

Improving California Golf Course Water Use Efficiency

Principal applicant: Northern California Golf Association

Co-applicants: Southern California Golf Association, Santa Clara Valley Water District, East Bay Municipal Utility District, and Coachella Valley Water District

Cooperator: Metropolitan Water District of Southern California

Statement of Work

The purpose of the proposed project is to create an association of California golf courses and local water agencies that will undertake water use efficiency (WUE) improvement efforts. The association will provide an educational and technical assistance program to assess current irrigation practices and improve them with the goal of reducing water usage. Efficiency achievements will be publicly recognized to encourage golf course participation.

The program is a collaboration of four local water agencies – Santa Clara Valley Water District (SCVWD), East Bay Municipal Utility District (EBMUD), Metropolitan Water District of Southern California (MWD) and Coachella Valley Water District (CVWD) – and the Northern and Southern California Golf Associations.

Though this project has a technical assistance component (distribution uniformity and pumping plant efficiency evaluations), it has been submitted under the category “training, education or public information programs with statewide application” because of its focus on education and training.

Section 1: Relevance and Importance

1.1 Project need as related to critical water issues

Approximately 80% of California’s 912¹ golf courses are located in areas that are designated by the United States Department of the Interior to be substantially or highly likely areas for water supply conflicts by the year 2025². Golf course irrigation will come under greater scrutiny as water supplies become more limited.

Dr. Charles Burt of the Irrigation Training and Research Center (ITRC) at California Polytechnic State University, San Luis Obispo suggests that the concept of irrigation system evaluation is very new in landscape irrigation, and turf evaluation procedures are less sophisticated than in agricultural irrigation³. Dr. Burt also points out that educating the landscape industry and familiarizing it with the appropriate terminology is an obstacle that still needs to be addressed.

¹ There are 912 golf courses in California according to the National Golf Foundation www.ngf.org/cgi/whofaq.asp

² United States Department of Interior, Bureau of Reclamation website. *Water 2025: Preventing Crises and conflict in the West*. www.doi.gov/water2025/Water2025.pdf

³ Personal communication

A survey of golf course superintendents conducted in the summer of 2003 by the Northern and Southern California Golf Associations revealed that roughly 61% have an irrigation season that is at least 9-10 months in length. 33 % of Northern California responders reported their irrigation season is 9-10 months or more. 95% of responding Southern California superintendents said their irrigation season is over 9-10 months, and 82% said they have an 11-12 month irrigation season. Clearly, a significant amount of water is being applied to golf courses nearly year-round throughout the state. Due to these long irrigation seasons, golf course water use is likely to frequently exceed agricultural water use on an acreage basis.

A key point generated by the survey was that the majority of superintendents did not know the distribution uniformities (DU)⁴ of their irrigation systems. 76% of the Northern California superintendents surveyed said they did not know their DU. 56% of the Southern California superintendents did not know their DU. In sum, the survey revealed a lack of familiarity with golf course water use efficiency issues but a willingness to improve knowledge and expertise in this area.

A report by the Pacific Institute states that improving efficiency and increasing conservation are the least expensive options for meeting California's future water needs⁵. Another report by the Pacific Institute emphasizes the necessity of measuring water use for businesses trying to understand their water use practices⁶. A central tenet of the proposed project is the idea that "if you don't measure it, you can't manage it"

The CALFED Bay-Delta Program Record of Decision states that one of the CALFED objectives is to "reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system." This can only be achieved by conservation.

Though the state's varied microclimates dictate large differences in irrigation requirements, an 18-hole golf course might use from 250 acre feet to 450 acre feet of water a year on average. Improvements in water use efficiency can dramatically reduce water demand from this largely urban sector. Some golf course water use efficiency improvements are cost effective at present, and increasingly sophisticated improvements will become effective as water rates increase.

1.2 Project goals and objectives

The project's primary goal is to reduce California golf courses's water use and, in the case of courses served by SCVWD, demands on water from the Central Valley Project.

The project objectives therefore are to:

- 1) Create an association of golf courses and water districts with an advisory board formed of representatives from these groups and assisted by water efficiency experts from agencies

⁴ Distribution uniformity, or DU, is a measure of how evenly water is applied to a landscape by an irrigation system. DU is calculated in the field by analyzing the results of catch-can tests.

⁵ Pacific Institute. Waste Not, Want Not: The Potential for Urban Water Conservation in California, Executive Summary.

⁶ Pacific Institute. Freshwater Resources: Managing the risks facing the Private Sector.

including the California Alliance for Golf and University of California Riverside, Division of Agricultural and Natural Resources.

- 2) Improve California golf course superintendents' management and maintenance of their irrigation systems through a program of education, self-testing, field tests and data collection.
- 3) Publicly recognize water efficiency improvements to promote the program and highlight achievements in the industry.

1.3 Consistency with local and regional water management plans and activities

The program is consistent with Best Management Practice (BMP) 5, Large Landscape Conservation Programs and Incentives, as defined in the Memorandum of Understanding Regarding Urban Water Conservation in California (MOU) established by the California Urban Water Conservation Council. As members of the Council, SCVWD, MWD and EBMUD implement the MOU's BMPs. BMP 5 requires water agencies to provide customer support, education, and assistance; to assign reference evapotranspiration-based (ET_o) water use budgets to accounts with dedicated irrigation meters; and to provide water-use audits to accounts with mixed-use meters beginning July 1, 1999.

The proposed program constitutes outreach to a specific sector included in BMP 5. It complements SCVWD's Irrigation Technical Assistance Program (ITAP) for large urban landscapes and provides extension of pump testing and irrigation system evaluation services currently performed by SCVWD's agricultural water conservation program for agricultural BMPs A3, B2 and B10⁷ to the golf course sector. These agricultural BMPs are outlined in the *Bureau of Reclamation, Mid-Pacific Region's Conservation and Efficiency Criteria 2002*.

SCVWD has provided large landscape water audits to sites in Santa Clara County with 1 acre or more of landscaping through ITAP since 1995. Landscape managers are provided with water-use analyses, scheduling information, in-depth irrigation evaluation, and recommendations for affordable irrigation upgrades. SCVWD recognizes that more focused technical assistance is required for golf courses, and has learned from experience gained in its agriculturally-oriented Irrigation and Fertilizer Management Assistance Program that technical assistance over several seasons is more effective than one-time provision of sets of recommendations.

The proposed project will expand the services EBMUD offers to its commercial irrigation customers. EBMUD currently provides commercial irrigation audits and irrigation equipment

⁷ A3. Provide or support the availability of Water Management services to water users. Develop and conduct individual programs or cooperative programs with other Contractors in regional programs. Services include: on-farm evaluations, normal year and real-time irrigation scheduling and crop ET information; surface, ground, and drainage water quantity and quality data; Agricultural Water Management educational programs and materials for farmers, staff, and public

B2. Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to crops or soils.

B10. Facilitate or promote water user pump testing and evaluation.

rebates, and provides budgets for irrigation-only customers. EBMUD is also the lead agency in Northern California for a Weather Based Irrigation Controller Grant that will start in 2005. The grant targets residential and commercial customers.

As a sponsor of the California Department of Water Resources Mobile Laboratory Program, CVWD has been conducting audits on golf courses since 1987. CVWD has audited 75 golf courses and has a Certified Golf Course Irrigation Auditor on staff. CVWD's water management plan specifically calls for golf course conservation measures, with a goal of reducing all course water use by at least 5% by 2010. The District is preparing a golf course water conservation plan and promoting efficient irrigation techniques. Additionally, the District is establishing maximum applied water allowances for golf courses. The proposed program and certification process will assist golf courses served by CVWD in meeting their allowances and will help CVWD verify that they did.

1.4 How the project will further implement existing water management activities or initiate new ones

Up to this point, little attention has been paid to providing golf course superintendents with the tools they need to understand and improve their irrigation water use efficiency. With the potential water savings available from reasonable increases in WUE on acreages with long irrigation seasons, assistance to this sector offers the opportunity to make significant additions to urban water use efficiency.

The proposed program is composed of two components whose implementation represents considerable progress in urban WUE. The first is that of directed sector-specific outreach and technical assistance conducted by local agencies and increased cooperative endeavor by the agencies partnering with golf courses in their jurisdictions. This is important because of the WUE savings potential as a result of courses' large acreage and long irrigation season.

The second component is the extension of historically agricultural WUE technical assistance to golf courses. This is a natural extension that will transfer experience acquired in the agricultural sector to the courses.

The program will provide experience to participating water districts in offering WUE technical assistance to courses and introduce WUE concepts to the courses as well as offer publicity to the courses in the form of signage and press releases. Based on the lessons learned in the first three years of this program, CVWD intends to assign their Golf Course Water Management Specialist the goal of getting every golf course within the Coachella Valley certified as water efficient.

Additionally, as mentioned in 1.3 above, the project will expand pump testing and irrigation system evaluation services currently performed by SCVWD's agricultural water conservation program to golf courses.

The success of the proposed project in improving golf course irrigation system efficiency is expected to expand into a statewide project that will serve all of California's golf courses.

1.5 How outcome supports the California Bay-Delta Program’s WUE Program Plan

The proposed project satisfies the California Bay-Delta Water Use Efficiency Program’s overarching goal to “reduce water demand through ‘real water’ conservation”. More specifically, the essence of the proposed project is to support and inform sound water management decisions, which is a WUE program commitment listed in the most recent program plan.⁸ Increasing the use of recycled water is another goal listed in the WUE Program Plan that the proposed project will help achieve.

Furthermore, the project satisfies the solution principles in the CALFED Bay-Delta Record of Decision⁹ as follows:

- *Reduce Conflicts in the System* – the project will lead to reduced water use and consequently help reduce “major conflicts among beneficial uses of water”
- *Be Equitable* – the project will serve a sector that utilizes a large volume of water but has received little water use efficiency attention and education.
- *Be Affordable* – once golf course superintendents are educated about their irrigation systems, they will be able to make immediate low-cost and no-cost changes to their systems, which will save water.
- *Be Durable* – by building the foundation for continuing cooperation between golf associations and water districts, the project will create an ongoing entity that will provide education and technical assistance and periodically monitor water use efficiency on courses. These factors will provide the institutional basis for permanent changes in water management behavior.
- *Be Implementable* – the project provides golf course superintendents with a variety of water- and cost-saving educational and technical services, which will strengthen program participation, as well as implementation assistance to ensure irrigation system improvements are made.
- *Have No Significant Redirected Impacts* – the project will not have negative impacts on the Bay-Delta system.

Section 2: Technical/Scientific Merit, Feasibility

2.1 Methods and procedures

The proposed project has two components: 1) an educational program and 2) golf course irrigation system evaluations and technical assistance. The project will be headed by an advisory board, which will be formed of representatives from all of the participating agencies, as well as other water use experts. This board will determine the content of the educational workshops and will review the test data and project content annually. NCGA’s Director of Turfgrass Services will coordinate the advisory board and project and will be the industry contact for promoting the project throughout the state.

⁸ Water Use Efficiency Program Multi-Year Program Plan (Years 5-8), California Bay-Delta Program, July 2004.

⁹ Page 9 of the Record of Decision, August 28, 2000.

2.1.1 Educational program

Educational workshops will be conducted at the offices of each cooperating water district. In the first year, these workshops will outline the program and provide golf course superintendents with instruction in:

- irrigation system uniformity
- overall pumping plant efficiency
- irrigation infrastructure testing, maintenance and improvement
- irrigation scheduling
- sprinkler testing parameters
- auditing procedures
- life-cycle benefit-cost analysis of system improvements

These workshops will also include presentations on the appropriate use of recycled water, which poses challenges due to its normally higher concentration of sodium and chloride. Irrigation with recycled water usually exceeds plant water use in order to apply enough extra water (known as a leaching fraction) to flush the root zone. This is done to prevent accumulation of salts in the root zone. While training in the use of recycled water may not reduce the amount used, it can enhance the uptake of the resource and help prevent problems resulting from its use. This assistance will give superintendents the confidence to use recycled water properly and avoid using fresh water in its place.

Educational workshops will continue in years two and three to both educate superintendents from newly-recruited courses and to provide resources for first-year superintendents. Follow-up meetings will be held in the second year with these first-year participants, who will provide feedback on the training and education they received as well as their experiences with testing their irrigation systems (detailed below) in order for the curriculum, educational materials and testing procedures to be improved.

The advisory board, with assistance from NCGA staff, will create a clearing house of information on irrigation system efficiency, distribution uniformity (DU), and related subjects to help superintendents obtain updated industry-relevant information. A detailed report on water-efficient irrigation systems, based on the findings of this pilot project, will be written by the Advisory Board to provide information and recommendations for golf course superintendents. This report will be made available to golf course superintendents through the NCGA and SCGA, as well as the participating water districts.

2.1.2 Golf course irrigation system evaluations and technical assistance

Golf course irrigation systems will be systematically evaluated in a three-step process:

- 1) Self-administered test
- 2) Field data
- 3) Test and data review/evaluation

STEP ONE: Course superintendents will first evaluate their own irrigation systems with a self-administered test. (See Appendix D - **Irrigation System Self-Assessment Test**). This test will provide the superintendent insight into the strengths and weaknesses of the current irrigation system and its day-to-day management of operations, scheduling and maintenance. A similar

document has been used by the Southern Nevada Water Authority for assisting superintendents in developing a golf course efficiency plan for irrigation use.¹⁰

The self-test was created based on a self-assessment tool used by the Central Coast Vineyard Team. CCVT, a non-profit grower-group that promotes sustainable vineyard practices on the Central Coast, developed the tool for evaluating the sustainability of vineyard practices used on working farms.¹¹ The CCVT tool has been instrumental in helping growers to effectively assess their maintenance practices and to see how they can become more efficient and environmentally aware in their operations. The test for the proposed project was supplemented by questions on irrigation system evaluation from the text *Golf Course Irrigation*¹².

STEP TWO: The second step is to validate the self-test findings. This will be done by documenting various components of the irrigation system and with field tests. Irrigation system components to be documented will include:

- record keeping for current activities such as maintenance and preventive maintenance practices and water usage diaries (daily, weekly, monthly and yearly)
- historical data such as usage reports, evapotranspiration (ET_o) rates, energy costs, pump efficiency ratings, conservation plans, drought contingency plans, etc.

(See Appendix E - **Irrigation System Documentation Checklist**.) Additionally, a sample sprinkler will be sent to the Center for Irrigation Technology (CIT) at California State University, Fresno for analysis. By sending sprinklers from the field, theoretical sprinkler performance information can be generated by CIT. Tests are performed indoors, which provides the best possible information for sprinklers based on type, model, nozzle, pressure, etc. This indoor data will then be compared to outdoor data, which has outside influences such as wind, temperature, etc., to determine sprinkler performance problems or coverage deficiencies. A database comparing field audit reports and CIT data will be developed to determine if any correlation can be established between laboratory and actual field performance to guide managers in management and equipment selection.

Field tests will involve distribution uniformity, pump operating efficiency, soil texture, infiltration rates, and water holding capacity tests.

Distribution uniformity (DU) in a turf setting measures how evenly water is applied by the sprinklers. DU is typically used in landscape audits to assess irrigation system performance.

$$DU_{\text{low quarter}} = \frac{\text{Average catch in the low quartile}}{\text{Average catch overall}}$$

To calculate the DU_{low quarter} (DU_{lq}), catch-can readings are ranked from low to high. The average of the lowest 25 percent of the catch-can readings is then calculated, and this is divided by the average of all the catch-can readings. While other segments of the ranked catch-can data can be used, the low quarter has been found to be practical in most irrigation settings.

¹⁰ Southern Nevada Water Authority. *Southern Nevada Golf Course Efficiency Plan*. 2004

¹¹ Central Coast Vineyard Team. Positive Points System – Self assessment tool for evaluating sustainable management practices used in vineyards, 2003. www.vineyardteam.org (as of 1/1/05)

¹² *Golf Course Irrigation*, Barrett, J., Vinchesi, B., Dobson, R., Roche, P. and Zoldoske, D. 2003

The pump test measures standing and pumping water levels, flow rates and discharge pressures, and calculates pump efficiency from the ratio of energy consumed to the energy represented by the pressure and flow rate of the pumped water. The calculated kilowatt-hours / acre-foot informs the pump owner as to whether installing a more efficient pump will save the owner money within a specified payback period. While the pump test itself does not save water, it is an attractive benefit to course superintendents, which will help encourage their participation in the program.

Soil texture, infiltration rates (particularly on slopes and in swales to find limiting rates for each fairway), and water holding capacity tests will also be performed to determine how quickly water can move through the soil profile. Many courses have poor soil quality or very shallow soils which hinders the ability to irrigate deeply and infrequently. By knowing the existing soil properties, turf managers can make informed decisions which will help to prevent runoff and optimize water use

Step two is done for the simple reason that replacing visual or intangible beliefs or biases about the irrigation system's performance with actual data concerning usage, efficiencies, etc., gives the superintendent and/or club officials a more precise strategy for making system and scheduling improvements and financial decisions in the future¹³.

STEP THREE: In the third and final step, the advisory board will review the self-test results and the field data. A board representative will make a site visit to the golf course to spot check recordkeeping data, system and sprinkler maintenance and irrigation scheduling determinations. Based on the test evaluations and site visit, the advisory board may recommend corrective actions for the superintendent to take. Technical assistance will be provided to help the superintendent implement these actions.

Depending on the board's assessment and corrective actions taken, the golf course may be recognized as a California Certified Water-Efficient Golf Course (CCW-EGC) at the bronze, silver or gold level, depending on the level of efficiency achieved. (See attached Appendix F - **Certification Levels**.) It is anticipated that awards will be given beginning in the second year of the program.

In order to retain their certification, courses will file their annual water use data with the association. This will ensure that courses make permanent changes to their irrigation systems and maintenance procedures and that the program has long-lasting impacts on WUE.

In the second year of participation, courses will have follow-up system evaluations, including a second set of DU tests, to check program efficacy. A member of the advisory board member will conduct a site visit to spot check improvements and provide any technical assistance.

One golf course in each of the four cooperating water districts will be designated to serve as a pilot course for the first year of the program. Additional courses will be recruited in subsequent years with the expectation that the education and testing curriculum will become standardized

¹³ Lewis, Michael., 2003. Moneyball W.W. Norton & Company, Inc. pg. 90-91

after the second year of the project. As discussed in section 6, after the initial proposed project period of three years, the project is expected to become established and outreach through NCGA and SCGA will occur across the state.

2.2 Task list/project plan

A task list and schedule, with a project plan and work schedule are included in Appendix G.

2.3 Environmental Documentation

Since this is not a “project” as defined by CEQA, no plan for compliance is required.

Section 3: Monitoring and Assessment

3.1 Pre-project conditions and baselines, basic assumptions, anticipated accuracy

An important consideration in this program is the varying ages of the irrigation systems that are installed on the selected courses. A recent industry survey revealed that the average irrigation system age is 20 years old. A system’s age will determine its efficiency, depending on system maintenance and use. Older systems do not have the level of accuracy of newer systems, which have more advanced sprinkler head designs and pump stations.

In order to accurately determine water use for the golf courses within the pilot program, participating water districts will provide water use records for the courses chosen. The information that is gathered from the self-test and the water districts will serve as the initial baseline.

Recordkeeping at individual golf courses varies greatly. Some golf courses have excellent records while others have very little. The initial accuracy of the data will depend upon recordkeeping prior to starting the program. Once the golf courses start to document the various items as described in the program, then a more accurate picture of water use efficiency can be painted.

3.2 Monitoring methodologies and data that will be collected to assess results

Establishing a system that will track monthly water usage and daily ETo requirements as well as other parameters, such as those in the documentation checklist (Appendix E), will be essential in the project. The amount of monitoring information the participating courses submit will determine which certification level the golf course can achieve.

The data that is collected from the self-test and field tests will be compared to what was previously known in order to assess current management practices, system infrastructure efficiencies and system application delivery. In some cases, where pre-existing recordkeeping is negligible, the information that is obtained will serve as the initial baseline. The new data that is generated from these facilities will be used in conjunction with the recently-established baseline information to start assessing the criteria listed above.

The program data that is generated each year will tell how effective the project has been as an educational tool for improving water use efficiency on golf courses.

3.3 How the above data will be used to evaluate success

The end goal of this project is to show a marked improvement in golf course water use efficiency and water savings. One of the most important aspects in attaining this goal is to accurately measure how much water is being used so that it can be better managed. Participating golf courses will have existing flow meters maintained by the local water agencies or will maintain their own meters and document their maintenance. The program will highlight the importance of meter calibration and maintenance.

Once the initial baseline of water use has been identified, all of the other information generated from the program will be used to validate the data and eventually the success of the project in attaining its goal. The data will be used to compare golf course water use to ETo, as defined in the certification levels (Appendix F). Success will be considered to be the achievement of reasonable water use efficiency.

3.4 How external factors will be taken into account

Historical ETo data are available from CIMIS¹⁴. These data will be correlated with courses' historical irrigation records. Analyses referenced to ETo will automatically compensate for climate variation.

Cropping programs or, in the case for golf courses, turf selection is a factor. If club officials determine that another turf grass should be installed on a course, this would alter water use data. For example, the water use requirement during the summer for a cool season turf in an inland valley differs from the water use requirement for a warm season turf in the same location. A mixed stand of cool and warm season turf will have different water use requirements than warm or cool season turf stands alone.

Social and environmental conditions could also have varied impacts. A sudden downturn in the economy may keep turf managers from irrigating as much as they would like or even need. Should extreme circumstances compromise water availability, turf managers may be required to drastically reduce water consumption. A golfer education campaign about accepting less than ideal playing conditions could be embraced and result in turf managers reducing their water usage. These are just a few examples of how social conditions could change the direction of the project. However, deviations from the existing project goals are not foreseeable in the three year period of the proposed program.

3.5 How data will be handled, stored, reported and made accessible

The Northern California Golf Association will serve as the repository of information for the pilot golf courses in Northern California and the Southern California Golf Association will serve in the same capacity for Southern California pilot golf courses.

The acquired information may include but is not limited to hard copy storage and computer database files. Duplicate copies of records and data for pilot courses in Northern California will be sent to those water districts that are participating in the program. All records stored at the NCGA will be copied and sent to the SCGA for backup copies, and vice versa. Information and

¹⁴ CIMIS is the California Irrigation Management Information System

data from the pilot courses could be obtained via the websites of both the NCGA and SCGA or via the participating water districts' staff contact.

3.6 Estimated costs of the monitoring and evaluation plan

It is estimated that 10 – 15% of the Director of Turfgrass Services's time will be spent on monitoring and evaluation. Because a focus of the program itself is data collection, the additional time for monitoring and evaluation will be relatively small.

Section 4: Innovation

This program is unique because it is the first time a state or regional golf association has developed a certification program for golf courses that can document efficient water use. Golf course superintendents across the state will benefit from this program's model of self-testing, water use monitoring, and system auditing.

The self-test portion of the program is intended to help develop methods that can be implemented to make irrigation practices more efficient. The water use and auditing methods will document the irrigation systems' condition and recent water use. Measuring improvements through the irrigation system evaluations should demonstrate golf course commitment to water conservation by highlighting significant water use savings.

In short, the methodology of an industry making a concerted effort to quantify and monitor water use and to create certification levels based on participation and detailed recordkeeping is pioneering and has potentially broad application to other outdoor water use industries.

The most innovative aspect of this project, however, is the creation of a partnership between water agencies and golf associations. The association formed by these groups will provide institutional infrastructure for the continuation of irrigation efficiencies over time by annual reviews and recognition of irrigation efficiency and consequent water savings. Establishing an ongoing program is critical to ensuring that behavioral changes, and thus water savings, are permanent.

Section 5: Qualifications of the Applicants and Cooperators

5.1 Resumes

Resumes of the project managers are attached in Appendix H.

5.2 Role of external cooperators

Representatives from the California Alliance for Golf and University of California Riverside, Division of Agricultural and Natural Resources will assist the advisory board. The California Alliance for Golf serves as a liaison to state and local governments and to the public, emphasizing the economic impact and positive environmental practices contributed by the California golf industry. University of California Riverside, Division of Agricultural and Natural Resources has a turf scientist who will also provide assistance.

Additionally, SCVWD is currently finalizing agreements with University of California, Davis's Horticulture Department, UCD's Soils Graduate Group and the Center for Irrigation Technology to map and evaluate two golf courses for recycled water. SCVWD is investing approximately \$200,000 of its funds into research. Work with these agencies will help inform the proposed project and illustrates SCVWD's commitment to assisting golf courses with water use efficiency.

5.3 WUE grant projects

Co-applicant SCVWD is the lead agency for a three-year Proposition 13 grant from the State Water Resources Control Board in the amount of \$899,995; this grant provides irrigation and fertilization management assistance in five counties. SCVWD also received a Prop 13 grant for \$100,000 for a landscape irrigation retrofit program, which is currently beginning implementation. Appendix I lists the \$3.4 million grant funds SCVWD received for fiscal years 01/02, 02/03 and 03/04.

As mentioned earlier, EBMUD is the Northern California lead agency for a weather based irrigation controller grant that will start in 2005.

Section 6: Outreach, Community Involvement and Acceptance

Broad outreach throughout the state to California golf course superintendents will be possible through the cooperation of the nationally-recognized Northern and Southern California Golf Associations in cooperation with the six regional Golf Course Superintendents Association chapters and with the four participating water districts. One golf course from each water district will be selected during each year of the proposed project. It is anticipated that thereafter the program will be established and will spread throughout the state through NCGA and SCGA outreach efforts.

Public recognition of the water efficiency improvements achieved by golf courses is an important component of the proposed program. The California Bay-Delta Authority's Environmental Justice fact sheet states that environmental justice means "increasing awareness, understanding and effective cooperation within and among communities." The publicity generated by the awards will not only acknowledge the work of the participating golf courses but will also encourage other golf courses to participate and will educate the public and surrounding communities about the positive steps the golf industry has taken to reduce water use.

Results and lessons learned from this project will be included in a detailed report on water-efficient irrigation systems, which will be written by the Advisory Board. This report will provide information and recommendations for golf course superintendents and will be made available to all interested golf course superintendents through the NCGA and SCGA, as well as the participating water districts.

Section 7: Benefits and Costs

7.1 Table C-1 Budget

The participating water and golf agencies have demonstrated their commitment to the project by pledging \$207,376 in matching and in-kind funds. See Appendix C for Table C-1.

7.2 Table C-5 Project Annual Physical Benefits

7.2.1 Qualitative Description of Benefits

Bay-Delta

Decreases in the quantities of water used by golf courses in the CALFED solution area are expected to be the main benefit. Consequent reductions in the demand for exported Delta water will help offset future predicted growth. Additionally, training and technical assistance with the appropriate use of recycled water will help prevent problems from recycled water irrigation, which should enhance uptake of the resource. Finally, because of its applicability to golf courses throughout the State, the proposed project satisfies the proposal solicitation call for “broadly transferable practices that improve the management and efficient use of the State’s water resources”.

Local

The project will promote water use efficiency among local golf courses. The significant project benefit will be to produce a sustainable program for golf courses to improve water use efficiency, assisted by local water agencies.

Additional indirect local benefits will be:

- increased awareness of water use efficiency among golfers through the public acknowledgement of improvements made by golf courses.
- energy savings from a reduction in water pumping.
- environmental, from a reduction in urban runoff. In *Improving Golf Course Irrigation Uniformity: A Case Study*, David Zoldoske points out that reducing runoff “can reduce the movement of fertilizers and chemicals that have been applied to the plants. In many urban settings, the runoff water ends up at wastewater treatment plants. The processing of fertilizers and chemicals is a serious problem for waste water treatment plants.” In some of the areas served by this project, such as Los Angeles County and the Bay Area, golf course runoff joins storm runoff, which travels directly to the Pacific Ocean.

Time Pattern and Location of Benefit (Bay Delta and Local)

Benefit time patterns vary among locations. Irrigation operations continue throughout the year in the desert areas of California. Irrigation is statewide in drought years. In general, though, the majority of benefits will be realized during the summer and fall months throughout the state.

Project Life: Duration of Benefits (Bay Delta and Local)

Significant benefits are not expected within the short term of the project. If the project successfully creates the foundation for golf course and water agency partnership for achieving water use efficiencies, the duration of benefits should continue indefinitely.

Why Project Bay-Delta benefit is Direct, Indirect or Both (Bay Delta)

The anticipated benefits of creating the golf-agency partnership are both direct and indirect. The direct project benefit of increased golf course water use efficiency throughout the CalFed service area will be a lessened rate of increase in demand from the service area water agencies for additional water supplies, and a reduced overall demand. An indirect benefit will be the increased efficiency of utilization of recycled water in large landscape environments. Appropriate use of recycled water will mitigate processing costs and improve community uptake of this resource.

7.2.2 Quantitative Benefits

Water savings are site-specific to each golf course and to each microclimate. The California Department of Water Resources CIMIS system has identified 18 general ETo zones throughout the state (See Appendix J - **18 Evapotranspiration zones**). A golf course in Zone 18 will save more water than a golf course in Zone 1 when applying the proposed project's procedures and programs.

According to *Economic Impacts of California's Golf Course Facilities in 2000*¹⁵ average water use for a golf course is 348 acre feet of water annually. The Northern and Southern California Golf Associations' survey of golf course superintendents discussed in section 1.1 found that the statewide water use average on a golf course was 345 acre feet annually. In *Improving Golf Course Irrigation Uniformity*, referenced in section 7.2.1, improving water use efficiency at each golf course by replacing sprinkler nozzles alone could result in water savings of 5-10% of ETo. Based on that report, a conservative reduction of 5 % in water use for each golf course equates to 17 acre feet of water savings per golf course. If the amount of water conserved is increased to 10%, the water saved per golf course increases to 34 acre feet annually.

To apply these water savings numbers to the 12 courses that will be in the pilot program for the first three years, the total amount of water saved at the 5% level could be 204 acre feet and 408 acre feet at the 10 % level.

When these conservative water use reductions are applied to all of the golf courses in the state, based upon the statewide average of water used on a golf course, the amount of water saved on an annual basis can range from 15,504 acre feet at a 5% reduction to 31,008 acre feet of water at a 10% reduction.

While the goal of the proposed project is to increase golf course water use efficiency, it is not expected to be cost-effective in its three year length. Rather, the expectation is that the program developed will be expanded statewide in order to realize significant savings on a state level.

¹⁵ Clemson University, Department of Agricultural and Applied Economics and University of California, Berkeley, Department of Agricultural and Resource Economics, August 2003.

Appendices

Appendix A - **Project Information Form**
Appendix B - **Signature Page**
Appendix C - **Budget**
Appendix D - **Irrigation System Self-Assessment Test**
Appendix E - **Irrigation System Documentation list**
Appendix F - **Certification Levels**
Appendix G - **Task List and Work Plan**
Appendix H - **Project Manager Resumes**
Appendix I - **Grants Received by SCVWD**
Appendix J - **18 Evapotranspiration zones**

Attachments

Matching Funds Commitment Letters

NCGA
SCGA
CVWD
EBMUD
MWD
SCVWD

Letters of support

California Urban Water Conservation Council
California Alliance for Golf
UC Riverside, Div. of Agricultural and Natural Resources

APPENDIX C

Applicant: Northern California Golf Association

THE TABLES ARE FORMATTED WITH FORMULAS: **FILL IN THE SHADED AREAS ONLY**

Section A projects must complete Life of investment, column VII and Capital Recovery Factor Column VIII. Do not use 0.

Table C-1: Project Costs (Budget) in Dollars

	Category (I)	Project Costs \$ (II)	Contingency % (ex. 5 or 10) (III)	Project Cost + Contingency \$ (IV)	Applicant Share \$ (V)	State Share Grant \$ (VI)	Life of investment (years) (VII)	Capital Recovery Factor (VIII)	Annualized Costs \$ (IX)
	Administration ¹								
	Salaries, wages	\$169,681	0	\$169,681	\$128,081	\$41,600	0	0.0000	\$0
	Fringe benefits	\$83,976	0	\$83,976	\$67,336	\$16,640	0	0.0000	\$0
	Supplies	\$900	0	\$900	\$600	\$300	0	0.0000	\$0
	Equipment	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
	Consulting services	\$61,212	0	\$61,212	\$0	\$61,212	0	0.0000	\$0
	Travel	\$5,114	0	\$5,114	\$1,458	\$3,656	0	0.0000	\$0
	Other	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(a)	Total Administration Costs	\$320,883		\$320,883	\$197,476	\$123,408			\$0
(b)	Planning/Design/Engineering	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(c)	Equipment Purchases/Rentals/Rebates/Vouchers	\$0	0	\$0	\$0	\$0	10	0.0000	\$0
(d)	Materials/Installation/Implementation	\$4,000	0	\$4,000	\$2,400	\$1,600	0	0.0000	\$0
(e)	Implementation Verification	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(f)	Project Legal/License Fees	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(g)	Structures	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(h)	Land Purchase/Easement	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(i)	Environmental Compliance/Mitigation/Enhancement	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(j)	Construction	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(k)	Other (Specify)	\$7,500	0	\$7,500	\$7,500	\$0	0	0.0000	\$0
(l)	Monitoring and Assessment	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(m)	Report Preparation	\$0	0	\$0	\$0	\$0	0	0.0000	\$0
(n)	TOTAL	\$332,383		\$332,383	\$207,376	\$125,008			\$0
(o)	Cost Share -Percentage				62	38			

1- excludes administration O&M.

Salaries, Wages and Fringe benefits - table below includes matching labor.

50% FTE program assistant for Year 2 and Year 3 to assist with data collection, record keeping and filing, correspondence to participating clubs and agencies, etc. (\$20.00/hr with 40% benefits)

	# wks/yr @ 40 hrs/wk	Total hours (3 years)	Wages/ hour	Total Wages	Fringe/ hour	Total Fringe
Half-time program assistant	26	2080	\$20.00	\$41,600.00	\$8.00	\$16,640.00
NCGA lead	6	720	\$40.88	\$29,433.60	\$16.35	\$11,772.00
NCGA support staff	4	480	\$15.00	\$7,200.00	\$6.00	\$2,880.00
SCGA Asst Exec. Director	3	360	\$50.96	\$18,345.60	\$15.44	\$5,558.40
SCGA support staff	2	240	\$31.21	\$7,490.40	\$8.90	\$2,136.00
SCVWD	3	360	\$36.78	\$13,240.80	\$41.93	\$15,094.80
MWD	5	600	\$45.75	\$27,450.00	\$17.31	\$10,386.00
EBMUD	2.5	300	\$36.57	\$10,971.00	\$46.43	\$13,929.00
CVWD	3	360	\$38.75	\$13,950.00	\$15.50	\$5,580.00
Total				\$169,681.40		\$83,976.20
Matched portion				\$128,081.40		\$67,336.20

Supplies **Line item total**
 Office supplies and postage for mailing brochures & meeting notices and shipping sprinklers to CIT at \$300/yr or \$900 total (includes NCGA match of \$100/yr and SCGA match of \$100/year for \$200/year or \$600 total). **\$900.00**

Materials/Installation/Implementation
 Educational Materials, design and printing of brochures, reports, and awards: \$4000 (includes NCGA match of \$400/yr and SCGA match of \$400/year for \$800/year or \$2400 total). **\$4,000.00**

Consulting services

Sprinkler testing by Center for Irrigation Technology (CIT): Testing is \$70/sprinkler head. 2 sprinkler heads from each of four courses per year = \$560/yr or \$1680 total. \$1,680.00

Distribution uniformity testing at \$333/test. Courses will be tested for two years. In Year 1, each of the four courses will be tested 6 times at a cost of \$1,998/course for a total of \$7,992. In Year 2, four new courses will cost \$7,992 plus there will be 4 more tests for each of the Year 1 courses (16 tests at \$333 = \$5,328) for a Year 2 total of \$13,320. In Year 3, four new courses will be tested at a cost of \$7,992, and the four courses from the previous year will be tested 4 times each (\$5,328) for a total of \$13,320. Total cost for 3 years is \$34,632. \$34,632.00

Contract database programmer to create templates for recordkeeping, reports and other documents and database for data analysis (40 hours a year at \$75/hr, or \$3000/yr and \$9000 for the program). \$9,000.00

Pump Efficiency Testing: Northern California courses \$1500 (2 at \$750), Southern California Courses \$2000 (2 at \$1,000) for \$3500 per year or \$10,500 total. (Northern California courses tend to have fewer pumps, thus the reduced cost for pump testing at these courses.) \$10,500.00

Testing of soil texture, infiltration rates, water holding capacity - four courses per year at \$450/course = \$1800/year or \$5400 total. \$5,400.00

Total Consulting services **\$61,212.00**

Travel

For advisory board members to teach educational workshops, attend board meetings (for program development, review and updates) and site visits. Estimated mileage is calculated at \$.405/mile. Total includes SCVWD motor pool use of 200 miles/year at \$81/yr, or \$243.00 total; CVWD motor pool use of 200 miles/year at \$81/yr, or \$243.00 total; and NCGA motor pool use of 800 miles/year at \$324/yr or \$972.00 total. Total estimated travel costs of \$4,149.60 (includes total match of \$1458). These estimated expenses are detailed below.

One Annual Advisory Board meeting in Northern California: airfare for six Southern California representatives (MWD, CVWD, UCR, SCGA, California Alliance for Golf and UCCE) @ \$200/roundtrip flight, or \$1200. Plus, mileage for Northern Cal attendees at an average of 100 miles per person for three people, or 300 miles for a total of \$121.50. \$1,321.50

Two Annual Advisory Board meetings in Southern California: airfare for three representatives (NCGA, SCVWD, EBMUD) @ \$200/roundtrip flight, or \$600 per meeting or \$1200 for two meetings. Plus, mileage for Southern Cal attendees at an average of 100 miles per person for six people or 600 miles/meeting. \$243/meeting or \$486 total. \$1,686.00

Mileage for advisory board members (estimated at three board members per workshop) to teach annual educational workshops: Average 100 miles/workshop for each of 3 people at four locations, 1200 miles/year. Total is 3600 miles for \$1,458. \$1,458.00

Mileage to visit golf courses for site visits: Average 80 miles/course. Year 1: four courses, or 320 miles, Year 2: eight courses, or 640 miles, Year 3: eight courses, or 640 miles. Program total of 1600 miles, or \$648. \$648.00

Total Travel **\$5,113.50**

Other

Costs for regional meetings and educational workshops, includes \$1000/yr from SCVWD, \$1000/yr from CVWD and \$500/yr from EBMUD; \$2500/yr or \$7500 total. **\$7,500.00**

Monitoring and Assessment

Monitoring and Assessment costs are included in Salary & fringe

Report Preparation

Report Preparation costs are included in Salary & fringe