the following:

- Improve water management decisions by creating a significantly better modeling and decision-making framework to best prevent the District from nearly running out of water again.
- Ensure adequate model-based planning to fulfill mandatory environmental releases with the twin goals of supporting sensitive habitat and combating wildfire eruptions.
- Prevent the unnecessary purchase of water drawn from the Russian River delivered via Sonoma Water.
- Provide necessary data to aid neighboring water partners in their own internal decision making.

D.2.2.2.5 Project Location.

The *Climate Adaptation Strategies for Marin Water: A Water Supply Modeling Initiative* would focus on the North Bay Region of the San Francisco Bay Area in California, Marin County. This project area includes the seven smaller reservoirs upon which the District relies upon for 75% of its supply along with the Russian River aqueduct from which the District purchases the remaining 25% of its water. Figure 1 in Appendix A shows the planning area along with facilities where decision making impacts from the Project will be dispersed.

D.2.2.6 Data Management Practices

The MarinSim software being leveraged in this project is built using the industry standard GoldSim which is verified to be Geographic Information System (GIS) compatible.

E.1.1 Evaluation Criterion A—Water Management Challenge(s) (30 points)

- 1. Describe the water management challenge(s). Describe in detail the water management challenge is occurring within your project area. Describe the severity of the challenge to be addressed with supporting details.**

Marin Municipal Water District's (District) matrix of water management challenges is comprised of concerns about climate change that stresses both local and imported water supplies, environmental release requirements, and increasingly expensive purchased water supply.

The severity of the challenge is illustrated with the recent "close call" the District experienced in 2020-2021 when it nearly ran out of water to serve its customers. During that drought emergency, despite aggressive conservation measures, the District's storage was depleted to only 22,970 acre-feet (AF), relative to its 79,566 AF capacity. (Reservoir locations displayed on Figure 2.) However, the successive dry years of 2021 and 2022 lowered reservoir water levels to less than 30% of reservoir depth. As a result, the District issued a Drought Emergency Notice in April 2021-- per its Water Shortage Contingency Plan-- requiring a minimum 15% reduction in consumer usage. (Water Shortage Contingency Plan, 2023). By 2022, with yet another winter of much lower-than-average precipitation, the District was projected to run out of water completely. Heavy rains averted a disastrous outcome, but the incident made it clear that additional drought protection is needed to address the changing climate.

The District provides direct water service to approximately 190,000 customers in Marin County (service area map in Figure 3). However, many other communities will benefit from MMWD's proactive measures to address drought risk, since MMWD's imported water source is the same as used by the City of Santa Rosa, City of Rohnert Park, Petaluma, and others. To the extent that MMWD can reduce stress on that water supply by optimizing its overall water supply operations, the entire region benefits.

Additionally, the District fulfills mandatory environmental releases on Lagunitas Creek and Walker Creek. These creeks provide crucial habitat and fish passage for federally- and state-listed endangered Central California Coast Coho Salmon (*Oncorhynchus kisutch*) and federally-listed threatened Central California Coast steelhead (*Oncorhynchus mykiss*). Lagunitas Creek is recognized as a vital stronghold for these species, and it is listed as a top priority watershed for protection and restoration in the Priority Action Coho Team Report developed by the California Department of Fish and Wildlife and NOAA Fisheries in 2019. In addition, both Lagunitas Creek and Walker Creek

support relatively strong populations of federally- and state-listed endangered California freshwater shrimp (*Syncaris pacifica*), which only occur in Marin, Napa, and Sonoma Counties (USFWS 5-Year Review 2022). The approach to building this model includes incorporating the required environmental release quantities per creek, listed below:

Creek Name	Quantity Released Annually	Species Impacted
Lagunitas Creek	7,000 AF/Y	California Coast Coho Salmon
Walker Creek	4,000 AF/Y	California Coast Coho Salmon California Freshwater Shrimp

2. Describe the concerns or outcomes if this water management challenge is not addressed?

If the challenges posed by climate change to water supply are not addressed, drought risks will only increase, and thus the risk of impacts to human health and safety.

If the water management challenges are not addressed with the tasks of this project, there is also a lingering concern for the District’s ability to meet its mandatory environmental release requirements. Additionally, the threat of wildfire increases significantly during drought years necessitating careful planning of supplies- the key outcome of this project.

Should these concerns go unaddressed, the District will essentially be ‘flying blind’ in the context of rapidly changing climate scenarios. The results of which range from extreme financial impacts, to depriving the watershed of vital fish passage and habitat, to running completely dry and being unable to provide for human consumption the District faced the distinct possibility that it could run out of water completely. Should these concerns not be addressed with the appropriate and timely decision-making tools created by this project, there is a strong possibility a similar situation could be faced again if conditions repeat themselves.

3. Explain how your project will address the water management issues identified in your response to the preceding bullets and provide support for your response.

Through the implementation of this Project’s modeling and decision-making template, the District and its partners will be able to improve water supply reliability, manage forthcoming drought conditions related to climate change extremes, ensure watershed health and meet endangered species requirements.

Water Supply Reliability: During the drought of 2021 and 2022, the District’s reservoir levels had fallen to dangerously low levels and there was grave concern about water supply reliability for its downstream water customers. This project provides a significantly more robust modeling, projection and planning tool designed to help all stakeholders future-cast outcomes based on precipitation and prevent water loss.

Manage Forthcoming Drought Conditions: The current model relies on historic hydrology and does not have capacity to incorporate synthetic climate-driven drought conditions or extremes. This project upgrades the model to better plan for deep droughts not otherwise seen in the historical record. Preparation like this will be key to managing forthcoming drought conditions.

Ensure Watershed Health: Currently, the District provides mandatory environmental releases providing 11,000 AF/year to two crucial creeks throughout its service area. (See Figure 2 for detail.) This project incorporates those requirements and works to ensure that they can be met even during the driest of droughts. This is important not just for overall watershed health, but also for wildfire prevention and containment.

Meet Endangered Species Requirements: Through the environmental releases into creeks throughout its service area, the District supports federally- and state-listed threatened and endangered species, including Coho Salmon, steelhead trout, and California freshwater shrimp with fish passage and habitat preservation. These releases occur throughout the year to coincide with key migration, reproduction, and rearing seasons, which are crucial to support these species.

E.1.2. Evaluation Criterion B—Project Benefits

1. Describe how the need for the project was identified. Was the proposed project identified using a collaborative process with input from multiple and diverse stakeholder

The District’s pursuit of better precipitation modeling and decision forecasting began in 2017 with its ‘Water Resources Plan 2040’ involving several drafts, public stakeholder meetings, partner review and ultimately, Board approval (May, 2017). With this original plan, the ‘GoldSim’ software and hardware program was identified and adopted with the stated “to evaluate resiliency in the face of a variety of threats to water resources in its service area and to identify options to enhance resiliency for its customers.”

For this first iteration, 100 years of hydrological data were included plus 20 individual CMIP5 climate projections of which two projections were assessed to have important droughts for consideration. (The HadGemES (RCP 8.5) and CCM4 (RCP 4.5) model projections indicate droughts of 7- to 8-year durations similar to the 1987-1992 historical drought are possible and may challenge water management.) However, the climate model projections did not indicate greater severity of shorter duration droughts as compared to the most severe historical droughts of 1976-1977 and 2020-2022.

Since then, the District was at the mercy of rapidly changing climate impacts and during the drought of 2021-2022 it became clear that the model needed updating to include more robust synthetic data suites and inter-annual variability changes.

This was echoed by the District’s 2023 Water Supply Assessment Roadmap (Roadmap) whose purpose was to “evaluate the District’s current baseline water supply in the context of climate-change-driven droughts and to evaluate the impact of potential future water management alternatives that could improve the District’s long term water supply resiliency”. The Roadmap was

approved in May 2023, but the robust stakeholders and partners outreach process began a year before in February 2022.

During the development of the Roadmap, the District hosted five public Community Workshops and 15 Board meetings in which the topics were discussed. Additionally, partners such as Sonoma Water, North Marin Water District and the Cities of Santa Rosa and Rohnert Park were consulted.

At the conclusion of this Roadmap development process, it was clear that the model would benefit from the strategic updates embedded in this Project: "Climate change is likely to increase the severity of these extreme events and make drought water management even more challenging in the future... Several elements of the recommended strategy will require further investigation...to provide greater clarity and cost definition" (Roadmap, 2023).

2. Describe how the tool, method, or information will be applied and *when* will it be applied.

- **Will the tool or information be used immediately or will additional work need to be done before the tool will be used?**

MMWD anticipates being able to utilize a tool that incorporates updated operating strategies immediately once testing and validation is completed. Additionally, the District has planned for Operator Implementation Trainings (Task 4) and Dissemination of Results with partners (Task 5). The tool will be implemented internally at District Facilities.

3. Describe, in detail, the extent of benefits that can be expected to occur upon implementation of the project, and provide support for your responses.

- **Who will use the tool or data developed under this proposal and how will they benefit from the project? Support could include but is not limited to letters from stakeholders expressing support for the project and explaining how they will benefit.**

The District will be the primary, daily user of the tools developed in this project. Additionally, the District will disseminate results of the project with its regional water partners at the Bay Area Regional Reliability Project (BARR). This project will support the key aims of that regional eight-member organization identified in its "BARR Drought Contingency Plan" including: Facilitating the transfer of water supplies during critical periods of drought or following natural disasters, bolstering emergency preparedness, enhancing overall water supply reliability. The tool is intended to be useful for all stakeholders for years to come.

- **How will the project improve *water management decisions*?**

Poor water management decisions are executed due to lack of adequate information leading to water loss and over-expenditure of precious public funds. This project will

improve water management decisions by accurately providing the right information at the right time, shared amongst stakeholders as needed, and constantly evaluated against both historical and synthetic data.

- **Describe if the results of your project will be *applicable elsewhere*. What additional work would need to be done to make the project results transferable to others?**

While the immediate results will benefit the region, the project is expected to yield significant value to other water agencies. The general approach to developing and evaluating operational strategies that incorporate forecast-informed operations would be applicable to many water system operators that face decisions about when and how much water to release, purchase, transfer, etc.

- **To what extent will the project address the water management challenges described in E.1.1.?**

With climate change, the District is destined to continue facing water management challenges such as Water Supply Reliability, Management of Forthcoming Drought Conditions, Ensuring Watershed Health, and Meeting Endangered Species Requirements. This project addresses each by providing the kind of robust modeling, projection, and planning tool that will enable preparation and prevention of the worst of those impacts—for both humans and the regional biosphere. The algorithms and data decision-making tool developed by this project could potentially save more than 9,000 AF/Y in wasted water and millions in public funding due to over or under purchase of surface water. The District experienced the worst of drought and climate change effects in 2021 & 2022 and as a result has a clear picture of exactly the tool needed to best combat the associated water management challenges.

- 4. Explain how your project complements other similar efforts in the area where the project is located. Will your project complement or add value to other, similar efforts in the area, rather than duplicate or complicate those efforts? Are there other similar efforts in the area that have used a similar methodology successfully which can be complimented? Applicants should make a reasonable effort to explore and briefly describe related ongoing projects. Consider efforts by any Federal, state, local agency, or non-governmental organizations.**

Forecast-Informed Reservoir Operations (FIRO) are increasingly recognized as offering value, and are used in the region, e.g., by Sonoma Water, the agency from which MMWD imports water. The current project will complement that work by providing a way to evaluate efficiently specific candidate FIRO strategies on a quantitative basis. Additionally, the Bay Area Regional Resilience Project (BARR) outlined the need for exactly this type of project in its recent “BARR Drought Contingency Plan” (2018). This project clearly supports similar regional efforts by providing otherwise missing information to help create a more complete water picture overall.

E.1.3. Evaluation Criterion C—Project Implementation (20 points)

Describe your project implementation plan:

- 1. Briefly describe and provide support for the approach and methodology that will be used to meet the objectives of the project. You do not need to repeat the full technical project description included in Section D.2.2.4 under the Technical Project Description. However, you should provide support for your chosen methodology, including use of any specific models, data, or tools.**

The District believes the tools developed by this project will be effective based on early feasibility study and analysis in its Water Supply Roadmap (Roadmap), adopted May 2023. Studied for over a year and built on significant data as well as community member and stakeholder input, the Roadmap clearly points to the need for more robust data modeling in the face of rapidly changing climate. Besides this early feasibility report validating the approach and methodology, this Project is undertaken with regional partners in mind who will all provide similar feedback during the implementation phases. This type of partner validation will likewise prove the project’s approach and methodology. Financial oversight of the project is performed by the District’s Chief Financial Officer while programmatic milestone tracking will be accomplished by the Director of Water Resources and General Manager. Additionally, Consultant team members will be executing on clear Scope of Work documentation. With the foundation of feasibility study reporting coupled with strong internal and external validation, the outcomes of this project are expected to be robust and long-lasting.

- 2. Describe the work plan for implementing the proposed scope of work. Such plans may include, but are not limited to:**
 - a. an estimated project schedule that shows the stages and duration of the proposed work,**
 - b. milestones for each major task,**
 - c. start and end dates for each task and milestones, and**
 - d. costs for each task**

Work for this project is anticipated to begin May 1, 2024 (5/1/2024) and be completed by September 30, 2026 (9/30/2026). The tasks included in Project work plan are summarized in Table 1. The project is estimated to cost \$301,226. Work on Task 1 will span the length of the project while tasks 2 and 3 will be accomplished in year one. Tasks 4 and 5 are expected to be completed in Year 2. Project timeline will be driven by primary applicant with supplemental work performed by consultant team. Prospective Consultant Scope of Work is included in Appendix B for deeper review. Project tasks are described in more detail in Section D.2.2.2.4 Detailed Project Description .

Table 1: Summary Tasks, Milestones, Budget, & Dates

TASK	MILESTONES/PRODUCT	BUDGET	Anticipated Start Date	Anticipated End Date
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Climate Adaptation Strategies for Marin Water:
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Task 1: Project Meetings & Management	Annual meeting with regional stakeholders sharing project progress	\$27,500	5/1/2024	9/30/2026
Task 2: Expand MarinSim Model to Evaluate Alternative Operating Strategies and Forecast Methods	Algorithm development with consultant team + includes software upgrades	\$62,002	7/1/2024	7/1/2025
Task 3: Strategy Testing & Evaluation	Three (3) testing and validation exercises when upgrade completed	\$62,002	7/1/2025	1/1/2026
Task 4: Training and Implementation at Operator Level	Two (2) in-service field days with front line operator staff	\$62,002	1/1/2026	6/1/2026
Task 5: Dissemination of Results	Four (4) outreach activities including emails, webinars, and in-person meetings with regional water resource managers	\$60,000	6/1/2026	9/30/2026

3. Provide a summary description of the *products* that are anticipated to result from the project. These may include data, metadata, digital or electronic products, reports, and publications. *Note: using a table to list anticipated products is suggested.*

A summary description of the anticipated products that will be produced by the Project are listed in Table 2.

Table 2: Summary Description of Project Products

Product Type	Product Description
Algorithm Research & Development	Initial algorithms will be developed in concert with staff and consultants incorporating historic data and synthetic climate alterations.
New Model Scenarios	After algorithm development, a new MarinSim model will be produced showcasing multiple new model scenarios.
Training Presentation	Training Presentations will be prepared and led by consultant team with support by staff. Presentation will be available long term in staff training binders.
Results Reports & Presentations	During final data dissemination phase, reports and presentations will be made to regional water management stakeholders and uploaded on related website pages.

- 4. Who will be involved in the project as project partners? What will each partner or stakeholder's role in the project be? How will project partners and stakeholder be engaged in the project and at what stages? If you are a Category B applicant, be sure to explain how your Category A partners will be engaged in the project.**

Non-financial stakeholders in the project include Sonoma Water who manages offtake from the Russian River and sells water to the District as needed. Additionally, the City of Petaluma, the City of Santa Rosa, and the North Marin Water District are considered project stakeholders as they purchase and receive water from the District and will be affected by the new model-driven decisions created by this Project. Project partners will be engaged early in the Project to be made aware of potential changes that could affect them as a result of Project completion. They will also be engaged after the Project has been implemented and staff are trained to share relevant real-time results and data during the Results Dissemination phase. Relevant stakeholders have expressed excitement and support for the project in the enclosed Letters of Support listed in Appendix C.

- 5. Identify staff with appropriate credentials and experience and describe their qualifications. Describe the process and criteria that will be used to select appropriate staff members for any positions that have not yet been filled. Describe any plans to request additional technical assistance from Reclamation or via a contract. Please answer the following:**

Key staff listed below and include notes on an upcoming Scope of Work involving consultant team support.

Financial Management: Bret Upendahl

Bret Upendahl has been with the Marin Municipal Water District for multiple years serving in various financial management capacities. Currently, he is the District Chief Financial Officer and will have signatory responsibility for reporting and withdrawal requirements.

Project Management: Paul Sellier

Paul Sellier was appointed to the position of Water Resources Director at Marin Municipal Water District (MMWD) in 2021 and prior to his appointment as Water Resources Director Paul was the Operations Director for the District. Paul joined the District in 2002 as an Assistant Engineer working on capital upgrades to the water treatment plants. He was then promoted to Associate Engineer to support the Desalination project, including project permitting, operating the pilot facility and working with the public as the effort took shape. Paul was then promoted to Senior Engineer where he worked on a range of water treatment plant projects and water quality and environmental regulatory issues, and has had increasing responsibilities including managing the recycled water and backflow group, the water quality lab and the water treatment plants.

Project Administration: Sabrina Gonzalez

Sabrina Gonzalez has been with Marin Water District for eight years. Currently in the role of Administrative Assistant for the past two years and recently began assisting with the administrative duties for grant applications for CDFW, CEQA, Cal Fire and State Coastal Conservancy.

Consultant Team: Woodard & Curran

Woodard & Curran is an environmental engineering firm serving municipal and district clientele across the nation since 1979. For this project, Woodard & Curran will be deploying four staff members to fulfill the modeling, testing, and training requirements of Tasks 2, 3, and 4 including a Project Manager, Project Engineer, Modeler, and Project Assistant. Woodard & Curran currently has a contract with Marin Municipal Water District, earned on a competitive basis, to accomplish this scope. Woodard & Curran has experience with the USBR Applied Science Grant having helped previous clients including the Coachella Valley Salt & Nutrient Management Project coalition complete past projects in subbasin modeling.

Water Operator Team Members: Multiple Staff

Operators are responsible for the day-to-day management of all District water systems throughout the service area. They are the front-line staff who will likely use the model on a day to day basis and will receive full training before implementation.

All District team members have performed similar grant management tasks before executing the Water Resources Development Act grant for \$28 million executing water supply projects and the Department of Water Resources Urban Multi-Benefit Drought Relief grant program for \$2 million over 2 years.

The Project team is Capable of Proceeding with tasks within the proposed project immediately upon entering into a financial assistance agreement.

E.1.4. Evaluation Criterion D—Dissemination of Results (10 Points)

Explain how project results will be disseminated, including:

- **Describe how the tools, frameworks, or analyses developed under the proposed scope of work will be disseminated, communicated, or made available to water resources managers who may be interested in the results.**

The reports and results provided by the upgraded MarinSim Water Supply modelling tool will be disseminated in two ways: First, the tool will be introduced to stakeholders via email, webinar, and presentations as needed. Second, ongoing reports from the tool will be shared with stakeholders regularly- long after the completion of the project. The intention is that the tool helps not just the District with its water management decisions as the impacts of climate change worsen, but that the real-time data and relevant scenario casting will be helpful for regional partners as well. Specifically, partners in the Bay Area Regional Resilience Project-will receive regular data and updates in alignment with the group's 2018 "Drought Contingency Plan". In this instance, data will be shared via email and website listing with click-thru links showcasing available reports.

- **If the applicant is the primary beneficiary of the project, explain how the project results will be communicated internally, and to interested stakeholders and interested water resources managers in the area, if appropriate.**

Task 4 of Section D.2.2.2.4 outlines how the project results will be communicated internally. Specific highlights include the use of a shared spreadsheet resource, adequate operator training, and collection of regular operator feedback validating use of model. Information will be shared publicly at District Board meetings and be made available on the District website as needed. Additionally, the District maintains a regular Social Media presence and anticipates sharing selected data sets on its platforms to communicate issues directly impacting consumers and stakeholders.

- **If the applicant is not the primary beneficiary of the project (e.g., universities or research institutes), describe how project results will be communicated to project partners and interested water resources managers in the area.**

Applicant is the primary beneficiary of the project.

- **Describe how the project results will be shared with other water managers in the West that could use the information to support water management objectives.**

Task 4 in Section D.2.2.2.4 details the use of project data and results for dissemination amongst regional water partners. In the larger West, Project results will be catalogued on the District website, available for any interested water resource managers. Additionally, District staff will undertake any opportunities to further share results at relevant conferences- not part of this Project scope, but a possible opportunity and side-effect of the project after its completion.

E.1.5. Evaluation Criterion E—Presidential and Department of the Interior Priorities (10 points)

- **Climate Change: E.O. 14008 emphasizes the need to prioritize and take robust actions to reduce climate pollution; increase resilience to the impacts of climate change; protect public health; and conserve our lands, waters, oceans, and biodiversity.**
 - **If applicable, describe how the project addresses climate change and increases resiliency. For example, does the project help communities respond to or recover from drought or reduce flood risk?**

Looking at the overall watershed, California's 4th Climate Impact Assessment (2022), indicates that for the District, "hydrologic changes will affect the amount and location of precipitation and snowpack in California's mountainous regions [and] will stress existing storage reservoirs, impacting surface supply, imported water, and water transfer availability, especially in the summer and fall. While many strategies to address scarcity are similar for imported and local supplies (e.g., water recycling), the impacts of climate change on the available quantities of surface water could be different for local supplies (e.g., Marin, Sonoma) than those originating from the Sierras (e.g., San Francisco), as changes in local precipitation patterns are different than changes in snowpack and snowmelt." The Assessment further stipulates that "Moyle et al. (2017) concluded that climate change is a major threat to salmon populations throughout California, and that the historic 2012-

2016 drought contributed to continuing declines in recent years. The Russian River watershed...is home to three threatened and endangered salmonid species: Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), and steelhead (*Oncorhynchus mykiss*).” The environmental releases provided by the District combat the worst impacts of climate change for these species in particular, but with clear positive prevention for the entire ecosystem. To continue combating this increasing level of climate uncertainty regarding water availability, more data and complex algorithmic analysis is required. This project provides exactly the type of predictive modelling needed to increase resiliency and overcome climate impacts.

- **How will the project build long-term resilience to drought? How many years will the project continue to provide benefits? Please estimate the extent to which the project will build resilience to drought and provide support for your estimate.**

Based on previous modelling performed by consultant Woodard & Curran, the project is anticipated to provide benefit and drought resiliency for 20+ years or more.

- **Will the proposed project reduce greenhouse gas emissions by sequestering carbon in soils, grasses, trees, and other vegetation? Does the proposed project seek to reduce or mitigate climate pollutions such as air or water pollution? Does the proposed project contribute to climate change resiliency in other ways not described above?**

This project helps preserve the ability of the regional ecosystem to maintain photosynthetic integrity and thereby store CO₂ quantities underground. Without the environmental releases provided by the District, the region would struggle to sequester carbon in soil via grasses, trees, and other vegetation. In total, the District releases approximately 11,000 AF/Y to environmental release.

- **Disadvantaged or Underserved Communities:** E.O. 14008 and E.O. 13985 affirm the advancement of environmental justice and equity for all through the development and funding of programs to invest in disadvantaged or underserved communities.
 - **Please use the Council on Environmental Quality’s interactive Climate and Economic Justice Screening Tool, available online at [Explore the map - Climate & Economic Justice Screening Tool \(geoplatform.gov\)](#) to identify any disadvantaged communities that will benefit from your project.**

Drawing upon its seven reservoirs captured within the Climate & Economic Justice Screening Tool, the District provides direct water sales to 200,000 households, while also providing water sales to multiple regional centers of population such as Marin City, the City of Santa Rosa, and the City of Petaluma. Among Marin City’s 256,000 population, 7.8% are classified as being under the poverty level according to the Council on Environmental Quality’s Climate and Economic Justice Screening Tool and the American Community Survey. The City of Santa Rosa’s 177, 000 population has a slightly higher Disadvantaged and Underserved Community quotient at 9.8% of the total population. The

highest Disadvantaged and Underserved Community partaking of District water is Rohnert Park at 10.4%.

- **If applicable, describe how the project benefits those disadvantaged or underserved communities identified using the tool. For example, does the project increase reliability of water supplies, improve water quality, provide economic growth opportunities, improve, or expand public access to natural areas or recreation, or provide other benefits in a disadvantaged or underserved community?**

The project benefits the regional disadvantaged and underserved communities by increasing water supply through adequate predictive modeling in the face of drought driven climate change impacts. Benefits also include retaining public access to natural lands supported by the District's environmental releases. Water released by the District into regional creeks also helps prevent dangerous wildfires destined to negatively impact sensitive and disadvantaged communities.

- **Tribal Benefits: The Department of the Interior is committed to strengthening tribal sovereignty and the fulfillment of Federal Tribal trust responsibilities. The President's memorandum, *Tribal Consultation and Strengthening Nation-to Nation Relationships*, asserts the importance of honoring the Federal government's commitments to Tribal Nations.**

- **If applicable, describe how the project directly serves and/or benefits a Tribe, supports Tribally led conservation and restoration priorities, and/or if the project incorporates or benefits Indigenous Traditional Knowledge and practices.**

No direct Tribal impacts, however, the results of this project will positively impact the regional ecosystem and support the Coho Salmon, California Steelhead and Shrimp species which have cultural relevance to the nearby Yoruk, Shasta, and Hupa tribes.

- **Does the proposed project support Reclamation's Tribal trust responsibilities or a Reclamation activity with a Tribe?**

No known impacts

D.2.2.8 Project Budget

The total project cost is \$301,225 to complete tasks 1-5. These costs are for items associated with work that will be completed from May 2024 through September 2026. The District is requesting \$150,628 from Reclamation under this NOFO equating to 50% of total cost at \$301,225. The remaining non-federal cost share will be sourced from the MMWD General Water Fund as indicated in Table 1 below.

Table 1- Summary of Non-Federal and Federal Funding Sources

FUNDING SOURCES	AMOUNT
Non-Federal Entities	
1.MMWD General Water Fund	\$ 150,628
Non-Federal Subtotal	\$150,628
REQUESTED RECLAMATION FUNDING	\$ 150,628

The Budget proposal section below provides detail the Project Cost by Task. (Table 2)

Table 2— Project Cost by Task

TASK	BUDGET
Task 1: Project Meetings & Management	\$27,500
Task 2: Expand MainSim Model to Evaluate Alternative Operating Strategies and Forecast Methods	\$62,002
Task 3: Strategy Testing & Evaluation	\$62,002
Task 4: Training and Implementation at Operator Level	\$62,002
Task 5: Dissemination of Results	\$60,000

Please see Appendix B for further detail on tasks assigned to Consultant staff.

D.2.2.9 Environmental and Cultural Resources Compliance (as applicable to the project)

H.1 Environmental and Cultural Resource Considerations

- *Will the proposed project impact the surrounding environment? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area.*

No earth-disturbing work affecting air, water, or animal habitat in the project area is anticipated.

- *Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or is designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?*

This project does not involve any earth-disturbing work, and therefore no species would be affected.

Within the project area, Lagunitas Creek and Walker Creek are designated critical habitat for CCC Coho Salmon and CCC steelhead. Portions of the District’s watershed lands and adjacent lands are designated critical habitat for northern spotted owl, marbled murrelet, and California red-legged frog.

- ***Are there wetlands or other surface waters inside the project boundaries that potentially fall under SWA jurisdiction as “Waters of the United States”?***

No Waters of the United States are included in this Project Area.

- ***When was the water delivery system constructed?***

The water delivery system was chartered in 1912 as Special District No. 1 in California.

- ***Will the proposed project result in any modification of or effects to, individual features of an irrigation system?***

No modifications to irrigation system features is anticipated.

- ***Are any building, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places?***

Although there may be a selection of sites listed on the National Register of Historic Places, considering this is primarily an algorithm software development initiative, no historical sites will be incorporated or impacted by this Project.

- ***Are there any known archeological sites in the proposed project area?***

The software/algorithm development will occur within the

- ***Will the proposed project have a disproportionately high and adverse effect on low income or minority populations?***

No negative or adverse effects anticipated for low-income or minority populations.

- ***Will the proposed project limit access to, and ceremonial use of, Indian sacred sites or result in other impacts on tribal lands?***

No impacts to tribal lands.

- ***Will the proposed project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?***

As a software improvement project with no construction or ground disturbance, there will be no contribution to the spread of noxious weeds or native invasive species.

H.1.1 National Environmental Policy Act

As a software modeling project updating existing technology with no disturbance of ground or other construction, this project is expected to have no Environmental Impact and likely qualify for a Categorical Exemption (CE).

H.1.2 National Historic Preservation Act

As a software modeling project, this Project is not expected to have impact or effect to historic properties in accordance with Section 106.

D.2.2.10 Required Permits or Approvals

There are no permits or approvals required to implement the Project.

D.2.2.11 Overlap or Duplication of Effort Statement

There is no overlap between the Proposed Project and any other active or anticipated proposals or projects in terms of activities, costs, or commitment of key personnel. Moreover, this proposal is not in any way duplicative of any proposal or project that has been or will be submitted for funding consideration to any other potential funding source—whether it be Federal or non-Federal.

D.2.2.12 Conflict of Interest Disclosure Statement

Marin Municipal Water District discloses no perceived Conflict of Interest with USBR Science Grant Program and will undertake any funding in accordance with 2 CFR 200.318.

D.2.2.13 Uniform Audit Reporting Statement

Marin Municipal Water District is a local government entity expending less than \$750,000 in federal grant funds within the current fiscal year. EIN: 94-6000878.

D.2.2.14 SF-LLL Disclosure of Lobbying Activities

Please see Appendix D for a copy of form SF-LLL disclosing lobbying activities.

D.2.2.15 Letters of Support

Please see Appendix C for collection of Letters of Support for this project.

D.2.2.17 Official Resolution

Please see Appendix E for draft of the Official Resolution.

D.2.2.18 Letter of Funding Commitment

Please see Appendix F for the completed Letter of Funding Commitment

REFERENCES CITED

“Marin Municipal Water District: Strategic Water Supply Assessment. Water Supply Roadmap”, Jacobs Engineering, MMWD. May 2023

“Marin Municipal Water District: Water Shortage Contingency Plan”, MMWD. February 2023

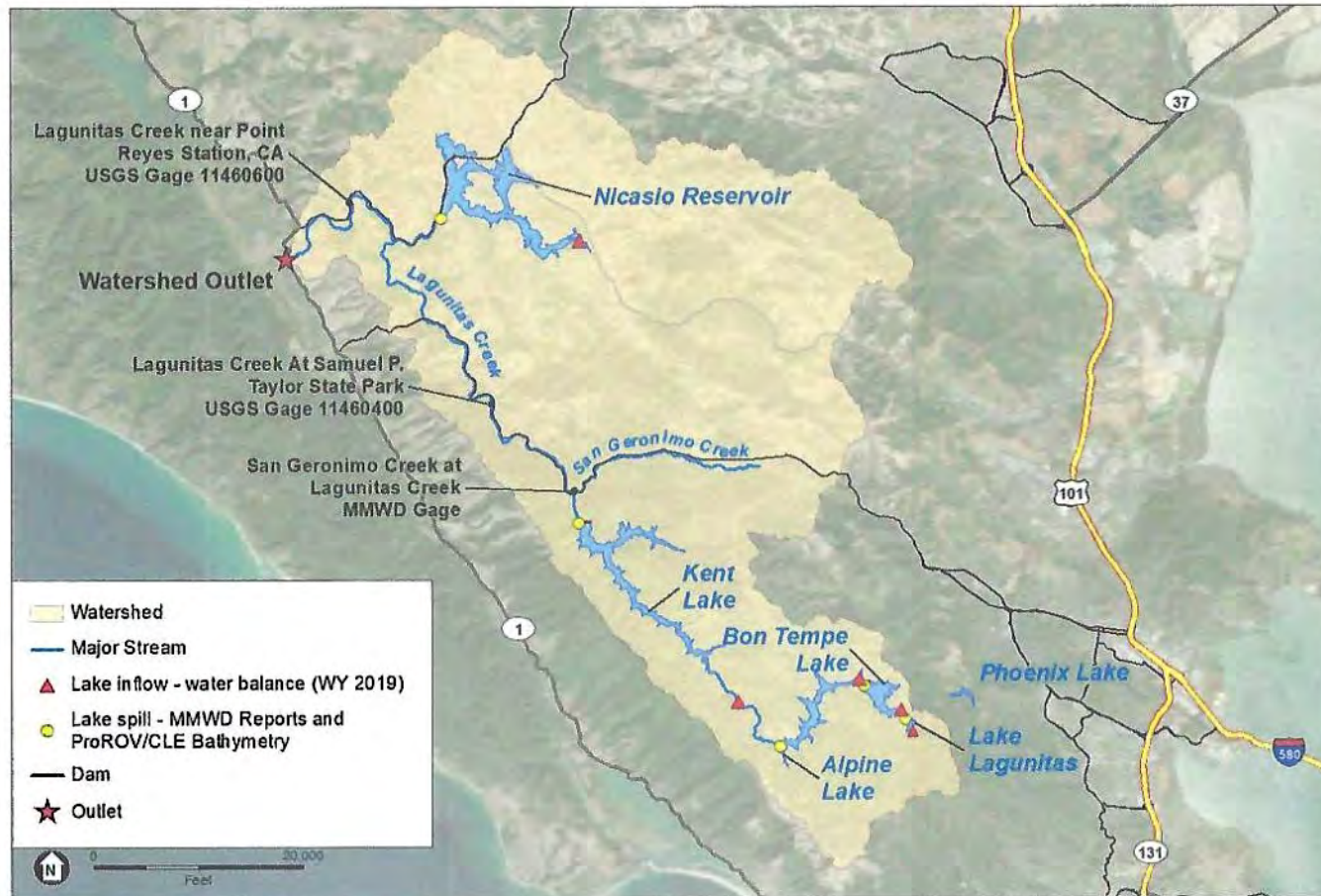
“California’s Fourth Climate Change Assessment: San Francisco Bay Area Region Report” Ackerly, David, Andrew Jones, Mark Stacey, Bruce Riordan. (University of California, Berkeley). 2018. San Francisco Bay Area Summary Report. California’s Fourth Climate Change Assessment.

Priority Action Coho Team (PACT). 2019. Priority Action Coho Team: Strategic Partnering to Accelerate Central California Coast Coho Salmon Recovery 164 pp. California Department of Fish and Wildlife and NOAA Fisheries. Sacramento, California.

US Fish and Wildlife Service 5-Year Status Review Under the Endangered Species Act, 2022

APPENDIX A

Service Area Map with Environmental Release Locations



APPENDIX B

WaterSMART:

Applied Science Grant FY 2023

Notice of Funding Opportunity No. R23AS00446



BUDGET NARRATIVE FOR:

Marin Municipal Water District

Climate Adaptation Strategies for Marin Water: A Water Supply Modeling Initiative

Submitted by:

Marin Municipal Water District

220 Nellen Avenue

Corte Madera, California 94925-1169

Project Manager:

Paul Sellier, Director of Water Supply

psellier@marinwater.org

Tel: 415-945-1557

Budget Summary

Summary			
Figures in this summary table are calculated from entries made in subsequent categories, only blank white cells require data entry.			
6. Budget Object Category	Total Cost	Federal Estimated Amount	Non-Federal Estimated Amount
a. Personnel	\$123,500		
b. Fringe Benefits	\$27,750		
c. Travel	\$0		
d. Equipment	\$0		
e. Supplies	\$0		
f. Contractual	\$150,005		
g. Construction	\$0		
h. Other Direct Costs	\$0		
i. Total Direct Costs	\$301,255		
i. Indirect Charges	\$0		
Total Costs	\$301,255	\$150,628	\$150,628
Cost Share Percentage		50%	50%

A. Personnel

Marin Municipal Water District Director of Water Resources Paul Sellier will serve as the Project Manager overseeing all tasks and milestones of the project. Starting in May 2024, Director Sellier will contribute a total of 600 hours at an administrative rate of \$80/hour for all Tasks 1-5 of the project.

Director Sellier will also oversee the Administrative Personnel and as well ensure that the District's Chief Financial Officer contribute needed reports and sign documents. The Administrative Personnel's hours are articulated in Task 1 of the Technical Proposal but they are also expected to expend hours in support of Task 5 for the Dissemination of Results. The Administrative Personnel is budgeted for a total of 300 hours at \$50/hour. The Chief Financial Officer is budgeted for 50 hours at \$250/hour.

Additional Personnel include four (4) Water Management Operators who will participate in Tasks 3 & 4 validating the model and receiving training on its daily usage. Operators are budgeted to contribute a combined 800 hours at \$60/hour.

No annual rate or wage increases are anticipated.

Chief Financial Officer- All tasks: 50 hours x \$250/hour= \$12,500

Director Water Resources/Project Manager- All tasks: \$80/hour x 600 hours= \$48,000

Administrative Personnel- Task 1 & Task 5: \$50/hour x 300 hours= \$15,000

4 Operators- Tasks 3 & 4: \$60/hour x 800 hours collectively= \$48,000

TOTAL PERSONNEL: 123,500

B. Fringe Benefits

Fringe Benefits are based on hours for each staff member and include benefits and required taxes paid for each position. Fringe Benefits are calculated at a standard 25% rate and include FICA, Unemployment, WIC, medical, dental, retirement, and leave.

C. Travel

No Travel anticipated to be included in this application

D. Equipment

No equipment purchased as part of this project.

E. Supplies

No Supplies expected as part of this project.

F. Contractual

Contractual work will be performed by qualifications-based engineering firm Woodard & Curran. Woodard & Curran will be responsible for contributing to Tasks 2, 3, & 4. Woodard & Curran will fulfill the needs of this project utilizing four staff members including a Lead Project Manager, a Project Engineer, a Modeler, and a Project Assistant.

Task and associated Hourly Rate details available in the table below

	Project Manager	Project Engineer/Planner 2	Modeler	Project Assistant	Total Hours	Total Fee
	Xavier Irias	Jason Roberts	Melissa Stine	Staff		
	\$345	\$300	\$265	\$130		
Task 1: Program Management						
					0	\$0
					0	\$0
					0	\$0
Subtotal Task 1:	0	0	0	0	0	\$0
Task 2: Model Enhancement						
Integrate climate-impacted hydrology	6	12	24	2	44	\$12,290
Develop operating strategy options for water purchases	8	16	40	2	66	\$18,420
Integrate water purchase options into model	6	14	32		52	\$14,750
Review and refine model	16	24	40		80	\$23,320
Process results	4	12	20		36	\$10,280
Subtotal Task 2:	40	78	156	4	278	\$79,060
Task 3: Operating Strategy Assessment						
Assess operating strategy scenarios	8	24	36		68	\$19,500
Review and refine assessment	15	24	40		79	\$22,975
Process results	4	12	20		36	\$10,280
Subtotal Task 3:	27	60	96	0	183	\$52,755
Task 4: Strategy Implementation						
Polish model for MMWD use	2	8	16		26	\$7,330
Create model user guide	2	6	14		22	\$6,200
Final model package	2	4	8	5	19	\$4,660
Subtotal Task 4:	6	18	38	5	67	\$18,190
TOTAL	73	156	290	9	528	\$150,005

G. Construction

This is not a construction project and anticipates no construction expenditures.

H. Other

No other costs budgeted for this project

I. Indirect Costs

This organization has never received a Federal negotiated indirect cost rate and will default to the 10% de minimis rate. However, the organization does not anticipate utilizing indirect funds for this project.

APPENDIX C



October 13, 2023

U.S. Bureau of Reclamation
WaterSmart-Applied Science Grant
Notice of Funding: No. R23AS00445

Subject: Support for Marin Water's Applied Science Grant Application: Integrating Advanced near-term Forecasts with Long-term Drought Modeling

I am writing to express our strong support for Marin Water's proposal to the US Bureau of Reclamation's WaterSMART-Applied Science Grant for Fiscal Year 2023. In response to historic drought conditions in California and Marin County, Marin Water developed a Strategic Water Supply Assessment in 2023. One of the drought response action identified in the report related to improving the use of near-term weather forecasting to inform long-term drought modeling, which could help support decision making relating to water systems operations.

This grant proposal aligns with the intention of the Applied Science Notice of Funding as it would increase access to information and improved modeling and forecasting capabilities will help avoid water conflicts and improve the ability to meet a variety of water management objectives, including: support for water supply reliability, management of water deliveries, drought management activities, water rights administration, ability to meet endangered species requirements, watershed health, conservation and efficiency, and other water management objectives. We believe this project will significantly improve the regions ability to use data to inform water system operations.

We strongly support this opportunity to advance near-term forecasting efforts in Marin County and the North Bay, and appreciate your favorable consideration of Marin Water's proposal.

incerely,

Anthony Williams, P.E.
General Manager



CITY OF PETALUMA

POST OFFICE BOX 61
PETALUMA, CA 94953-0061

Kevin McDonnell
Mayor

Brian Barnacle
Janice Cader-Thompson, *Dist. 1*
Mike Healy
Karen Nau, *Dist. 3*
Dennis Pocekay
John Shribbs, *Dist. 2*
Councilmembers

October 11, 2023

U.S. Bureau of Reclamation
WaterSmart-Applied Science Grant
Notice of Funding: No. R23AS00445

RE: Support for Marin Water's Applied Science Grant Application: Integrating
Advanced Near-Term Forecasts with Long-Term Drought Modeling

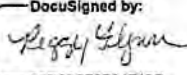
To Whom It May Concern,

The City of Petaluma is submitting this letter of support for the Marin Municipal Water District (Marin Water) proposal to the US Bureau of Reclamation's 2023 WaterSMART-Applied Science Grant. In response to recent historic drought conditions in California and Marin County, Marin Water developed a Strategic Water Supply Assessment (Assessment) in 2023. One of the drought response actions identified in the Assessment was related to improving the use of near-term weather forecasting to inform long-term drought modeling, which would help with decision-making about water system operations.

This grant proposal aligns with the intention of the Applied Science Notice of Funding as it would increase access to information and improved modeling, as well as forecasting capabilities that will help avoid water conflicts and improve Marin Water's ability to meet a variety of water management objectives, including support for water supply reliability, management of water deliveries, drought management activities, water rights administration, ability to meet endangered species requirements, watershed health, and water conservation and water use efficiency.

We strongly support this opportunity to advance near-term forecasting efforts in Marin County and the North Bay and look forward to hearing about its success.

Sincerely,

DocuSigned by:

03D99C70B34748C
Peggy Flynn
City Manager

Cc: Christopher Bolt, Director of Public Works & Utilities
Chelsea Thompson, Deputy Director of Environmental Services

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