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REQUEST FOR PROPOSALS

ANALYSIS OF OPERATIONS AND EFFICIENCY OF THE SANTA BARBARA COUNTY PRECIPITATION ENHANCEMENT PROGRAM

August 26, 2022

GENERAL:

Santa Barbara County Water Agency (SBCWA) wishes to conduct a study to build on past program research, using new evaluation techniques and models, to better understand the efficiency of current operations and program designs being used to enhance precipitation in the drainages above major reservoirs in the County, and to make recommendations for future program design optimization. The study will provide SBCWA, their program partners, and contractors, a better understanding of current program efficiency and returns, and will help in future program development, design, and growth.

SBCWA is looking for a qualified firm to perform this research. We are requesting a concise proposal and cost estimate for this study. **Proposals should be limited in size to six pages and be specific to this project.** An appendix of previous work of similar scope and references can be attached separately.

PROGRAM HISTORY:

Santa Barbara County Water Agency has administered a regional cloud seeding program in Santa Barbara County and Southern San Luis Obispo County since 1981 to augment local water supplies. A project summary can be located on the Cloud Seeding (Precipitation Enhancement) webpage. Winter storms are seeded with silver iodide (AgI) particles to increase rainfall and runoff into four major reservoirs. Seeding is currently completed using up to seven ground sites. At times in past years, areal seeding was conducted but has not been used in recent years. In Southern Santa Barbara County, increased runoff is captured by Juncal, Gibraltar and Cachuma Reservoirs on the Santa Ynez River to serve mainly as water supply for residents of the South Coast and Santa Ynez Valley. In northern Santa Barbara County and southern San Luis Obispo County, increased runoff is captured by Twitchell Reservoir and used to supplement groundwater recharge to the Santa Maria Valley Groundwater Basin (see Figure 1). Program length depends on funding and is operated at a maximum period between mid-November and early April, or a minimum period between December and March.

As early as 1951, cloud seeding research was conducted in Santa Barbara County. Under the direction of North American Weather Consultants, this project extended into 1953 and concluded that substantial increases in precipitation could be made from the release of AgI both by ground and air operations. The State of California Water Resources Board became interested in the project and the Statistical Laboratory of the University of California did an evaluation of the program, with the same results. In 1955 the State Water Resources Board published *Weather Modification Activities in California* which summarized operations at that time and methods employed. Much of the analysis in the report came from the Santa Barbara Program.

In 1957 a cooperative project was undertaken from previous research activities in Santa Barbara County by the State Department of Water Resources, University of California Statistical Laboratory, United States Forest Service, United States Weather Bureau, North American Weather Consultants and Santa Barbara County. At this time several weather modification programs to augment precipitation were being run in California, and there was a great amount of interest in the benefit of such a program. This project ran through 1960 and was named the *Santa Barbara – Ventura Weather Modification Project*. The benefit was statistically shown to be a 10-20% increase in precipitation over the target area.

In the early 1960s the Research Department for the Naval Weapons Center at China Lake became interested in cloud seeding activities and funded the *Santa Barbara Convective Band Seeding Test Program* which operated between the years 1967 to 1974. The summary of this project was that seeding activities do produce additional precipitation.

In 1977 County staff was directed to investigate Water Resources Planning and as part of that effort, analyzed the benefit of such a program. Staff concluded that a benefit of an increase in precipitation of 10-20% was feasible.

In 2015 North American Weather Consultants completed a statistical analysis of historical data and estimated a precipitation increase of 20% in the Upper Santa Ynez area and a 9% increase in the Twitchell Dam area. These research activities and statistical analyses are the basis of Santa Barbara County's operational program, which began in 1981 and continues today.

Links to many of these reports, as well as yearly operations reports, can be located at the Reports & Documents: Cloud Seeding webpage, or within the SBCWA agency library (available for loan if requested).

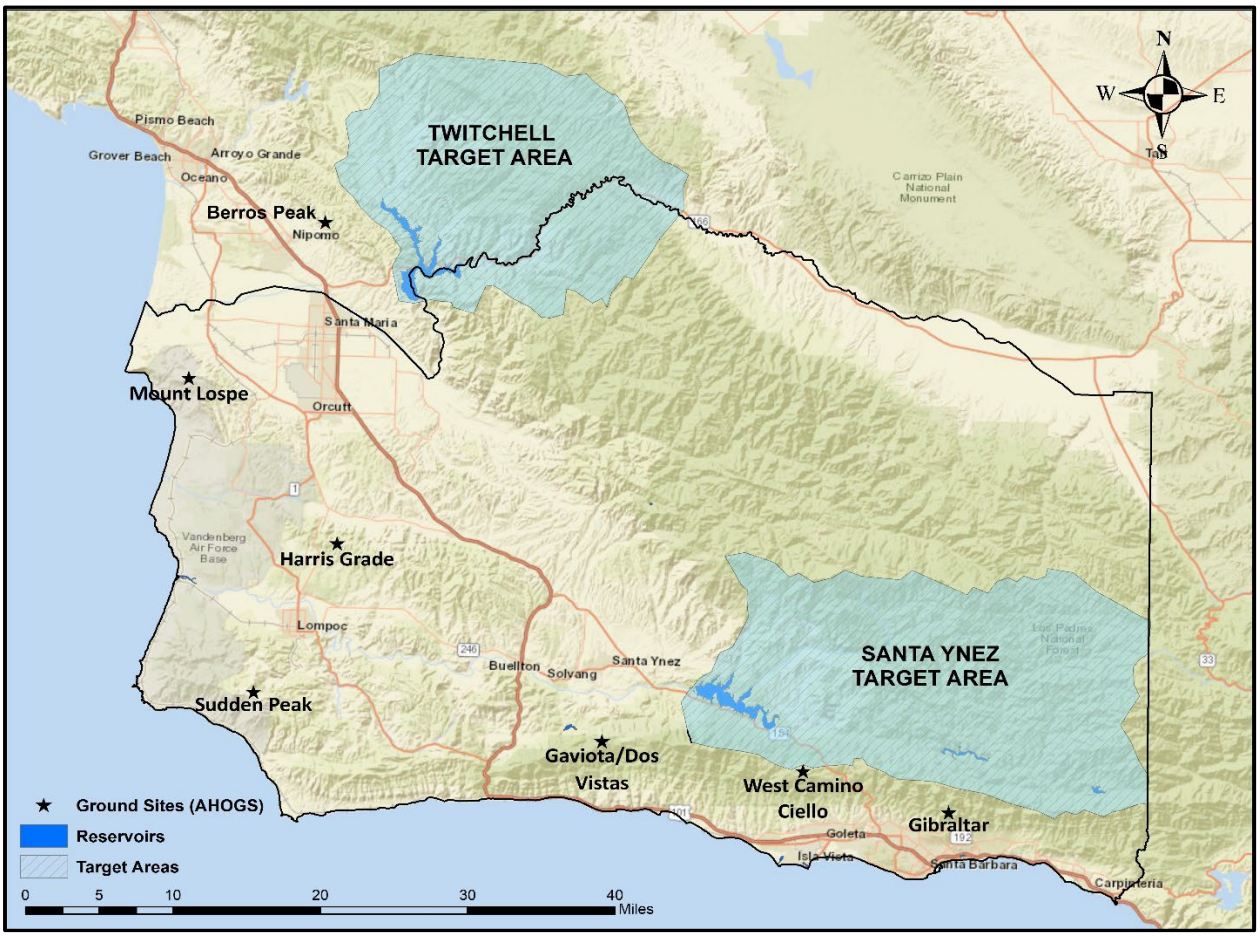

Figure 1: Target areas for Santa Barbara County cloud seeding showing location of seven ground sites.

PROGRAM DESIGN:

The program design is based on Santa Barbara II research. Santa Barbara II was conducted during the winter seasons of 1967 to 1973. The study consisted of the release of silver iodide from a ground site in the Santa Ynez Mountains northwest of Santa Barbara. These silver iodide releases were made as convection bands passed overhead. The releases were conducted on a random seed or no-seed decision basis in order to obtain baseline non-seeded, natural, rainfall information for comparison. A large network of recording precipitation gauges was installed for the research program. The amount of precipitation that fell from each seeded or non-seeded convection band was determined at each precipitation gauge location. This study indicated that convection bands contributed approximately one-half of the total winter precipitation in this area. If it is also assumed that all convection bands could be seeded in a given rainy season and that a 50 percent increase was produced, the result would be a 25 percent increase in total rainy season precipitation when these assumptions are correct during an optimized situation. Results from additional studies (Solak et al., 1996 and Thompson et al., 1988 and Griffith et al., 2015) indicate a 20% increase in precipitation in the Santa Ynez watersheds, and a 10% increase in the Twitchell watersheds.

Based on the long history of research and operational programs in this area, both airborne and ground-based seeding modes have been found effective when properly employed. In recent seasons, only the ground-based seeding mode from six locations has been utilized. The primary seeding opportunity is associated with convective bands that are embedded in winter storms as they pass over Santa Barbara County.

These convective bands are common features of Pacific Coast storms impacting California during winter storms. The bands contain updrafts that lift low-level, moisture laden air from near the surface to higher elevations. This results in clouds containing supercooled (below freezing but still liquid) droplets as the rising air passes above the freezing level. Our understanding of these bands is that the low-level vertical updrafts that are fueling the bands dynamics are frequently focused along the leading edges of these bands. These inflow/updraft portions of the bands are the areas where supercooled cloud droplets are present in the greatest concentrations, and are the focus of seeding operations.

SCOPE OF SERVICES:

SBCWA is requesting a thorough analysis of its current operations and program design to determine program efficiency and investigate opportunities for optimization. Using current data and available modeling tools, evaluate the potential for future enhancements. Questions of interest include the following:

1. Is the weather regime underpinning current operations and program design still relevant? Are the nature of the storms the same as when the program began, and when the initial studies were completed (Santa Barbara II Research) which is the basis for the program design? Has storm frequency changed? Are storm temperatures the same? Does the program need to be re-designed to a changing climatology of the region?
2. How effective is the current program design relative to the maximum potential increase in precipitation?
    a. What is the current estimated increase in precipitation?
    b. What are the limitations of the current program design (ie- frequency of inversion)?
3. Are the number and placement of ground seeding sites adequate relative to the maximum potential increase in precipitation?
4. Have the program results diminished without the use of airborne seeding? If so, how?
5. Will the use of remote ground generators, aircraft, or aerial seeding alternatives (such as the Selerys multi site & multi target aerial cloud seeding) provide opportunity for further precipitation enhancement relative to the current program design? If so, what is the cost-effectiveness in doing so?
6. What is the estimated increase in precipitation that could be reasonably expected with an optimized program design?

Content of Proposal:

Each proposal should include, but is not limited to the following:

1. Identification of Proposer & Executive Summary
2. Project Overview and Technical Approach
3. Capabilities, Tools, & Processes
4. Statement of Staff Qualifications
5. Related Project Experience
6. Project Schedule & Estimated Time for Completion
7. Cost of Services

All questions pertaining to the contents of this RFP must be made via email to the attention of Matthew Scrudato, Senior Hydrologist, at mscruda@countyofsb.org.

Deliverables:

- Digital copy of the draft report provided to SBCWA, and a presentation on its findings.
- Digital copy of the final report
- Five (5) hard copies of the final report
- Once the study is complete, the contractor will provide SBCWA and their program partners a presentation on the findings.

EVALUATION OF PROPOSAL:

The selection process will be based on the project approach and ability to complete the work. The selected consultant will be chosen and negotiations for the work will begin with that consultant and if a successful project scope and fee cannot be agreed upon, SBCWA will suspend negotiations and will open negotiations with the next highest rated consultant.

By submitting a Proposal, your company agrees to the review process and the decision resulting from this review process. Making a submission in no way ensures your company will work on the project. All documents made part of your submission will become the property of SBCWA. All decisions of the reviewing Committee are final.

REJECTION OF PROPOSALS:

SBCWA reserves the right to reject all proposals and abandon the project, or re-issue a Request for Proposals.

DEADLINE:

All proposals must be **received no later than 5:00 p.m. on October 10, 2022**. Proposals shall be submitted to mscruda@cosbpw.net. Proposals may also be mailed or hand-delivered to:

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Santa Maria, CA 93455
mscruda@countyofsb.org
805-803-8781