Big Dry Creek Watershed Monitoring Project

A Drought Resiliency Project

FY 2020 WaterSMART Drought Response Program Grant
U.S. Department of the Interior - Bureau of Reclamation

Funding Opportunity Announcement No. BOR-DO-20-F002

Applicant: City of Clovis, California

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EXECUTIVE SUMMARY

This project will establish a weather and soil moisture monitoring program in the Big Dry Creek watershed northeast of the City of Clovis (see Attachment A). Runoff from the watershed is collected and stored inside the Big Dry Creek Reservoir, a facility originally built by the U.S. Army Corps (Corps) and managed by Fresno Metropolitan Flood Control District (District). The watershed/project area is shown on Attachment B.

Grant funds from the U.S. Bureau of Reclamation will help fund the construction of six weather stations inside the watershed. These stations will be identical to the 'Legacy-HMT Tier 1' monitoring ensembles used by the National Oceanic and Atmospheric Administration/California Department of Water Resources for atmospheric-river research in the Russian River watershed. The NOAA/DWR effort aims to develop and test principles of 'Forecast Informed Reservoir Operations', which hold considerable promise for increasing the ability of western reservoir operators to anticipate atmospheric river-driven precipitation and runoff events, and to respond to such events in ways that maximize post-event storage without compromising safety.

The Big Dry Creek Watershed Monitoring Project will be operated by the District on behalf of the Applicant (City of Clovis) and other regional partners. Data collection will span at least 15 years. The data will support District and Corps decision-making on operational modifications needed at Big Dry Creek Reservoir to increase long-term local water supply and improve overall regional storage and conveyance capabilities.

Local, State, and Federal water purveyors that could benefit directly or indirectly from improved management of Big Dry Creek Reservoir include the cities of Clovis and Fresno, Fresno Irrigation District, and the U.S. Bureau of Reclamation and Friant Water Users Authority (in their roles as co-operators of the Friant-Kern Canal). The storage of more water behind Big Dry Creek Dam makes more water available for routing to downstream uses, including approximately 90 of the 150 groundwater recharge sites built throughout the Fresno-Clovis area. Further, most of the 59,098-acre watershed served by the project area is used for grazing. Real-time weather and soil-moisture information could be of interest to private and public rangeland managers. The data will be available to the public and archived for use by all interested parties.

Construction is planned to begin in May 2021 and be completed by July 2021. Total project cost is approximately $253,000. One of the weather stations will be built at Big Dry Creek Dam, a U.S. Army Corps facility that is owned and operated by Fresno Metropolitan Flood Control District. A second station will be built in or adjacent to the right-of-way of the Friant-Kern Canal, which is a Bureau of Reclamation facility. The remaining four sites will be established at public schools, churches or on private property easements, as needed.

BACKGROUND DATA

Purpose

The Big Dry Creek Watershed Monitoring Project is a USBR "Task B" type project i.e. a *'Project to Improve Water Management through Decision Support Tools, Modeling and Measurement'*. Task B Projects include:

- Developing decision support tools to help communities identify alternative water supplies or water management options in times of drought. The availability of real-time weather and soil moisture data will inform the reservoir operator (District) and its oversight agency (Corps) about the soil infiltration capacity at representative points within the watershed. Knowledge of the antecedent soil infiltration capacity, combined with estimates of the precipitation yield of an incoming storm (or storm series) and statistics on current and past weather conditions gives the reservoir operator insight into the expected runoff that will be generated by the watershed. Knowing this facilitates decision-making about if and when reservoir storage must be reduced to accommodate incoming runoff. It will also help to make decisions about when non-stormwater can be safely imported into the reservoir for later use. Reclamation conducted a study related to the possibility of importing Bureau-managed water into the Big Dry Creek Reservoir; "Upper San Joaquin Storage Investigation-Big Dry Creek Reservoir Modification" in October 2003. This study is included as Attachment C). The District is following up on this study with a review of the actions necessary to construct a turnout from the Friant-Kern Canal into Big Dry Creek Reservoir.

- Real-time operational modeling to track supply conditions and demands. Modeling can be used to analyze different operational scenarios to optimize water delivery needs. The primary purpose of the proposed monitoring network is to provide regional entities with real-time weather information important to managing water resources - to minimize the effects of drought and respond to the onset or threat of drought by maximizing local water supply and supporting groundwater recharge (storage). The data generated by the project will be used to develop a digital watershed model to understand the behavior of the watershed and exploit opportunities to maximize its yield, without compromising safety. The California State University Fresno Civil and Geomatics Engineering Department has advised on the design of the monitoring program and expressed an interest in developing this model. The underlying methodology and role of the project as a decision support tool are described in the paper "*A Twenty-First-Century California Observing Network for Monitoring Extreme weather Events*", by Alan White and other researchers with the National Oceanic and Atmospheric Administration and California State Department of Water Resources (Attachment D).

- Installing water measurement equipment and monitoring instrumentation devices to accurately track water supply conditions. As described above, the project is the installation of measuring equipment. Post-installation, the District will assume all responsibility for the long-term operation, repair, replacement and upgrade of the weather stations, related telemetry and site and security features.

Project Area

The project area is the Big Dry Creek watershed, an 82.2 square mile area in central Fresno County, California. The watershed begins at Big Dry Creek Dam (dam crest elevation 442 feet above sea level) and runs northeast to its headwaters near Sierra Nevada mountains, at an elevation of 4573 feet (Attachment B). The Big Dry Creek Dam was built in 1948, then enlarged in 1994 to intercept Dog Creek, a stream south of Big Dry Creek. The addition of the Dog Creek watershed, itself approximately 10.1 square miles, brought the total area flowing into Big Dry Creek Reservoir to 92.3 square miles.

The Big Dry Creek Dam and Reservoir were originally built in 1948 by the U.S. Army Corps of Engineers, prior to the establishment of the District in 1956. The District has since assumed ownership and operational responsibility for the Corps facilities, including Big Dry Creek Reservoir, the largest impoundment in the Project. The reservoir was designed to control flows originating from Big Dry Creek and Dog Creek, and to provide up to 11,250 acre-feet of conservation storage. Conservation storage could take the form of holding stormwater (stream flows) for re-direction, accepting Class II irrigation water on behalf of other agencies, or allowing the U.S., Bureau of Reclamation to flow Section 215 water (non-storable surplus water from Millerton Lake) into the reservoir.

The current (1994) Army Corps Water Control Manual governing operation of Big Dry Creek Reservoir requires that the entire volume of the reservoir be reserved for flood storage. Releases of accumulated stormwater, through the Little Dry Creek Diversion Channel to the San Joaquin River, are mandated as part of the complete draining of the reservoir after runoff-producing storm events.

The Corps, under pressure from Congress to engage local agencies in more creatively managing original Corps and Corps-affiliated water projects, has begun exploring the "re-operation" of reservoirs. Re-operation involves the study of how the Corps-established operating parameters of a particular facility could be changed to enhance water supply/security for water users. Presently the Corps is studying the possible re-operation of Lake Mendocino (Russian River) and Lake Folsom (American River). *A key element to re-operation is the use of modern weather forecasting to gauge the likely impact of incoming weather systems on a watershed and to generate accurate runoff estimates. Good runoff estimates in turn allow reservoir operators to decide how much storage will be required to handle the storm event and, by extension, how much water can be safely left in the reservoir for later beneficial use.* Re-operation studies will lead to new operational parameters for reservoirs and revision of existing Corps Water Control Manuals.

The 1954 Reservoir Regulation Manual and the 1994 Water Control Manual discounted Hydrologic Forecasts, noting that long-term precipitation forecasts are not available. It also stated that forecasting of flood flows was not important since the release was small in comparison to the volume of the design flood. Weather forecasting has had major improvements since 1954. Atmospheric rivers and other hydrologic tendencies that result in major floods can be observed with current technology. *The use of the reservoir for conservation purposes can be supported by these improved weather and watershed monitoring tools.*

Water Conditions
Precipitation within the watershed varies considerably with elevation, with greater precipitation, including occasional snowfall, at the headwaters. The *average annual yield* of the watershed, as measured by annual inflow, is 7,560 acre-feet. The *greatest inflow* to the reservoir was 36,020 acre-feet in 1998. There have been several years where inflow was unmeasurably low.

There are no water rights associated with the natural runoff generated in the Big Dry Creek watershed and stored at Big Dry Creek Reservoir.

The runoff generated in the watershed and stored in the reservoir has, in general terms, three possible destinations: 1) through the dam's Little Dry Creek outlet to the San Joaquin River; 2) through the dam's Big Dry Creek outlet and into area recharge facilities; or 3) routing across and out of the metropolitan area to agricultural areas west of the City of Fresno. Discharge to the San Joaquin River is done when necessary to draw down the reservoir during flood operations. Recharge to groundwater is preferred in order to make the stored water available for future extraction for potable use. Routing across the metropolitan area and loss to the urban area is necessary when recharge pond levels are being kept low in winter to receive storm drainage (their primary function).

On average, 1,270 acre-feet is released each year from the reservoir into the regional groundwater recharge network. The year 2017 saw the highest recorded outflow from the reservoir via the Big Dry Creek outlet at 11,337 acre-feet.

Losses of water to the region occur when high inflows to the reservoir trigger necessary releases through the Little Dry Creek Diversion Channel. This channel routs water out of the reservoir and into the San Joaquin River. The average annual loss is 6,258 acre-feet.

Climate Change
The Fresno-Clovis area has experienced drought in five of the last six years. Over the last 20 years, central Fresno County (i.e. the Project Area) has been in drought 46% of the time. Long-term urban and agricultural water demand exceeds supply, a problem that is being addressed by California's Sustainable Groundwater Management Act (SGMA), passed in 2014. SGMA has fostered the creation, for our area, of the North Kings Groundwater Sustainability Agency (NKGSA). At present, the groundwater basin underlying the NKGSA is in a condition of critical overdraft, as determined by the California Department of Water Resources (DWR). The goal of the NKGSA is to stabilize the aquifer serving the region, bringing groundwater demand and supply into balance by 2040. This will come about through a range of methods, including water conservation, water recycling, exercising latent surface water supply agreements, and *capturing, for beneficial re-use, stormwater generated by the local watersheds*.

Climate modeling done by the State of California and others projects that climate change will present our region with stronger and less frequent precipitation events. To operate our system in the most protective and productive way possible, we will need to be able to anticipate large runoff events and carefully calibrate our water handling protocols to ensure that we both fulfill our duty to provide flood protection *and* capitalize on opportunities to hold stormwater to augment regional water supply. This effort will require an investment in data gathering within the Big Dry Creek

watershed. The data will allow us to: 1) continuously monitor weather and soil moisture (infiltration capacity) conditions in the watershed; and 2) build a model of watershed behavior to inform our operational protocols. The result will be a progressively improving capacity to respond dynamically to the weather and seasonal vagaries induced by climate change; to capture and store more water for access by those public agencies charged with ensuring water supply in the region.

Previous Reclamation Involvement

In 2003 the Bureau and California State Department of Water Resources did a joint study titled "Upper San Joaquin River Basin Storage Investigation" (Attachment C). The aim of the study was to look into the possibility of using Big Dry Creek Reservoir for off-stream storage of Reclamation water released from Friant Dam. The study found that a turnout could be built to accept Section 215 surplus water (per Reclamation Reform Act of 1982 regarding temporary water supplies that are unusually large and not storable by a USBR project). Further, this turnout could route flows into Big Dry Creek Reservoir during an extreme/emergency event that had the Bureau looking for ways to keep from flooding communities downstream from Friant Dam.

Surplus Reclamation/Friant Water Authority flows stored in Big Dry Creek Reservoir could conceivably be routed down the reservoir's Little Dry Creek Diversion Channel to its junction with the San Joaquin River (via Dry Creek), to help the Bureau meet regulatory flow requirements for habitat. The establishment of weather monitoring within the Big Dry Creek watershed can begin the process of preparing for the safe operation of the turnout (i.e. the application of "Forecast-Informed Reservoir Operations" to the Big Dry Creek watershed).

Grant Applicant & Grant Implementation

Water-SMART Drought Response Program Grants for Drought Resiliency require that the grant applicant have water or power delivery authority. The City of Clovis is the municipal water supplier closest to Big Dry Creek Reservoir and is hydraulically linked to reservoir and other District operations through the Fresno Metropolitan Flood Control District stormwater routing and recharge programs. The City is positioned to be a major beneficiary of improvements in surface water capture by the reservoir and is eligible to serve as the grant applicant for this proposal. The City is a member of the Fresno Stream Group, a regional organization with a decades-long interest in augmenting local water supplies for the benefit of the Fresno-Clovis metropolitan area.

Fresno Metropolitan Flood Control District proposes to implement the grant program on behalf of the City of Clovis. The District is governed by a Board of Directors whose members are appointed by the cities of Fresno and Clovis and the County of Fresno. The District is responsible for the operation and maintenance of the Redbank-Fancher Creeks Project, which includes Big Dry Creek Reservoir. The Reservoir and other major elements of the Redbank-Fancher Creeks Project are Corps-built facilities that have been transferred to the District. The District's interest in the project is to acquire the data needed to support the community's interest in eventually "re-operating" the Reservoir to exploit its value for enhancing local groundwater recharge.

PROJECT LOCATION

The project is located entirely within the Big Dry Creek watershed northeast of the City of Clovis (see Attachment B). The watershed is in the unincorporated area of Fresno County. The exact locations for each of the six proposed weather station sites have not been determined. The watershed map shows possible locations, which have been chosen based on a number of factors which are detailed in the Technical Project Description (below). The choice of which locations will be used and the specific placement of each station is a function of the outcome of the NEPA/CEQA environmental review findings. Sites will be selected to avoid or minimize impacts. Below is a table of *general* site locations, specific sites are yet to be determined.

Site	Property Owner/Controller	Coordinates(generalized) Decimal Degrees
Site #1	Fresno Metro Flood Control District	-199.668 W/36.876 N
Site #2	Friant Water Users Authority	-119.609 W/36.895 N
Site #3	Private Landowner, to be determined	-119.504 W/36.936 N
Site #4	Private Landowner, to be determined	-119.446 W/36.961 N
Site #5	State Dept Forestry Fire Station	-119.447 W/36.959 N
	or Cemetery District/Church	-119.405 W/37.011 N
Site #6	Pine Ridge School District	-119.370 W/37.061 N

Fresno Metropolitan Flood Control District is party to many interagency agreements, land use agreements, land leases and easements and will acquire and administer the agreements on behalf of the project.

PROJECT DESCRIPTION AND MILESTONES

Equipment

The equipment ensemble used to make up each weather station will be sized and configured generally as shown on the attached brochure for Campbell Scientific MetPro weather station (Attachment E). The tripod mounting the instruments will be approximately seven feet in diameter, and the height of the instrument ensemble approximately eleven feet (see diagram, Attachment F). The Campbell Scientific WeatherPro Station replicates the abilities of NOAA's HMT-Legacy Tier 1 monitoring stations, as specified in Attachment C.

The equipment will include a ground-anchored automated rain gauge adjacent to the tripod. A 15-foot by 15-foot perimeter fence with gate will protect the equipment. It has not yet been determined whether in all cases a concrete pad will be built on which to mount the stations. However, for purposes of the review of project impacts, a concrete pad of the same dimensions as the fence (15-by-15-foot) has been assumed.

Soil moisture sensing probes will be placed vertically in a series, either inside or outside the enclosure, and connected by cable to the weather station. The "footprint" of these probes will probably be limited to a 2-foot diameter patch of disturbed ground where the probes are driven into the soil, attached to the station by a cable. If the probes are located outside of the enclosure, they may need to be sheathed and buried (entrenched) to protect them from grazing.

Site Selection

The basic site parameters for placement of a weather station are:

- the site is free from overhead or nearby obstructions (poles, trees, buildings etc.) that could compromise the function of the instruments (block wind or rain, or create shadows)
- the immediate area where the equipment is to be placed is flat or easily graded flat
- the surrounding topography is not exceedingly hilly or rough, which could create unrepresentative wind speed or direction effects
- the site conditions (soil quality, depth, dryness) support the construction of a 15-by-15-foot security enclosure for the equipment (see model diagram of a station site)
- within a 20-foot radius of the *perimeter* of the enclosure are undisturbed or at least non-compacted soils suitable for the placement of soil moisture probes (these are attached by cable to the weather station).
- the station is not easily seen from a public highway or major road
- Verizon wireless service is available for telemetry back to the District Operations Center in Fresno.

Some stations will be established on properties owned by public agencies and some stations will be on private property.

Permitting

Fresno Metropolitan Flood Control District staff has worked with the County of Fresno to determine if any permits are required for construction of the weather stations. The County has indicated that the installations would be considered to be portable equipment not connected to any utility, and no construction permit or inspection would be required, even in cases where a poured concrete foundation is included.

Environmental Compliance

Fresno Metropolitan Flood Control District, by formal agreement with City of Clovis (the Project Grant Applicant), will lead compliance with the California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA) and all other applicable environmental laws including the National Historic Preservation Act and Endangered Species Act. The District has discussed the grant project with Reclamation environmental compliance staff and has been provided an estimate for the cost for Reclamation staff to review and consult on the District's environmental compliance effort.

Impacts from the siting of the six weather stations are expected to be minimal due to the small footprint, short construction period, and limited need to access the sites. Final site selection will take into account opportunities to minimize environmental impacts by using sites adjacent to existing private or public roads on land that has already been converted from its natural state.

Final Design

Final design for each site will be completed once long-term access to the site has been secured via land use agreement, easement or other method, and the equipment vendor has presented the final layout of the mounted equipment ensemble. While each site will have the same basic equipment configuration/layout (the highest elevation station, above 4500', will include a heated rain/snow gauge instead of a conventional rain gauge) there will be variations on fence/gate orientation to account for site-specific difference in how the units are accessed. The location of the soil moisture probe(s) may also vary from site-to-site.

Construction

All station components are lightweight and can be hand-carried to the site, however the construction of concrete pads and fences will require that vehicles access each site several times. Preference in site selection is given to sites that are next to existing private or secured public roads, in order to minimize construction impacts and simplify site access. It is expected that all weather stations will be ordered at the same time, assembled and tested, then broken down for transport to their sites. Construction should be accomplished through the use of a single contractor for all sites and should take less than one month.

Operations & Maintenance

The stations are automated but may require periodic maintenance, such as calibration, cleaning, parts replacement or repair. Preference in site selection is given to sites that are next to existing private or secured public roads, in order to simplify equipment maintenance and replacement.

Schedule/Milestones

U.S. Bureau of Reclamation FOA BOR-DO-20-F002 stipulates that no construction funded by the grant can take place before October of 2020. Grant funds could be awarded in Spring 2020, at which time contracting for site surveys, CEQA, NEPA and associated consultations could begin. After compliance with all environmental reviews has occurred, the local project sponsors will seek formal permission from public and private owners of the sites for construction and long-term access. Equipment will be procured, tested and made ready for installation. The actual construction of the six sites could be done within a single month. It is possible that all equipment could be installed and operational be July 2021.

A detailed schedule is provided as Attachment G. Major milestones are:

1. Submission of grant application to USBR
2. Award of grant
3. Execution of funding agreement with USBR
4. Completion of NEPA and CEQA processes
5. Final site selection and entry into long-term land access agreements
6. Construction of equipment enclosures and ordering of equipment
7. Receipt, testing and installation of equipment
8. Initiation of telemetry feed of weather data
9. Final reporting to USBR and close-out of grant

PERFORMANCE MEASURES

The weather and soil-moisture monitoring network will collect detailed data at each of the six sites for wind speed, wind direction, relative humidity, precipitation, solar radiation and soil moisture (water content). This data will be collected at 10-to-60-minute intervals (frequency has yet to be determined) and transmitted to the Operations Center at Fresno Metropolitan Flood Control District. The individual weather stations will be solar-powered with a battery back-up system. Data will be converted from raw telemetry feed to a report format for review, distribution, and archiving. There are two methods of confirming performance of the project:

1) Evaluation of the reliability of data collection and transmittal (i.e. hardware and software reliability); and

2) Evaluation of how useful (predictive) the data is when applied to analysis of watershed behavior.

In the first case, the project is performing properly if all the equipment works properly for the duration of the project (15 years, at least). This will be measured by recording the hours of proper operation, and hours of downtime due to repairs, unscheduled maintenance or complications with telemetry.

In the second case, the performance of the project will not become apparent until a large data set has been generated and input into a model of watershed behavior. Over time, more data will become available and correlations made between precipitation occurring in the watershed and storm-generated inflows to the Big Dry Creek Reservoir. The project will perform properly if it helps establish this quantitative relationship between precipitation and inflow, and that relationship becomes essential to making decisions on how to optimize reservoir water storage for later beneficial use by the community. An evaluation of the usefulness of the data set could be made every five years and the results submitted to Reclamation and other interested parties.

It should be noted that the project is part of a larger effort to address one of the region's core problems – frequent and significant drought. Over the last 20 years, the project area has been in *a state of drought or abnormally dry conditions for 66% of the time*, as determined by data provided by the U.S. Drought Monitor. The area is actually in ***drought***, as defined, 46% of the time. The Big Dry Creek Reservoir is capable of temporary storage of up to 30,000 acre-feet of water and intermediate-term storage of at least 10,000 acre-feet of water. The Reservoir is extensively interconnected through a network of streams, canals and pipelines network to most of the Fresno-Clovis metropolitan area and to an extensive groundwater recharge system. The development of a robust model of watershed behavior, of which the Big Dry Creek Watershed Monitoring Project is the first step, will start the community on the path to safely exploiting the full storage and drought-fighting potential of the reservoir.

EVALUATION CRITERIA

E.1.1. Evaluation Criterion A—Project Benefits (40 points)

How will the project build long-term resilience to drought? How many years will the project continue to provide benefits?

Response: The project will provide, for at least 15 years (probably many decades longer), data important to managing Big Dry Creek Reservoir for improved surface water storage. During operation of the reservoir for flood control (its primary purpose), storm runoff entering the reservoir must at times be diverted out of the area, into the San Joaquin River, where it is lost to the region. Decisions regarding when flood releases (losses) occur are driven by the U.S. Army Corps Manual governing reservoir operations, last updated in the early 1990s. The Manual's directives do not allow for deviation from the flood release 'rule curve', even when modern weather forecasting provides a level of assurance that incoming storms will not generate runoff capable of exceeding the reservoir's design storage capacity. The Big Dry Creek Watershed Monitoring Project will begin to build the data-set necessary to take advantage of *Forecast-Informed Reservoir Operations (FIRO)*, a quickly evolving field that fuses watershed-scale weather and streamflow monitoring/modeling with continental scale tracking and analysis of atmospheric river events, to enable reservoir operators to calibrate their response to large storms and storm-series in ways that meet flood control needs without releasing more stored water than is necessary.

Increasing surface water storage in Big Dry Creek Reservoir opens up opportunities to build drought resilience in the Fresno-Clovis metropolitan area. Stored water can be readily routed out of the reservoir and through the existing network of natural and man-made channels, into downstream groundwater recharge facilities operated by Fresno Metropolitan Flood Control District and intertied to the Fresno Irrigation District's canal system. During wet years, groundwater storage can be boosted. During dry years, when the communities' surface water supplies are limited, that stored water is available to supply the potable water needs of the cities of Fresno and Clovis. In addition, groundwater supplies in downstream proximity to Big Dry Creek Reservoir will benefit from increased surface to groundwater recharge. This area within the reservoir is geologically unusual within the District's service area, as it is at the foot of the Sierra Nevada Mountains and has a shallow groundwater aquifer, with clay soils that have poor percolation. This creates a situation where the reservoir itself has low losses to infiltration but high potential to recharge the much more permeable areas downstream.

Will the project make additional water supplies available?

Question: What is the estimated quantity of additional supply the project will provide and how was this estimate calculated? Provide this quantity in acre-feet per year as the average annual benefit over ten years (e.g., if the project captures flood flows in wet years, provide the average benefit over ten years including dry years). What percentage of the total water supply does the additional water supply represent? How was this estimate calculated?

Response: At present Big Dry Creek Reservoir cannot be used for long term surface water storage. The project will generate information necessary to make the case to the U.S. Army Corps of Engineers to permit the District to optimize the management of Big Dry Creek Reservoir for

increased water storage. It is not possible at this early stage of data-collection/watershed modeling to quantify the additional water that will be made available to the community over time. The reservoir's temporary maximum inundation volume is 30,300 acre-feet, and the Water Control Manual governing reservoir operations calls for a post-storm drawdown to zero storage. Future weather and streamflow data-driven modeling (based on the project proposed for grant funding in this application) will identify, for each particular storm event, the amount of water that can be safely stored inside the reservoir and no longer lost to the community.

Provide a brief qualitative description of the degree/significance of the benefits associated with the additional water supplies.

Question: Will the project improve the management of water supplies? For example, will the project increase efficiency, increase operational flexibility, or facilitate water marketing (e.g., improve the ability to deliver water during drought or access other sources of supply)? If so, how will the project increase efficiency or operational flexibility?

Response: The project will generate information necessary to optimize the management of Big Dry Creek Reservoir for increased water storage. Understanding the amount of rainfall occurring in the watershed upstream of Big Dry Creek Reservoir will allow calculation of how much water can be captured and retained. It is not possible at this early stage of data-collection/watershed modeling to quantify the additional water that will be made available to the community over time. The reservoir's temporary maximum inundation volume is 30,300 acre-feet, and the Water Control Manual governing reservoir operations calls for a post-storm drawdown to zero storage. Future weather and streamflow data-driven modeling (based on the project proposed for grant funding in this application) will identify, for each particular storm event, the amount of water that can be safely stored inside the reservoir.

Question: What is the estimated quantity of water that will be better managed as a result of this project? How was this estimate calculated? Provide this quantity in acre-feet per year as the average annual benefit over ten years (e.g., if the project captures flood flows in wet years, provide the average benefit over ten years including dry years).

Response: At present, Big Dry Creek Reservoir cannot be used for long-term water storage. the project will provide measurement of the amount of rainfall occurring in the watershed upstream of the reservoir, and this will allow calculation of how much water can be captured for beneficial use (recharge). It is not possible at this early stage of data-collection/watershed modeling to quantify the additional water that will be made available to the community over time. The reservoir's temporary maximum inundation volume is 30,300 acre-feet, and the Water Control Manual governing reservoir operations calls for a post-storm drawdown to zero storage. Future weather and streamflow data-driven modeling (based on the project proposed for grant funding in this application) will identify, for each particular storm event, the amount of water that can be safely stored inside the reservoir.

Question: What percentage of the total water supply does the water better managed represent? How was this estimate calculated? Provide a brief qualitative description of the degree/significance of anticipated water management benefits.

Response: The reservoir's temporary maximum inundation volume is 30,300 acre-feet. Future weather and streamflow data-driven modeling (based on the project proposed for grant funding in this application) will identify, for each particular storm event, the amount of water that can be safely stored inside the reservoir for future use. For perspective, 30,300 acre-feet represents about two times the annual potable water use by the City of Clovis and about one-seventh of the annual potable water use by the immediately adjacent City of Fresno. Such a volume of water is significant in a highly populated area with a semi-arid climate that is repeatedly and regularly subject to drought. The population of the City of Clovis is approximately 112,000 and the City of Fresno's population is approximately 530,000 (U.S. Census Bureau American FactFinder 2018 Population Estimates).

Question: Will the project make new information available to water managers? If so, what is that information and how will it improve water management?

Response: The project purpose is to make real-time weather and soil moisture information about the Big Dry Creek watershed available to all regional water management agencies. At present there is minimal data available on weather conditions in the watershed. The project will collect data at six locations on wind speed, wind direction, precipitation, temperature, relative humidity and soil moisture content. The project's primary aim to generate data for use by Fresno Metropolitan Flood Control District in their role as operator of the Big Dry Creek Reservoir, however the data will be readily available to all interested parties and could be particularly useful to other agencies with land and fire management interests in the Big Dry Creek watershed, such as California Department of Forestry, Sierra National Forest, U.S. Fish & Wildlife, Fresno County Agricultural Commissioner, Fresno County Fire Protection, U.S. Army Corps of Engineers et al.

The data yielded by implementation of the project will be central to managing Big Dry Creek Reservoir for improved surface water storage. During operation of the reservoir for flood control (its primary purpose), storm runoff entering the reservoir must at times be diverted out of the area, into the San Joaquin River, where it is lost to the region. Decisions regarding when flood releases (losses) occur are driven by the U.S. Army Corps Manual governing reservoir operations, last updated in the early 1990s. The Manual's directives do not allow for deviation from the flood release 'rule curve', even when modern weather forecasting provides a level of assurance that incoming storms will not generate runoff capable of exceeding the reservoir's design storage capacity. The Big Dry Creek Watershed Monitoring Project will begin to build the data-set necessary to take advantage of *Forecast-Informed Reservoir Operations (FIRO),* a quickly evolving field that fuses watershed-scale weather and streamflow monitoring/modeling with continental scale tracking and analysis of atmospheric river events, to enable reservoir operators to calibrate their response to large storms and storm-series in ways that meet flood control needs without releasing more stored water than is necessary.

Question: Will the project have benefits to fish, wildlife, or the environment? If so, please describe those benefits.

Response: The project will enable reservoir managers to hold more water within Big Dry Creek Reservoir for longer periods of time. When inundated, the reservoir serves as a very large habitat for a variety of water fowl and raptors, including mallards, coots, geese, herons, egrets, pied-billed

grebes and red-tailed hawks. The watershed itself is primarily used for grazing. The publicly-accessible real-time weather and soil data generated through the operation of the project may assist rangeland managers.

Metering/Water Measurement Projects.
Questions: To what extent are the methods tested/proven? To what degree will the project improve the ability to predict the onset of drought earlier and/or with more certainty? To what degree will the project improve the ability to anticipate the severity and magnitude of drought? To what degree will the project improve the likelihood/timing of detecting mitigation action triggers? Explain why this is a necessary sub-component of another eligible Drought Resiliency Project as described in Tasks A-C.

Response: The project is not a water metering/measurement project as defined/described in the grant guidelines.

E.1.2. Evaluation Criterion B—Drought Planning & Preparedness (15 points)

How does the applicable drought plan address drought?
The project area is part of two water resource management plans, both of which were created to comply with State of California legislation. They are the Kings Basin Integrated Regional Water Management Plan ("**IRWMP**", Executive Summary provided as Appendix #1) and the (draft) North Kings Groundwater Sustainability Agency's Groundwater Sustainability Plan ("**GSP**", Executive Summary provided as Appendix #2).

Was the drought plan developed with input from multiple stakeholders/a collaborative process?
The Kings Basin IRWMP is a collaborative effort among 57 public, private and non-governmental agencies to manage water resources in the Kings Groundwater region (Kings Basin). There are seventeen official members, and 40 interested parties. The City of Clovis and the Fresno Metropolitan Flood Control District are official members of the Kings Basin Water Authority. The initial IRWMP was prepared in 2007. This Plan was the outcome of a two-year collaborative planning and facilitation process that included completion of a wide range of technical studies, preparation of briefings and technical memoranda, development of the Kings Basin Integrated Groundwater and Surface Water Model (Kings IGSM), extensive stakeholder involvement and community affairs process, and numerous meetings among various work groups and participants. A full list of IRWMP members and participants is on page 3 of the updated 2018 Kings Basin Water Authority IRWMP. See Appendix #1, KBWA IRWMP Executive Summary.

Does the drought plan include consideration of climate change impacts to water resources or drought?
From the IRWMP, Chapter 17: "Climate change in the Kings Basin could impact precipitation patterns and cause higher temperatures and earlier snowmelt. The area is especially vulnerable due to its dependence on mountain snow as a water supply. The IRWMP includes a climate change vulnerability assessment for water supplies, water demands, water quality, flooding, ecosystems, and hydropower. Climate change adaptation will be accomplished through 'no-regret' strategies, which are actions that have benefits with or without climate change. The main strategies will

include water conservation, recycled water use, groundwater recharge, and increasing water storage capacity.

Does the drought plan identify the proposed project as a potential mitigation or response action?
One of the 'Resource Management Strategies' in the IRWMP is "System Reoperation". System Reoperation involves changing operational procedures for existing reservoirs and conveyance facilities to increase water related benefits. System reoperation may improve the efficiency of existing water uses or it may increase the emphasis of one use over another. In this Plan, Fresno Metropolitan Flood Control District suggested there may be potential to re-operate flood flows at Big Dry Creek Reservoir, and additional study is needed. Changes in water demands and climate change could provide the need for re-operation, and consequently re-operation options will be periodically evaluated." (Plan page 6-6)

The Big Dry Creek Watershed Monitoring Project is foundational to building a case for reoperation of Big Dry Creek Reservoir to allow for increased surface water storage for groundwater supply, water supply reliability, enhanced flood protection, and wildlife habitat benefits. All of these benefits align with priorities outlined in the IRWMP.

Does the proposed project implement a goal or need identified in the drought plan?
Yes, the proposed project will lay the foundation for re-operation of Big Dry Creek Reservoir. Re-operation will provide community water benefits that meet at least four of the five 'Regional Goals' identified in the Kings Basin IRMWP (page 5-3):

> Regional Goal 1: Halt, and ultimately reverse, the current overdraft and provide for sustainable management of surface and groundwater.
>
> Regional Goal 2: Increase the water supply reliability, enhance operational flexibility, and reduce system constraints.
>
> Regional Goal 3: Improve and protect water quality.
>
> Regional Goal 4: Provide additional flood protection.
>
> Regional Goal 5: Protect and enhance aquatic ecosystems and wildlife habitat.

One of the Resource Management Strategies to meet the Regional Goals listed above, is to increase surface water storage, "Smaller storage projects include reservoirs on the Fresno Stream group that provide flood control and some storage benefits. Building large-scale surface storage in California and the nation as a whole is difficult because most of the prime sites already have been dammed and regulatory, political, and economic constraints make planning for and construction of dams extremely slow and difficult. Small-scale reservoir projects may hold more promise due to the significant expense of developing large-scale surface storage. Off-channel reservoirs have been successfully developed by irrigation and water districts in the San Joaquin Valley and offer potential to some local agencies. In the future, if climate patterns change causing reduced snow pack and increased winter runoff, the priority for surface storage for water supply and flood control purposes could change." (page 6-11)

The proposed project will make possible years of reliable rainfall data collection to build a compelling case to allow long-term surface water storage in Big Dry Creek Reservoir. This would meet an important regional water management goal.

Is the proposed project prioritized in the referenced drought plan?
One of the 31 'Resource Management Strategies' to meet the five Regional Goals in the IRWMP is System Reoperation, as a means to 'Improve operational efficiency and transfers'. System Reoperation involves changing existing operation procedures for existing reservoirs and conveyance facilities to increase water related benefits. System reoperation may improve the efficiency of existing water uses or it may increase the emphasis of one use over another. Fresno Metropolitan Flood Control District suggested there may be potential to re-operate flood flows at Big Dry Creek Reservoir.

E.1.3. Evaluation Criterion C—Severity of Actual or Potential Drought Impacts to be addressed by the Project

What are the ongoing or potential drought impacts to specific sectors in the project area if no action is taken, and how severe are those impacts? Are there public health concerns or social concerns associated with current or potential drought conditions? Are there ongoing or potential environmental impacts (e.g. impacts to endangered, threatened or candidate species or habitat)? Are there ongoing, past or potential, local, or economic losses associated with current drought conditions (e.g. business, agriculture, reduced real estate values)? Are there other drought-related impacts not identified above (e.g. tensions over water that could result in a water-related crisis or conflict)?

Response to the above impacts and concerns: The Fresno County Multi-Hazard Mitigation Plan (MHMP) updated in 2018, identifies natural and man-made risks and risk mitigation actions for Fresno County, including the Project Area. The MHMP process includes review and approval by both the Federal Emergency Management Agency and the California Office of Emergency Services. The MHMP identifies Drought as a "Likely, Widespread, Highly Significant" risk to the community considers actions to mitigate drought and the associated risk of land subsidence to be High Priority. An excerpt from the MHMP profile of drought risk in the County is provide below.

Fresno County Multi-Hazard Plan (see Appendix #3):

> In California, rising temperatures are projected to increase the average lowest elevation at which snow falls, reducing water storage in the snowpack, particularly at those lower mountain elevations which are now on the margins of reliable snowpack accumulation. Higher spring temperatures will also result in earlier melting of the snowpack. The shift in snow melt to earlier in the season is critical for California's water supply because flood control rules require that water be allowed to flow downstream and that water cannot be stored in reservoirs for use in the dry season.
>
> Climate change will likely adversely impact the ability of watersheds and ecosystems to deliver important ecosystem services. There is a broad range of climate change impacts that affect water resources in California. These changes may limit the natural capacity of

healthy forests to capture water and regulate stream flows. Peterson et al., (2008) report that Sierra Nevada mountain winters and springs are warming, and on average, precipitation as snowfall relative to rain is decreasing. A warming climate with reduced snowpack will result in earlier snowmelt and will subsequently reduce downstream water availability during summer and early fall.

As such, Fresno County potentially has less capacity to address future drought (and wildfire) risk related to climate change due to projected temperature increases and shortages in water; ground-water withdrawals have been occurring at a deficit rate of one to two million acre feet per year, where the impacts of drought include decreased availability of water for agriculture and environmental uses.

The high degree of risk posed by drought will be exacerbated by greater climate variation in the future, which, in this case, means greater variation and uncertainty regarding the availability of water supplies which are already under tremendous stress. The HMPC will continue to explore solutions for mitigating the drought hazard by accessing the best available data and resources on climate change and its relationship to drought.

Describe existing or potential drought conditions in the project area. Is the project in an area that is currently suffering from drought or which has recently suffered from drought?
A review of online data available from the U.S. Drought Monitor website (https://droughtmonitor.unl.edu/Maps/MapArchive.aspx) for the years 2000 to present (September, 2019) reveals that the project area experiences Abnormally Dry or Drought conditions 65% of the time. Specifically, a review of monthly drought monitor mapping for central Fresno County shows that, for the previous 20 years, 46% of 225 months represented in the data set were in some level of Drought, and another 20% of the time were Abnormally Dry. The table below summarizes conditions in the project area since the year 2000:

Drought Condition	# Months in this Condition	% of Time Period in this Condition
None	76	35%
Abnormally Dry	46	20%
Moderate Drought	30	13%
Severe Drought	35	16%
Extreme Drought	12	5%
Exceptional Drought	26	11%

The Drought Monitor maps integrate data from several sources including the Palmer Drought Index, Soil Moisture Models, U.S. Geological Survey Weekly Stream flows, Standardized Precipitation Index, and Satellite Vegetation Health Index.

Describe any projected increases to the severity or duration of drought in the project area resulting from changes to water supply availability. Provide support for your response (e.g., reference a recent climate informed analysis, if available).

Response: Reclamation's SECURE Water Act Section 9503(c) Report to Congress Chapter 8: Sacramento and San Joaquin River Basins (2016), is included as Appendix #4. This report speaks to future water conditions in the region, including significant increases in variability and form of

precipitation that will exacerbate the effects of the drought cycle. The report also points towards adaptation to drought, which the Big Dry Creek Watershed Monitoring Project will support. The following discussion is excerpted from that report's study of the Sacramento-San Joaquin Basins:

> Temperatures are projected to increase throughout the century. Variation in precipitation, both temporally and spatially, will likely occur, and snowpack will likely decline consistently over time, primarily due to warming. In addition, runoff and river flows will likely continue to exhibit temporal variability and earlier seasonal runoff, with little overall flow changes in the north and slight reductions in the south. In general, impacts to water-related resources include decreased reservoir storage and increased opportunities for spring riparian flows and fall flood-control storage.
>
> Each basin is projected to exhibit a shift in runoff to more during late fall and winter and less during the spring. This projected shift occurs because higher temperatures during winter cause more precipitation to occur as rainfall, leading to increased runoff, less snowpack water storage, and earlier spring snowmelt runoff with reduced volume. This seasonal shift is greater in basins where the elevations of the historical snowpack areas are lower and therefore are more susceptible to warming-induced changes in precipitation from snow to rain.

The study cites potential water management actions and adaptation strategies that can mitigate drought/threat of drought:

- Improve operational efficiency through conjunctive groundwater management, enhanced groundwater recharge, increased surface storage.
- Improve institutional flexibility and adaptability to improve water system efficiency.
- Improve data, data management, and the use of data to support near-term and long-term decision-making.
- Expand water storage and groundwater; improve water supply reliability through implementing new surface water storage and groundwater management actions. These actions include expanded reservoir storage in the Sacramento and San Joaquin Basins, and conjunctive use with increased groundwater recharge.
- Increase flexibility of system operations and management, including actions designed to improve system performance without constructing new facilities or expanding the size of existing facilities. These actions include conjunctive use management with increased groundwater recharge.

The Big Dry Creek Watershed Monitoring Project will generate data and contribute to an understanding of the behavior of the watershed. This will in turn lead to: 1) improvements in operational efficiency of the existing surface water-groundwater conjunctive use function of the reservoir; 2) opportunities to flexibly manage water supplies and improve supply reliability; and 3) future expansion of the reservoir's safe storage capacity.

E.1.4. Evaluation Criterion D—Project Implementation (10 points)

Describe the implementation plan of the proposed project, including an estimated project schedule that shows the stages and duration of the proposed work, including major tasks, milestones, and dates. The implementation plan (sequencing, duration and sub-agency departments responsible for individual project components) is as shown on Attachment G.

Describe any permits that will be required, along with the process for obtaining such permits. No permits will be required for the project.

Identify and describe any engineering or design work performed specifically in support of the proposed project. The project includes configuring the proposed weather stations, power supplies, storage and telemetry so that they replicate the NOAA HMET-Legacy Tier 1 stations used in the Russian River watershed investigation previously outlined. A final equipment/enclosure ensemble/design will be developed along the lines shown in Attachments E and F. Individual station sites will be surveyed and legal descriptions written.

Describe any new policies or administrative actions required to implement the project. None.

Describe how the environmental compliance estimate was developed. Have the compliance costs been discussed with the local Reclamation office?
Fresno Metropolitan Flood Control staff developed a project profile for distribution to professional NEPA-CEQA consultants familiar with local conditions. This profile was also sent to Reclamation-Sacramento office staff, who produced an estimate of the cost of their review a consultant-prepared NEPA-CEQA document. Reclamation's estimate ($11,000) and an estimate on the high-end of the spread of consultant's estimates ($60,000) were used for developing the grant budget.

E.1.5. Evaluation Criterion E—Nexus to Reclamation (10 points)

How is the proposed project connected to a Reclamation project or activity?

Does the applicant receive Reclamation project water?

Is the project on Reclamation project lands or involving Reclamation facilities?

Is the project in the same basin as a Reclamation project or activity?

In response to the above four related questions: The Friant-Kern Canal, an element of Reclamations' Friant Division, traverses the project area. Reclamation, in collaboration with California Department of Water Resources, studied the possibility of building a turnout from the canal into the Big Dry Creek Reservoir (Attachment C). The study's findings included possible benefits from connecting the canal to the reservoir, such as routing Section 215 surplus waters into the reservoir. The proposed project will generate data useful to further consideration of such a project.

Will the project benefit any tribe(s)? No.

Will the proposed work contribute water to a basin where a Reclamation project is located? No.

E.1.6. Evaluation Criterion F—Dept of the Interior Priorities (10 points)

Project support of DOI priority: Utilize science to identify best practices to manage land and water resources and adapt to changes in the environment. The project is based directly on the HMET-Legacy Tier-1 weather monitoring methods/equipment used by NOAA and California Department of Water Resources, as described in Attachment D.

Project connection to DOI's water storage, transportation, and distribution systems and opportunities to resolve conflicts and expand capacity. The project will contribute data essential to the long-term management of the Big Dry Creek Reservoir and facilitate future connection of the reservoir to the Friant-Kern Canal, a Reclamation facility, to increase Reclamation's ability to flexibly manage runoff generated in the San Joaquin River watershed (as explored in Attachment C, the USBR-DWR study of the reservoir for enhanced surface water storage).

Project's contribution to management of competition for grazing resources (improved rangeland watershed data for private and public lands grazing). The project will provide real-time publicly-available soil moisture and weather information for a 58,000 acre watershed that is primarily used for grazing. Future watershed analysis based on the collected data will allow predictive modeling of watershed hydrologic behavior.

PROJECT BUDGET

Funding Plan, Resolutions and Letters of Commitment
The City of Clovis, as Applicant, passed Resolution 19-155 on September 16, 2019 authorizing submittal of the grant application and authorizing the City Public Utilities Director to lead the project and execute all required documents.

The non-Federal share of project costs will be provided by Fresno Metropolitan Flood Control District, on behalf of the Applicant, City of Clovis. The District's *Resolution* of Funding Commitment and *Letter* of Funding Commitment are provided as Attachment H. The budgeted local match of 50% of project costs is $126,652. Should the project for some reason require funding beyond the local match amount, the District will pay 100% of those additional costs. The District has already allocated funds for its share of project costs in its adopted FY 2019-2020 budget. These funds will carry over to future fiscal year budgets until construction of the project is complete and all grant obligations discharged.

The Staffing Budget (Attachment I) details the estimated value of the staff time contributed by the City of Clovis and the District (the third party). These contributions are discussed in more detail in the *Budget Narrative*.

The above-described arrangement for collaborative implementation of the grant will be governed by a formal agreement between City of Clovis and Fresno Metropolitan Flood Control District. As of the writing of this project description (October 9, 2019), the agreement is under review by both parties and representatives of both parties have been authorized by their respective agencies to execute the final agreement. A copy of the final executed agreement will be forwarded to Reclamation.

Budget Proposal

Table 1 shows a total project cost of $253,304. The 50% local match will be paid entirely by Fresno Metropolitan Flood Control District, on behalf of the City of Clovis (Applicant). All District monies used to pay the match originate in the District's General Fund and no other non-federal parties play any fiscal role in the project.

TABLE 1 - TOTAL PROJECT COST

SOURCE	AMOUNT
Costs to be reimbursed with the requested Federal funding	$126,652
Costs to be paid by the applicant	$0
Value of third party contributions	$126,652
TOTAL PROJECT COST	$253,304

Table 2 also shows a total project cost of $259,304, with the 50% local match paid by Fresno Metropolitan Flood Control District.

TABLE 2 - SUMMARY OF FEDERAL AND NON-FEDERAL FUNDING SOURCES

FUNDING SOURCES	AMOUNT
Non-Federal Entities	
Fresno Metropolitan Flood Control District	$126,652
City of Clovis	$0
Non-Federal Subtotal	$126,652
Other Federal Entities	$0
Other Federal Subtotal	$0
REQUESTED RECLAMATION FUNDING	$126,652

Table 3 identifies project costs. The salaries and wages charged to the project are detailed and explained in Attachment I, 'Staffing Budget'.

TABLE 3 - Budget Proposal

BUDGET ITEM DESCRIPTION	COMPUTATION		Quantity Type	TOTAL COST
	$/Unit	Quantity		
Salaries and Wages				
	See Attachment I, **Staffing Budget**			$40,794
Equipment				
MetPro Weather Station	$9,710	6		$58,260
Contractual/Construction				
Site Preparation, Concrete Pad & Security Fence Contractor	$9,000	6		$54,000
Surveys & Legal Descriptions for Site Lease Contractor	$5,000	5		$25,000
CEQA/NEPA Compliance Contractor	$60,000	1		$60,000
USBR Review of NEPA Document	$11,000	1		$11,000
Davis-Bacon Labor Compliance Contractor	$2,250	1		$2,250
Other				
State Dept Fish & Wildlife Filing	$2,000	1		$2,000
TOTAL DIRECT COSTS				$253,304
Indirect Costs				
				$0
TOTAL ESTIMATED PROJECT COSTS				$253,304

Budget Narrative

Salaries and Wages

The Project Manager is Scott Redelfs, Public Utilities Director for the City of Clovis, California. On September 16, 2019, Mr. Redelfs was authorized by a resolution of the Clovis City Council to serve in this capacity and to enter into and sign any and all agreements, contracts or other instruments required to complete the project. Mr. Redelfs is not himself included in the budget because he will not be charging time to the project; however, the work of several members of his staff is incorporated into the budget. City of Clovis staff costs amount to about 25% of the total staffing budget. The other 75% of the staffing budget pays for District staff. Staff titles, billable hourly rates, the role of each position in the project, and estimated hours dedicated to the project are shown in Attachment I.

Fringe Benefits

For Fresno Metropolitan Flood Control District Employees working on the grant, the budget uses the existing federal negotiated hourly rates that integrate the approved fringe benefits. These rates

were originally established in the course of the District implementing a federal Economic Development Agency infrastructure grant. These rates are periodically updated to track changes at the federal level.

City of Clovis employee billable hourly rates include a base rate and fringe benefits, where fringe benefits are 41% of the base wage rate. The fringe covers employee retirement and medical plan costs. This calculation is shown in the Staffing Budget (Attachment I).

Equipment

The equipment needed for the project is comprised of six automated weather stations with cellular-communications telemetry systems, solar panels and back-up batteries. This equipment will be housed within a 15-by-15-foot fenced and locked enclosure. A similarly-sized concrete pad may or may not also be built depending on the conditions at each site. The budget assumes that a concrete pad is needed at each site.

The prices of equipment, survey, site legal descriptions and construction are estimated in Attachment J. The price estimation for the weather stations is based on the receipt of an informal/unofficial bid from the equipment manufacturer. Prices for other weather station materials, construction, survey and engineering services are based on the District's experience with similar types of infrastructure projects.

Contractual & Purchasing

The following discussion details the one purchase and four contracts needed to implement the project.

CEQA-NEPA Consultant

Task(s): Fulfill California Environmental Quality Act and National Environmental Quality Act research, documentation and reporting requirements for the Applicant. Assist with identifying opportunities to avoid or minimize environmental impacts through the screening of potential weather station sites. Liaison with Reclamation environmental staff to ensure NEPA compliance is successful.
Estimated Cost: $60,000
Procurement Method: Competitive bid solicitation

Construction Contractor

Task(s): Prepare sites as needed (clearing, grading), pour concrete pads, install security fences, gates and mounting hardware for weather station components. A preliminary breakdown of required activities and hardware is shown in Attachment J.
Estimated Cost: $54,000
Procurement Method: Competitive bid solicitation

Site Survey & Legal Descriptions Contractor

Task(s): Conduct formal land surveys for weather station sites and write legal descriptions for the site areas. The survey and legal description information will be essential to entering into formal land use agreements/land leases with public agencies and private landowners owning the five sites *not* on Fresno Metropolitan Flood Control District property.
Estimated Cost: $25,000
Procurement Method: Competitive bid solicitation

Davis-Bacon Labor Compliance

Task(s): Ensure compliance with the federal Davis-Bacon Act governing wages, job classification and prevailing wage reporting and enforcement for contractors working on the project.
Estimated Cost: $2,250
Procurement Method: This task can be accomplished through the use of Fresno Metropolitan Flood Control District's long-term contract with California Labor Consultants LLC to conduct Davis-Bacon compliance for federal grants. This contract was originally competitively bid.

Weather Station Equipment Purchasing

Task(s): Acquire six weather stations constructed to be as close as possible in design and hardware to the HMET-Legacy Tier 1 units currently in use by the National Oceanic and Atmospheric Administration's Russian River watershed Forecast Informed Reservoir Operations research program.
Estimated Cost: $58,260 (six weather stations @ $9,710 each)
Procurement Method: The equipment used for an HMET-Legacy Tier 1 weather station is manufactured by Campbell Scientific. To best replicate NOAA's methods, the weather stations should use the same type and brand of equipment. This being the case, there may be only one source for the weather stations (Campbell Scientific), hence a competitive procurement process would be ineffective in producing multiple bidders. Attachment E is Campbell-Scientific's brochure on the equipment ensemble.

Third-Party In-Kind Contributions

The entire non-Federal share of project costs will be provided by Fresno Metropolitan Flood Control District, a third-party, as shown in Budget Tables 1 and 2 (above).

Environmental and Regulatory Compliance Costs

Reclamation environmental staff have reviewed our draft grant proposal/project and estimated that the Bureau's cost to review cultural resources and NEPA/ESA compliance at $11,000. This figure has been included in the project budget. An informal solicitation was made of professional environmental consulting firms for estimates of the cost to prepare a combined NEPA-CEQA document for the project. Estimates ranged from $10,000 to $80,000. A figure of $60,000 is included in the project budget to account for the possibility that although the project is fairly simple and of narrow scope, as yet unknown factors could drive the actual cost toward the high end of the range of estimates.

Other Expenses
All expenses expected in the course of the project have been included in the project budget.

Indirect Costs
Indirect costs have not been included in the project budget and will not be claimed by any of the non-federal participants.

ENVIRONMENTAL AND CULTURAL RESOURCES COMPLIANCE

H.1. Environmental and Cultural Resource Considerations

To facilitate understanding the applicant's answers to the following set of questions, please refer to this overview of the weather station establishment process:

> Weather Station Overview: Each weather station requires a 15-by-15-foot fence enclosure surrounding a poured concrete pad. The equipment inside the weather station will reach approximately 11 feet in height. The soil moisture sensors would typically be buried 1-to-5 feet deep, within 20-feet of the enclosure (usually much closer) and connected to the weather station by a small buried cable. It is expected that for each site, preparation and grading will take one day, the pouring of the concrete a second day, construction of the enclosure a third day, and installation of the weather station equipment ensemble a fourth day. Site access for construction will be short-lived and construction will not require heavy equipment. Sites will be chosen based on a combination of factors relating to meteorology and access but also because of their lack of environmental concerns. The NEPA, CEQA, and cultural/historical review processes will identify areas and issues of concern and steer the site selection process away from any sites that present compliance challenges or mitigation requirements. Post-construction (i.e. operations) access to the site will be minimal; as-needed to conduct maintenance or repairs.

Question #1: Will the proposed project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

Response to Question #1: Per the station overview above, ground disturbance will be minimal and short-lived. All contractors doing construction for Fresno Metropolitan Flood Control District (who is responsible for construction contract implementation) are obligated to follow State of California standard dust and stormwater pollution prevention practices. Site-candidates with the potential to impact habitat will be rejected in favor of sites with no impact.

Question #2: Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

Response to Question #2: Site-candidates with the potential to impact any threatened or endangered species or designated critical habitat will be rejected in favor of sites with no impact.

Question #3: Are there wetlands or other surface waters inside the project boundaries that potentially fall under CWA jurisdiction as "Waters of the United States?" If so, please describe and estimate any impacts the proposed project may have.

Response to Question #3: The entire Big Dry Creek watershed may be considered WOTUS. The project will not have any impact on area waters – weather station sites will be developed on flat or nearly flat terrain, away from waterways and all contractors doing construction for Fresno Metropolitan Flood Control District (who is responsible for construction contract implementation) are obligated to follow State of California stormwater pollution prevention practices which disallow impacts to waterways.

Question #4: When was the water delivery system constructed?

Response to Questions #4: This question pertains to grant projects involving water supply/irrigation, which is not part of this application.

Question #5: Will the proposed project result in any modification of or effects to, individual features of an irrigation system (e.g. head gates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

Response to Questions #5: This question pertains to grant projects involving water supply/irrigation, which is not part of this application.

Question #6: Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places? A cultural resources specialist at your local Reclamation office or the State Historic Preservation Office can assist in answering this question.

Response to Questions#6: This question pertains to grant projects involving water supply/irrigation, which is not part of this application.

Question #7: Are there any known archeological sites in the proposed project area?

Response to Question #7: To determine appropriate weather station sites, a review will be completed to determine whether there are known archeological sites in each project area. Site-candidates with the potential to impact any archeological sites will be rejected in favor of sites without archeological significance.

Question #8: Will the proposed project have a disproportionately high and adverse effect on low income or minority populations?

Response to Question #8: No. The project occurs away from inhabited areas.

Question #9: Will the proposed project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

Response to Question #9: Site-candidates with the potential to impact any Indian sacred sites or have impacts on tribal lands will be rejected in favor of sites without these concerns.

Question #10: 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?

Response to Question #10: No. Ground/soil disturbance will be limited to the six 15-by-15-foot concrete pad/fenced enclosure areas. Soil or vegetation will not be imported onto or off of the individual sites.

PERMITS, APPROVALS, PROJECT AUTHORIZATION AND SUPPORT

Permitting

Fresno Metropolitan Flood Control District staff has worked with the County of Fresno to determine if any permits are required for construction of the weather stations. The County has indicated that because of the nature and small size of the installations and the fact that no utility connections are needed, no construction permits or inspections will be required. Project staff have reviewed other Federal, State and Local permit programs and found that the weather station sites are too small and unobtrusive to require other types of permits.

Approvals

Permission for long-term (15-year) access to the station sites will be needed to ensure consistency of data collection. The approvals needed are summarized below:

Site	Property Owner/Controller	Type of Approval
Site #1	Fresno Metro Flood Control District	Not Required
Site #2	Friant Water Users Authority	Interagency Use Agreement
Site #3	Private Landowner, to be determined	Easement or Land Lease
Site #4	Private Landowner, to be determined	Easement or Land Lease
Site #5	State Dept Forestry Fire Station or Cemetery District or Church	Interagency Use Agreement Interagency Use Agreement Easement or Land Lease
Site #6	Pine Ridge School District	Interagency Use Agreement

Fresno Metropolitan Flood Control District is party to many interagency agreements, land use agreements, land leases and easements and will acquire and administer the agreements on behalf of the project.

Authorizing Resolutions

The City of Clovis resolution approving and authorizing grant participation is provided as Attachment K. The Fresno Metropolitan Flood Control District Resolution of Funding Commitment and associated letter is Attachment H.

Letters of Support

Letters of support have been received from City of Fresno, the Fresno Irrigation District and the North Kings Groundwater Sustainability Agency and are provided in Attachment L.

Involved Congressional Districts

The project area spans two federal Congressional Districts: CA-022 (Nunes) and CA-04 (McClintock) as shown on Attachment M.