



Midpeninsula Regional
Open Space District

R-17-71
Meeting 17-14
June 14, 2017

STUDY SESSION AGENDA ITEM 1

AGENDA ITEM

Innovation Team Fog Harvesting Project Informational Report

GENERAL MANAGER'S RECOMMENDATION

Informational report only. No Board action required.

SUMMARY

The Innovation Team researched fog harvesting efforts in other locations throughout the world and evaluated how the District might utilize fog harvesting technology on District properties. The Team decided to partner with the United States Geological Survey (USGS) on a research project to install arrays of fog collectors using different meshes with data collectors to measure the available fog and collector efficiency. When available, data will be evaluated to guide decisions on how, where, and if to install fog collectors for practical purposes in the future.

DISCUSSION

General Manager Steve Abbors started contemplating harvesting water from fog while working for East Bay Municipal Utilities District in 2003. Although the idea did not gain traction at that time, he continued to look for opportunities when he came to work for the District. In June, 2015 Mr. Abbors and Assistant General Manager Kevin Woodhouse decided to reach out to District staff to see if there was interest in forming an Innovation Team to investigate fog water harvesting potential on District land. District employees Brian Malone, Grant Kern, Michael Gorman, Don Mackessy, Jessica Lucas, Frank Healey, and Dennis Heimer volunteered to start the Innovation Team for Fog Harvesting. Craig Beckman later replaced Brian Malone when Brian transitioned to Land and Facilities Services Manager.

The initial goal of the Fog Team was to investigate how fog harvesting could supplement District water sources for cattle, wildlife, or residential use. During the extended drought conditions, many traditional water sources ran dry during the summer. While researching how to put together fog collectors, the committee reviewed efforts in other parts of the world. In the course of their research, they made contact with Alicia Torregrosa with the USGS who is an expert on the scientific intricacies of fog. A cooperative partnership formed and the goal of the Fog Team evolved to support scientific research on the efficacy of fog harvesting on District land.

To provide valid scientific data, the Fog Team identified sites on District lands where fog collectors could be installed which would compare the effectiveness of several different mesh surfaces in different fog distribution patterns. Potential locations included Toto Ranch, Big Dipper Ranch, Sears Ranch, Skyline Ridge, and Purisima. Those sites were evaluated and four sites were selected to install fog collectors for research purposes (Miramontes Ridge, Purisima, Skyline Ridge and La Honda-Sears Ranch.) The District committed to spend up to \$25,000 with USGS providing scientific expertise and additional equipment.

As investigation of the cost of scientific instrumentation was completed, it was determined that the cost for four sites would exceed the District financial commitment. The Fog Team decided to collect better data at fewer sites to stay within budget. The preferred sites, based on weather patterns and access, were Skyline Ridge near the ranch house and Purisima Creek near the staff residence at the North Ridge parking lot. The District funded scientific data collection equipment (including the ability to monitor remotely over a cell phone network.) USGS and NBD Nanotechnologies provided sophisticated fog particle monitoring equipment (FM-120), high-tech mesh surfaces, and expertise in worldwide fog collection research.

Through Ms. Torregrosa and USGS, a connection was made with Decker Sorenson of NBD Nanotechnologies. NBD is a rapidly emerging global leader in surface wettability solutions with proprietary state of the art technology. USDA awarded NBD a small business innovation research grant to test the efficacy of a passive water collection solution for agricultural use in arid coastal regions of the world. NBD is fulfilling the USDA grant through the creation and testing of new coating formulations for fog water harvesting mesh. The results from the District data will help NBD understand the dynamics of different materials and the effectiveness of a coating designed to improve the efficiency of collection via modification of surface wettability. The value of the research and development by NBD and USGS to support the District is estimated at \$194,600:

- Coating chemistry optimization (\$20K)
- Investigation into additive chemistry: direct integration into plastic to eliminate coating (\$60k)
- Final production of coated meshes (\$2K)
- Principal Scientist Time (\$60k).
- Sophisticated fog droplet measurement equipment (FM-120 -- \$50 K)
- Meteorological research grade barometers (\$1800)
- Materials for the construction of second-generation collector troughs and miscellaneous hardware (\$800).

The desired result for the District and USGS/NBD is to figure out the best type of mesh for fog collection. Assuming that there are three to four different combinations of environmental conditions (high vs low wind; strong wave action in ocean splash zone producing marine aerosols vs low action; high upper atmosphere subsidence; strong inversion vs. no inversion) we should be able to have enough data to reach a conclusion after six to ten fog events. Once we get that information (along with accompanying FM-120 data) we could move on to the next phase of scaling up from the one meter square meshes to making larger meshes that take advantage of the larger outer frame.

In the course of preparing and installing the harvesting devices, other interested parties became involved in sharing information or developing their own sites. Hanger One Vodka representatives observed an installation site on District land and contacted Ms. Torregrosa to develop their own site for commercial use. Open Roads worked with District staff to produce a segment for broadcast. Bay Nature magazine contacted Ms. Torregrosa to prepare an article.

FISCAL IMPACT

Project-to-date cost to the District has been \$23,500. Of that, \$17,500 paid for the data collection equipment and the remainder paid for the frames. There is no budget impact because the funds were included in the Land and Facilities Department budget. The District funding has leveraged investment from USGS and NBD Nanotechnologies in the amount of \$194,600.

District staff have invested 400 hours in researching and planning for the project, 550 hours constructing the frames and storage cabinets, and 60 hours monitoring the devices after the installation.

Future cost will be limited to maintaining the structures in case of damage by extreme weather (a small amount of damage occurred due to high winds this winter). This cost will come out of the Skyline Field Office Services and Supplies routine budget. An incidental amount of staff time is anticipated to be spent in the future to maintain the equipment and discuss the analysis of the data collected.

BOARD COMMITTEE REVIEW

No committee review is required.

PUBLIC NOTICE

Public notice was provided as required by the Brown Act

CEQA COMPLIANCE

The District completed and filed a Notice of Exemption (NOE) for the Project in December 2015, to study the efficacy of different fog harvesting materials for the purpose of water conservation. As part of the NOE, the District concluded that the installation of the fog collection devices is categorically exempt under Article 19 of the CEQA (California Environmental Quality Act) Guidelines as follows:

Section 15306 – Information Collection: Class 6 exemptions consist of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource. In accordance with this exemption, this project is for research and information gathering purposes and does not result in serious disturbance to an environmental resource.

Section 15304 – Minor Alterations to Land: Class 4 exemptions consist of minor alterations in the condition of land or vegetation which does not involve removal of healthy trees.

NEXT STEPS

Depending on the pace and analysis of the data collected at these stations continuing into FY2017-18, the District could move ahead with installation of fog collection devices at other locations in FY2018-19 if desired. Future sites might provide water to supply a summer wildlife trough or remote cattle troughs. Once the project reaches this point, assessment and installation of additional sites will be included in the District Action Planning and Resource Loading prioritization process for Board consideration. This would involve further assessment of the aesthetics, capacity, alternative mesh configurations, cost comparison to other collection methods (rainwater storage, wells) and locations.

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