California Department of Water Resources
2004 Water Use Efficiency Program: Section B – Research and Development

Application
for

Commercial Landscape Wireless Valve End Use Management Research Project

Submitted By

Central Basin Municipal Water District

January 11, 2004

Prepared By

PSOMAS

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I. PROJECT INFORMATION FORM

2004 Water Use Efficiency Proposal Solicitation Package

Project Information Form

Applying for: ✓ Urban ❑ Agricultural

1. (Section A) **Urban or Agricultural Water Use Efficiency Implementation Project**

❑ (a) implementation of Urban Best Management Practice, #_____

❑ (b) implementation of Agricultural Efficient Water Management Practice, #_____

❑ (c) implementation of other projects to meet California Bay-Delta Program objectives, Targeted Benefit # or Quantifiable Objective #, if applicable _____

❑ (d) Specify other: _____

2. (Section B) **Urban or Agricultural Research and Development; Feasibility Studies, Pilot, or Demonstration Projects; Training, Education or Public Information; Technical Assistance**

✓ (e) research and development, feasibility studies, pilot, or demonstration projects

❑ (f) training, education or public information programs with statewide application

❑ (g) technical assistance

❑ (h) other

3. Principal applicant (Organization or affiliation): Central Basin Municipal Water District

4. Project Title: Commercial Landscape Wireless Valve End Use Management Research Project

5. Person authorized to sign and submit proposal and contract:

Name, title	Art Aguilar and Rich Nagel, Co-General Managers
Mailing address	17140 S. Avalon Blvd., Suite 210, Carson, CA 90746-1296
Telephone	(310) 217-2222
Fax.	(310) 516-1327
E-mails	arta@wcbwater.org richn@wcbwater.org

6. Contact person (if different):

Name, title.	Gus Meza, Conservation Coordinator
Mailing address.	17140 S. Avalon Blvd., Suite 210, Carson, CA 90746-1296
Telephone	(310) 660-6209
Fax.	(310) 516-1327
E-mail	gusm@wcbwater.org

7. Grant funds requested (dollar amount): $492,155
(from Table C-1, column VI)

8. Applicant funds pledged (dollar amount): $414,667

9. Total project costs (dollar amount): $906,822
(from Table C-1, column IV, row n)

10. Percent of State share requested (%) 54%
(from Table C-1)

11. Percent of local share as match (%) 46%
(from Table C-1)

12. Is your project locally cost effective?

Locally cost effective means that the benefits to an entity (in dollar terms) of implementing a program exceed the costs of that program within the boundaries of that entity.

(If yes, provide information that the project in addition to Bay-Delta benefit meets one of the following conditions: broad transferable benefits, overcome implementation barriers, or accelerate implementation.)

- ❑ (a) yes
- ❑ (b) no

13. Is your project required by regulation, law or contract? If no, your project is eligible.

    If yes, your project may be eligible only if there will be accelerated implementation to fulfill a future requirement and is not currently required.

    Provide a description of the regulation, law or contract and an explanation of why the project is not currently required.

- ❑ (a) yes
- ✓ (b) no

14. Duration of project (month/year to month/year): November 2005- December 2008
15. State Assembly District where the project is to be conducted: 55- Jenny Oropeza
16. State Senate District where the project is to be conducted: 28- Debra Bowen
17. Congressional district(s) where the project is to be conducted: 37- Juanita Millender-McDonald
18. County where the project is to be conducted: Los Angeles County
19. Location of project (longitude and latitude) 33n50 and 118w17
20. How many service connections in your service area (urban)? 500,000 retail connections

    292 imported service connections
21. How many acre-feet of water per year does your agency serve? 109,465 AFY

22. Type of applicant (select one): ✓ (e) Public Water District

23. Is applicant a disadvantaged community? If 'yes' include annual median household income.

    (Provide supporting documentation.)

- ✓ (a) yes, (see Appendix D) median household income
- ❑ (b) no

II. SIGNATURE PAGE

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III. STATEMENT OF WORK

Section 1: Relevance and Importance

A. Project Goals and Objectives

Central Basin Municipal Water District (Central Basin) provides water to a 227-square mile service area, comprised of 24 cities and several unincorporated portions of southeast Los Angeles County. Central Basin's mission statement defines its operational objectives, as follows:

> *"To acquire, sell and conserve imported and other water that meets all required standards, and to furnish it to our customers, in a planned, timely and cost effective manner that anticipates future needs. The District serves as the official representative for its public at the Metropolitan Water District of Southern California. It also provides leadership, support, advice and communication on water issues to the people and agencies within and outside its boundaries, as appropriate."*

To continue to meet the mission statement objectives, Central Basin is requesting to partner with the California Department of Water Resources (DWR) on an exciting and innovative research study that will result in technology to be used for solving current problems associated with managing inefficient landscape irrigation systems. Central Basin, the primary applicant for the proposed project, has partnered with multiple water agencies and cities from a targeted area of 43 cities.

Central Basin proposes the Commercial Landscape Wireless Valve End Use Management Research Project (Project), which involves the implementation of wireless valve evapotranspiration (ET) controllers as a management technology to enhance water management and water use efficiency on local, regional, and statewide levels.

Based on recent reduction runoff studies, implementation of ET Controller technology has resulted in an estimated range of water savings of 18% - 27% of the total demand for exterior use.[1] However, since the irrigation systems in the proposal region, which includes Central Basin Municipal Water District (includes 24 cities throughout Los Angeles County) (see Map 1 in Appendix B), West Basin Municipal Water District (includes 17 cities throughout Los Angeles County) (see Map 2 in Appendix B), the City of Torrance (see Map 3 in Appendix B), and the City of Compton (see Map 4 in Appendix B), all have areas that operate on old wired communication, the wireless technology will allow implementation of an end use water management system to reduce irrigation demand through communicating wirelessly to irrigation valves. The Project will serve as a water use efficiency research project and will provide detailed analysis of the water savings, runoff elimination, management savings, and economic savings of utilizing an end use water management system over the traditional controller technology. The overall objective of the Project is to assess the feasibility of implementing an end use water management system that can wirelessly communicate to irrigation valves, which results in reduced imported water demands.

[1] Bamezai, Ph.D. Los Angeles Department of Water and Power (LADWP), *Weather based Irrigation Controller Pilot Study* (2004).

Specifically, the Project will include 130 HydroEarth ET Station Controller sites and Communication Systems, using the HydroEarth ET Controller technology in approximately 43 different cities, including 20 disadvantaged communities. Eighty of the sites will utilize a wireless HydroEarth irrigation valve operated remotely by a HydroEarth ET controller system, while 50 other sites will serve as control sites and include a Hydrosaver controller that will be operated manually. All of these systems will be managed through a local wireless server that communications with a central operation system for both management and recording of changes.

One of the Project goals, is to provide the water utility industry enough research data to determine if wireless irrigation valves and end use management is technically feasible for revolutionizing the management of exterior urban water use. The number one use of urban potable water is for landscape or exterior use. Therefore, the Project's ultimate goal is to reduce the water demand for commercial landscape irrigation. Consistent with California Bay-Delta Program objectives, the Project aims to reduce runoff migration, water losses from inefficient irrigation practices, the overall imported water demands, as well as to build upon existing water use efficiency concepts.

The four water agencies in the Project service area include Central Basin Municipal Water District, West Basin Municipal Water District, the City of Torrance, and the City of Compton, which are Metropolitan Water District of Southern California (MWD) member agencies and receive imported water from the California Bay-Delta. Central Basin and the participative agencies utilize imported water supplies for commercial landscaping purposes, which makes up approximately half of their total water demand.

Since the participative agencies' service areas have old wired irrigation systems, manual operations are required and result in a higher potential for over watering. This excess use of exterior water drains back into the creeks, streams, and ocean. One of the largest contributors to runoff pollution migration and water waste is non-residential commercial irrigation. This pollution migration ultimately harms the natural integrity of our water resources and wildlife. Utilization of wireless HydroEarth ET Controller Technology will provide a solution to reducing demands on imported water and high volume of runoff pollution.

The Project will have wide-spread transferable benefits to California and other states facing water use and runoff management issues that pollute rivers, oceans, and other bodies of water. One of the major goals of the California Bay-Delta program is to reduce urban water demands both directly and indirectly by reducing imported water demands from the California Bay-Delta region. The Project will meet California Bay-Delta goals and objectives by accomplishing the following:

Critical Assessment of Future Technology

Project research findings will:

- Contribute information on wireless valve technology to solve major irrigation management issues.
- Contribute information on end use management systems to solve irrigation management, runoff management and energy savings for water utilities.

Determination of Technological Capability

The Project will allow the following to be determined:

- The potential for end use management technology to empower water agencies to monitor and manage irrigation water use at any given time.
- The effectiveness of automatic ET programmable scheduling engines to allow multiple sites to be effectively managed from one location.
- The Autorecord report generation methodology, as developed with controller technology, will be able to address water use, water runoff and irrigation management.

Identification of Technological Applications

The Project will assess the ability to:

- Manage the entire irrigation system down to the irrigation valve from a central location that can be anywhere in the country.
- Adjust water scheduling for droughts and emergencies from a central location for regional or targeted areas.
- Adjust water scheduling during peak water use to address electricity cost, pressure problems and individual water use per site.
- Measure the amount of water savings for both the wireless valve over existing systems.
- Measure the traditional behavior of standard irrigation management without ET or automatic scheduling systems.

Data Development

Upon completion, the Project will produce the following:

- Statistical models to determine the best mixed use and commercial sites for targeting utilizing wireless valve and ET commercial controller central management systems.
- Baseline demand data for managed sites utilizing an ET controller central system by water management irrigation scientists verses the traditional managed sites.

Cost Assessments

The Project will provide reliable information to determine the cost of the following:

- Converting Hydraulic systems to a wireless system.
- Converting a broken wire system over to a wireless system compared to repair or replacement of the wired system.
- Cost and water savings to convert a street median stand alone system to a wireless central system.

B. Project Need

One of the major urban irrigation problems that continues to face cities today is the use of older inefficient hydraulic irrigation sprinkler systems (hydraulic systems) and the use of traditional electrical wired irrigation systems (wired systems) that have broken communication wires. The communication wires assist in managing controlling irrigation. Since these systems are old and/or broken, their use is contributing to the increased amount of imported water that the participative agencies purchase from MWD, which source includes the California Bay-Delta. This proposal seeks to install and test new technology that will provide a solution to upgrading older inefficient sprinkler systems that will reduce imported water needs.

Hydraulic systems tend to be approximately 50 years old and can not take advantage of Weather Based Irrigation Controller (WBIC) technology or central management irrigation systems to reduce water use. This is consistent with the irrigation systems within the participative agencies service areas. Older electrical wired sprinkler systems with broken electrical lines are difficult to find and repair, and as a result irrigation landscapers tend to operate those valves manually. Irrigation valves that are manually operated waste both water and staff time. Most of the hydraulic irrigation systems and older electrical systems are located in the oldest schools and park systems throughout California. By taking advantage of current proven wireless technology, the Project team has developed a solution to upgrade older systems or manually operated systems.

The current solution to solving the hydraulic and broken wired systems is to remove them completely and install a new electronic wired system. However, the cost of installing electrical wiring is not cost effective because it requires trenching through large turf areas and concrete (est. $3,000 - $10,000 with trenching costs).

To our knowledge, a wireless solution to a central managed system has not been tested to determine if a wireless irrigation controller valve can be utilized to solve the hydraulic and broken wire system problems. The wireless controller valve does not require any wires and uses radio waves frequencies to communicate from the irrigation valve to the controller.

A new solution has been developed, but has not been tested on a large scale. The solution is to utilize a wireless valve called “Valvelink” developed by HydroEarth, Inc., which will allow the water purveyors to replace the hydraulic valve system with an electronic valve system at parks, schools, and street medians (see Figure 1 in Appendix A). The electronic valve system will then be connected wirelessly to a Hydrosaver weather-based irrigation controller, which has an automatic irrigation scheduling engine designed to conserve water, minimize runoff, and meet landscape needs.

The Hydrosaver weather-based controller is connected to a central management server that can communicate two ways to the controller and to the valve (see Figure 2 in Appendix A). This allows the irrigation manager to know when systems are running, when there is a line break, and to monitor water use in the operation. The system operates automatically and records all information every 10 minutes, which is ideal for researching wireless valves to solve other major problems, such as street medians and other specific stand alone uses. Each server will include an ET sensor (real time data) that will communicate the weather data to each controller. Data from the California Irrigation Management Information System (CIMIS) will be downloaded to each server to compare/contrast the data against ET data. The goal is to have the most current and accurate “real-time” weather data for the local weather conditions.

Since the participative agencies utilize imported water from the State Water Project and Colorado River through MWD to meet irrigation demands, the Project will reduce this demand by enhancing water use efficiency of the imported supplies. MWD’s total water demands are projected to grow from 1,990,000 acre-feet per year in 2005 to 2,340,000 acre-feet per year in

2020.[2] In addition, total water use is projected to uniformly grow across counties. Based on demographic projections, Los Angeles, Riverside, and San Diego Counties will show the greatest increase in urban water demands. However, the largest total increase in water demand is expected to occur in Los Angeles County, an increase of over 400,000 acre-feet per year between 2000 and 2025.[3] Central Basin alone totals 227 square miles, and serves approximately 109,465 acre-feet per year. Therefore, it can be assessed that the cumulative imported water demand of all the participative agencies demonstrates the need to significantly reduce the imported water demand. The Project will reduce commercial landscape irrigation demand by a range of 18 % to 27 %.[4] As a result, the Project will meet the needs of the local community, region, and state by reducing imported water demand and capitalizing on multiple water use efficiency benefits.

In addition, the Project will save imported water purchased from the Bay-Delta for groundwater replenishment. Central Basin's service area utilizes a blend of imported water and groundwater from the Central Basin, which is managed by the Water Replenishment District (WRD) of Southern California. Groundwater is extremely limited in Southern California, and districts like WRD must carefully manage the groundwater basin by purchasing imported water to replenish the groundwater basin to ensure a reliable supply for future years. By reducing the overall demand of groundwater for landscape irrigation, imported water purchases for groundwater replenishment will be greatly reduced. Since imported water is more expensive than groundwater, imported water purchases will be firstly reduced once groundwater demands decrease as a result of water conservation efforts. The Project's cost effective technology that will reduce current demands on imported water supplies from the Bay-Delta will provide an economically feasible solution to limited water supplies.

The Project will fulfill the critical immediate need to conserve water use and reduce water demand on a local, decentralized level to provide regional and state-wide benefits. The incorporation of new technology will allow water managing entities to directly implement small scale projects to offset the overall demand of water and result in widespread benefits.

C. Plan Consistency

MWD Integrated Water Resources Plan

As member agencies of MWD, Central Basin and the participative agencies follow MWD's Integrated Water Resources Plan (IRP). The IRP is one of many water management plans that MWD abides by to provide 100 percent reliability. However, the reliability of MWD's imported water delivery is expected to decline as existing imported water supplies from the Colorado River and State Water Project face increasing challenges, unless new programs are implemented. Due to competing needs and uses for all of the water sources, and regional water operation issues, MWD and its member agencies developed the IRP in 1996. The overall objective of the IRP is the selection and implementation of a Preferred Resource Mix (or strategy) consisting of complementary investments in local water resources, imported supplies and demand-side

[2] Metropolitan Water District of Southern California, *Report on Metropolitan's Water Supplies: A Blueprint for Water Reliability*, March 25, 2003.
[3] Metropolitan Water District of Southern California, *Report on Metropolitan's Water Supplies: A Blueprint for Water Reliability*, March 25, 2003.
[4] Bamezai, Ph.D. Los Angeles Department of Water and Power (LADWP), *Weather based Irrigation Controller Pilot Study* (2004).

management that meet the region's desired reliability goal in a cost-effective and environmentally sound manner.

The Project fulfills the objectives of the IRP by implementing a demand side (end use) water management system that will wirelessly communicate to any irrigation valve only when landscape moisture levels fall below a specified threshold. The Project's indirect benefits to the California Bay-Delta will be feasibly implemented on a small scale approach, but will result in state-wide benefits.

WRD Strategic Plan

WRD's Strategic Plan (September 2003) complies with its Mission Statement, which states the following:

> *"To provide, protect and preserve high quality groundwater through innovative, cost effective and environmentally sensitive basin management practices for the benefit of residents and businesses of the Central and West Coast Basins."*

The Strategic Plan identifies 12 priority projects and programs, including groundwater conservation programs. Specifically, WRD's projects include storage programs, pipeline implementation to conserve water waste discharge into the ocean, water treatment and reclamation, groundwater replenishment, contaminant removal, and barrier injection wells.

The Project directly supports WRD's Strategic Plan to conserve water and increase water reliability. The Central and West Basin Municipal Water Districts' service areas include users that rely on a blend of groundwater and imported water. Therefore, implementation of the Project will allow WRD to continue to effectively manage the groundwater basins to meet demands and reduce the potential of increased imported water demands. The Project's conservation of commercial landscape irrigation will meet WRD's Strategic Plan for optimizing available groundwater supply.

Central Basin UWMP

The Project is consistent with the goals and objectives of the Central Basin Urban Water Management Plan, as detailed in the following Section D.

D. Water Demand Management Activities

Central Basin's 2000 Urban Water Management Plan (UWMP), identifies numerous water demand management activities that have been successfully completed and continue to be enhanced.

Water Conservation is the cornerstone of the Central Basin Municipal Water District's management strategy. Within the UWMP, conservation practices are outlined, and include education of adults and school children through public information programs and school education, water recycling on a District-wide scale, and the aggressive implementation of the Urban Water Conservation Best Management Practices. As signatory to the 1991 Memorandum of Understanding Regarding Urban Water Conservation in California (MOU), the agencies support the California Urban Water Conservation Council strategic plan for water conservation

through implementation of 14 Best Management Practices (BMP). Central Basin has consistently implemented the BMPs through multiple projects and programs, including the Ultra-Low Flush Toilet (ULFT) Give-Away Program, ULFT Rebate Programs, Large Landscape Conservation, and High Efficiency Clothes Washer Rebate Programs.

Specifically, the Project will enhance implementation of BMP #5: Large-Landscape Conservation. Since current information on the performance of ET controllers and other landscape technologies has not been well addressed in the water utility industry, this Project will significantly contribute to an agencies' ability to meet this BMP and reduce landscape water use. The Project will show the potential savings that end use managed systems may offer to traditional management systems. The data will determine the potential savings per square foot.

Section 2: Technical/Scientific Merit, Feasibility

A. Feasibility and Technical Adequacy

The water management industry has focused much attention on ET, or weather-based, controllers along with multiple programmable scheduled controllers. This technology, if used properly, can show 18% to 27% water savings based upon application. However, without proper ongoing irrigation water management of each controller, these systems lose their effectiveness. A sure solution is to implement the Project, which will test a cost-effective two-way communication system where a qualified irrigation manager can manage thousands of controllers from one location.

The Project's incorporation of HydroEarth utility management is designed to test this concept by providing two way communications, ET sensors and the only programmable irrigation scheduling engine developed to date. The concept of wireless valves also allows the exploration of a new technology application for solving irrigation problems that impact our coastal areas and river areas that suffer from water runoff related pollutants. It also addresses the most serious water waste in street medians, parks and schools from inefficient or broken landscape irrigation systems.

The Project includes six new technologies. The first new technology is a wireless valve that can be used for medians, parks, schools, hydraulics, residential or commercial setting. The wireless valve technology will be used to communicate to a controller, which will then communicate directly to a server management system, and lastly to the internet (see Figure 1 in Appendix A).

The second technology is a wireless two way communication system utilizing 900 MHz spread spectrum communication (referred to as SATlink). This system is a free bandwidth and will allow Project operators to talk to multiple controllers in one location (see Figure 2 in Appendix A). One server can communicate with up to 1,000 controllers within 1.5 mile range. This will give the controller the ability to receive both management and weather base adjustment commands as well as receive information on any program changes at the controller. Since the communication system is inexpensive, the ET signal adjustment will be free of charge to existing commercial ET controllers that are part of a wired system. Sites that do not have a wire related problem will have the ET signal adjustment installed to the existing system to compare the difference in the economic cost between wired and wireless valve technology and maintenance.

The third technology is the automatic programmable scheduling engine. This allows the irrigation scientist to view and adjust water use at the valve level from any location (see Figure 3 in Appendix A). All 13 BMP irrigation factors of the Irrigation Association are programmable into the scheduling engine and include three additional runoff factors that can take advantage of California Institute of Technology (CIT) irrigation cycles and soak methodologies, along with custom designs.

The fourth technology will allow the water agency to communicate with the controller system (and potentially other systems) for times of emergencies, droughts and peak deliveries (see Figure 4 in Appendix A). Emergency operations include on/off criteria to respond to fires and/or pressure losses within a system. Drought capabilities allow a water agency to adjust the watering levels based on the type of irrigation use. Peak delivery measures provide the local water agency the ability to adjust the scheduled water deliveries to reduce peak deliveries for both energy savings and pressure losses.

The fifth technology involves utilizing professional irrigation scientists to remotely monitor and manage multiple sites from one location. The irrigation scientists' mission is to reduce water use, improve plant/vegetation health, eliminate runoff, and work with the contractors to produce reports to document issues of concern.

The sixth technology will allow automatic reports to be generated on water use, runoff and other water related issues that occur on any site at any given time. The HydroEarth system is written in Microsoft format so it allows the creation of reports for various system formats (i.e. spreadsheets, databases, and word documents). The system currently generates over 75 reports and stores all the information in databases for future research. The system also is capable of recording when someone touches the controller and when there is a configuration change.

The Project will test and implement all six of these technologies at the same time. The successful completion of the Project will provide significant water savings and runoff elimination, which will cause irrigation management to shift from field operators to irrigation scientists. The program will provide water agencies and cities with a baseline concept behind end use management to prepare for emergencies, droughts and peak distribution.

As part of this Project, a testing protocol solution will be included utilizing 130 sites within schools, parks, large landscapes and street medians located throughout the identified region. Eighty of the sites would utilize a wireless valve HydroEarth management ET controller system. Fifty additional sites would have a Hydrosaver controller that would be operated manually by the landscape contractor but would be monitored by the HydroEarth central management system to track all the scheduled water uses and irrigation scheduled changes of the controller (in essence performing as a water use and behavior data logger). The Project area is serviced by four water agencies: Central Basin Municipal Water District, West Basin Municipal Water District, the City of Torrance, and the City of Compton, which encompass a total of 43 cities. Many of the prospective sites are located in disadvantaged communities that do not have the funds or resources to upgrade their older inefficient sprinkler systems (see Section IV. D for further discussion).

The research area selected consists of some of the most mature water systems and some of the most runoff water pollution sensitive regions of the state. The wireless valve and end use management system is targeted to address some of the biggest challenges facing cities and schools today, which is to manage the actual end use of water in a cost effective manner.

B. Task List and Schedule

This proposed Project is based on both sound water management principles, ET weather based management principles, and engineering principles to create a tool kit to evaluate end use management, a new theory in water management. The water management principles are built upon the Irrigation Association BMPs and ET weather based management principles that have been demonstrated in numerous studies. The engineering principles for managing a wireless valve include both communication and the ability to turn off a valve utilizing a wireless command driven by a central system.

The overall concept of end use management is derived from energy conservation, where different agencies send out commands to turn on/off air conditioners for homeowners and businesses for energy conservation. In this Project, these principles will be applied by utilizing wireless valves.

Central Basin, along with its program vendor, HydroEarth, has met with several agencies to describe the proposed Project and discuss system conditions. Many hydraulic and broken wired irrigation systems have already been identified through this preliminary research. Following is a list of the cities and agencies that have signed on to participate in this research Project thus far:

Table 1 – Project Participants

City/Agency	Contact	Phone Number	E-mail
Central Basin Municipal Water District	Gus Meza	310-660-6209	gusm@wcbwater.org
West Basin Municipal Water District	Gus Meza	310-660-6209	gusm@wcbwater.org
City of Torrance	Chuck Schaich	310-618-6221	cschaich@torrnet.com
City of Gardena	Dave Negrete	310-217-9564	dnegrete@ci.gardena.ca.us
City of Downey	Lee Sharp	562-904-7196	LSHARP@downeyca.org
City of South Gate	David Torrez	323-563-5490	dtorres@sogate.org
City of Manhattan Beach	Steve Didier	310-802-5000	sdidier@citymb.info
City of Redondo Beach	Joe Lewinsky	310-372-4136	
City of Compton	Michael Harvey	310-605-5500	
California Water Service Company	Candida Rocha	408-367-8230	crocha@calwater.com
Los Angeles Unified School District	John Fernandez	213-633-7252	

As shown in Map 3 and Map 4 in Appendix B, there are 24 cities served by Central Basin and 17 cities served by West Basin Municipal Water District. As part of the Project, Central Basin and

HydroEarth will continue meeting and identifying Project sites throughout the Project participant area.

Project Work Plan

The Project Work Plan consists of seven major tasks. Each task is described below along with detail on how each participating city, school and water agency will contribute to the task.

Task 1: Study Group (Site) Selection and Water Agency Data

1.1 Prepare Site Selection Criteria: HydroEarth will assist participative water agencies in developing site selection criteria.

1.2 Perform Site Selection for Wireless Valve System: Participative water agencies, cities, and school districts will conduct site selection based on selection criteria. 130 sites will be selected within clustered geographical areas in the participative cities and school districts. Sites will be selected based upon irrigation system problems that can potentially be solved using a wireless valve technology. Each selected site is based on a voluntary basis. To accurately conduct the study, problem sites will be purposely selected, including facilities with hydraulics, broken lines, and street medians. Each facility will be documented as a separate case study to examine if wireless valves would solve the problem economically, where other techniques of wiring and trenching would not.

1.3 Perform Site Selection for Two-Way Communication System: Sites that do not have a wire related problem may still have a HydroEarth ET controller system installed since the radio is covered in the communication cost. It will be used to compare the difference in the economic cost for wired and wireless valve technology and maintenance.

Task 2: Site Survey and Analysis

2.1 Perform Water Audits: Each selected site will have a water audit performed for the 19 Irrigation Association BMPs and programmed into the irrigation schedule.

2.2 Upgrade Major System Problems: Participative agency will fix any major problems (i.e. broken lines) so the system can be operating in proper working condition.

2.3 Train On Management Solutions and Download Water Audit Factors: Load water audit factors into the HydroEarth Water Calculation, and calibrate to determine the water savings.

2.4 Select Sites for Comparative Analysis: Participative agency, city, or school will select sites that will be used for comparative analysis in each area.

Task 3: Purchase, Installation and Configuration of Wireless Valves and ET Controllers

Each participating agency will receive at least one complete wireless valve ET controller end use management system and one standard Hydrosaver ET controller. Systems will be installed after completion of the site water audit and water use calibration.

3.1 Purchase Wireless Valves: Purchase 50, 24-station wireless valves.

3.2 Purchase ET HydroEarth Controllers Management Systems: Purchase 130 controllers and 40 management servers and 40 ET sensors and 40 rain gauge sensors.

3.3 Install Wireless Valve and Standard ET Controllers and Communication Systems: Contractor to confirm site water audits and water use calibration, and then install wireless valves and standard ET controller systems at selected sites.

3.4 Management of Installation and Configuration of ET Controllers: HydroEarth is responsible for the communication system and the proper configuration of the ET controllers. Websites for each site will be created for tracking and monitoring purposes.

Task 4: Data Compilation, Water Management, and Reporting

4.1 Data Compilation: Hydromaster controller management software will be used to compile data and activity information, and will produce a monthly report showing the water use, times people access the system, times people make changes to the system, daily and monthly ET, flow sensor report, the times the system is activated, the times water use exceeds the configuration for runoff (human intervention at site), and the amount of water that is used at the site.

4.2 Water Management: HydroEarth will manage the water use of each site via the Hydrosaver controller. HydroEarth will also compile the water use history for the targeted accounts and the control group during the course of the study.

4.3 Monthly Reporting: System data is compiled into monthly reports to show the results of active water management versus traditional management systems.

Task 5: End Use Management

HydroEarth will perform a series of end use management tests to determine the feasibility of end use management for drought, emergency and peaking situations faced by a utility.

5.1 Design End Use Management Test for Emergency: Design the testing for emergency capability.

5.2 Conduct End Use Management Test for Emergency: The test for emergency will be to turn systems on and off in a particular location based upon fire, water loss, etc. The test will interact with local fire department and water department commands.

5.3 Design End Use Management Test for Drought: Design the testing for drought capability.

5.4 Conduct End Use Management Test for Drought: Conduct the drought test across all systems. Test for drought will be through evaluation of the ease of adjusting irrigation systems by plant Hydrozone over a large range of controllers in different locations. Drought commands will be given by local water agency in percentage decreases.

5.5 Design End Use Management Test for Peaking: Design the testing for peaking management modules.

5.6 Conduct End Use Management Test for Peaking: Perform the Peaking Management Module test. The test for system peaking will be to adjust the controllers to balance out use over the course of time. This deals with pressure losses, requiring short term movement where all water use is moved over to the next day, and deals with energy costs, which is a long term problem requiring the delivery system to be balanced out over time. This will be done in cooperation with local water agency to simulate a zone.

Task 6: Economic Analysis

6.1 Prepare Year One Economic Analysis:

- **Comparative Water Use Analysis:** Bowman Cutter, Ph.D. from the University of California at Riverside (UCR), will take the compiled data with the costs, and compare the water use between the active water management accounts and the traditional management systems.
- **Perform Economic Analysis:** Bowman Cutter, Ph.D., will perform the economic analysis of wireless valves in comparison with traditional wired valves for upgrading various types of landscape situations.
- **Conduct Cost/Benefit Analysis of Water Management Systems**: Bowman Cutter, Ph.D., will evaluate the costs and benefits of active water management systems in comparison to no water management systems.

6.2 Prepare Year Two Economic Analysis: Conduct same three analyses as in year one.

6.3 Prepare Year Three Economic Analysis: Conduct same three analyses as in year one and in year two.

Task 7: Administration, Management and Monthly Reporting

7.1 Administration and Management of Grant Project: Central Basin will administer and manage the grant contract, all Project participants and the overall activities of the Project.

7.2 Prepare and Submit Quarterly Fiscal and Programmatic Reports: Central Basin will lead the effort in preparing quarterly reports to include fiscal status of the Project and programmatic status including water use data from the monitoring program. Reports will be submitted quarterly to DWR no later than January 15, July 15, and October 15 annually.

7.3 Prepare Final End Use Management and Wireless Valve Report: A comprehensive final report that describes the goals and objectives of the Project will be prepared collaboratively by Gus Meza of Central Basin, Dr. Bowman Cutter of UCR, and Ted Hunt and Phil Regli of HydroEarth. The report will include an executive summary that can be used as a “stand alone” document on end use management and wireless valves.

7.4 Final Report Publication and Distribution: Central Basin will compile the final report and as part of this Program, will utilize a technical editor that will professionally edit and assist in producing the technical report. Central Basin will be responsible for the publication and distribution with electronic copies being distributed via their website.

Schedule

Execution of the Project will be three years. Project site selection, installation of the wireless valve, and installation of the Hydrosaver controller management system will be completed in the first six months. The remaining time will be used to collect data information on the management system and to perform the various peak delivery, drought, and emergency tests to the system.

Schedule for Central Basin Municipal Water District
Commercial Landscape Wireless Valve End Use Management Research Project

Sub-Task	Task Name	Start	Complete
		(11/06/05 - 12/01/08)	
Study Group Selection and Water Agency Data			
1.1	Prepare Site Selection Criteria	11/06/05	01/06/06
1.2	Perform Site Selection for Wireless Valve System	12/06/05	01/06/06
1.3	Perform Site Selection for Two-Way Communication System	12/06/05	01/06/06
Site Survey & Analysis			
2.1	Perform Water Audits	03/06/06	05/06/06
2.2	Upgrade Sites	03/06/06	05/06/06
2.3	Train on Management Solutions and Download Water Audit Factors	03/06/06	05/06/06
2.4	Select Sites for Comparative Analysis	03/06/06	05/06/06
Purchase, Installation and Configuration of Wireless Valves & ET Controllers			
3.1	Purchase Valves	03/06/06	04/06/06
3.2	Purchase Controllers	03/06/06	06/06/06
3.3	Install Wireless Valves and Standard ET Controllers	03/06/06	06/06/06
3.4	Configure ET Controllers and Create Website for each site	04/06/06	07/06/06
Data Compilation, Water Management and Monthly Reporting			
4.1	Data Compilation	07/06/06	09/06/08
4.2	Water Management	07/06/06	09/06/08
4.3	Monthly Reporting	07/06/06	09/06/08
End Use Management Design and Testing			
5.1	Design Emergency Capability Test	10/06/06	11/06/06
5.2	Perform Emergency Capability Testing	12/06/06	01/06/07
5.3	Design Drought Capability Test	02/06/07	03/06/07
5.4	Perform Drought Capability Testing	04/06/07	05/06/07
5.5	Design the Peaking Management Module Test	06/06/07	07/06/07
5.6	Perform Peaking Management Module Testing	08/06/07	09/06/07
Economic Analysis			
6.1	Prepare Year One Economic Analysis	12/06/06	03/06/07
6.2	Prepare Year Two Economic Analysis	12/06/07	03/06/08
6.3	Prepare Year Three Economic Analysis	09/06/08	12/01/08
Administration, Management and Reporting			
7.1	Administration and Management of Grant Project	11/06/05	12/01/08
7.2	Prepare/Submit Quarterly Fiscal/Programmatic Reports	07/15/06	10/15/08
7.3	Prepare Final End Use Management and Wireless Valve Report	09/01/08	11/01/08
7.4	Final Report Publication and Distribution	11/01/08	12/01/08

C. Preliminary Plans and Specifications and Certification Statements

Since this is not a construction project, this section does not apply.

D. Environmental Documentation

The project is introducing new technology to already existing irrigation infrastructure and, therefore, this project should be considered Categorically Exempt under CEQA, based on Section 15301 definition of existing facilities. A Notice of Exemption will be prepared and submitted to the California Office of Planning and Research and the County of Los Angeles.

Section 3: Monitoring and Assessment

A. Monitoring Plan

1. Baseline Determination

A control group of 50 commercial landscape sites will be monitored to measure the actual traditional irrigation management pattern of landscape contractors. This data will provide the pre-Project conditions and baseline data. It is assumed that wireless valves will save more water than traditional irrigation systems and will save more staff time and money than ET Controller systems.

The control group will have a Hydrosaver controller installed with the existing irrigation system and will implement the controller into the existing irrigation schedule. To ensure accuracy of data, participative agency staff will be informed by the research team on how to replace the controller. Participative agencies will also call a 1-800 number to schedule an appointment to receive instructions on how to program the controller. Each water agency will also work with the research team to adjust for peaking, drought and emergency conditions to test the controller. They will receive hands-on training and participate in simulations to ensure accurate data production. The utilization of HydroEarth technology will provide extremely accurate data collection, assessment, and monitoring.

2. Monitoring Methodologies

The Project will utilize the most unique ability to study and monitor water use. The HydroEarth controller system has the ability to monitor and record every change made on the controller, either at site or via the management system (see Figure 5 in Appendix A). The changes made at the site will be considered manual changes performed by the contractors and will be recorded. Likewise, when the controller is changed via the management system, the system will be able to record the automatic changes done via an ET controller (CIMIS) or by an ET sensor or management commands (drought, emergency, peaking).

The ability to monitor system wide and down to the valve (wireless or wired) is captured in the Hydrozone Editor. Each valve is set up in a hydrozone, based upon all 19 Irrigation Association BMPs, as shown in the table in Figure 3 in Appendix A. The Hydrozone Editor includes factors

that adjust for runoff for the purposes of the research. Runoff cycle and soak equations will be utilized to eliminate run off. This allows each site to be evaluated via a remote site.

The Autorecord feature allows recordation and evaluation of the number of changes made, as well as documentation of the data in the Hydrozone Editor, including the hydrozone, schedule, cycle and soak patterns, water use, ET changes, and all the manual changes. In fact, the system can record over 75 separate reports on a daily basis. These daily reports are compiled into a series of special reports to show the actual water savings, in real time, over prior years.

This ability to monitor and record allows the research team to actually study sites from various locations scattered in different urban locations. The team will also be monitoring water use via meter reads from the selected sites.

3. Success Evaluation

Dr. Bowman Cutter, UCR, and the research team will determine whether there are statistically significant differences in water usage between case and control sites to determine the success of the Project. They will also examine the key determinants of water savings from controller usage. If there are significant differences, monetary savings from installing controllers at comparable sites will be estimated.

In addition, Dr. Cutter will assist HydroEarth, Central Basin, and the Project participative agencies with building a model to estimate cost savings to the water utility from drought, emergency and peaking scheduling. HydroEarth will also supply Dr. Cutter with data on estimated runoff reduction at wireless or wired controller sites. Using this data, Dr. Cutter will estimate avoided costs of runoff control from increased controller usage.

Lastly, the various economic analyses will be compiled into a report that will detail direct and indirect savings from installing wireless or wired controllers utilizing HydroEarth water management services. The series of analyses will provide an accurate assessment of the Project's successful completion of the stated goals and objectives.

4. External Factors

The HydroEarth technology allows the water utility to communicate with the Hydrosaver controller system (and potentially other systems) for times of emergencies, droughts and peak deliveries (see Figure 4 in Appendix A). The system is designed to address external factors, including emergency operations. The system includes on/off criteria to respond to fires and/or pressure losses within a system.

The system also accommodates for changes in weather. For example, during droughts, a water agency can adjust the watering levels. In addition, peak delivery measures provide the local water agency the ability to adjust the scheduled water deliveries to reduce peak deliveries for both energy savings and pressure losses.

5. Information Handling

As stated in the Project Work Plan, Project data will be gathered and stored through the HydroEarth system. The Autorecord feature of the system will allow evaluation of the number of changes made, as well as document the Hydrozone, the schedule, the cycle and soak patterns, the water use, the ET changes, and all the manual changes. These daily reports will be compiled into a series of special reports to show the actual water savings, in real time, over prior years, and will be provided to DWR to disseminate Project results in quarterly and final reports.

With city and water agency approval, the results of the Project will be available on the internet for public review, through the two-way system that records all irrigation activity. For each of the targeted sites, periodic photos of area runoff will be taken before and after Project implementation. These photos will also be posted for public viewing on the internet (see Section V. for further Discussion).

6. Estimated Costs for Monitoring and Assessment Plan

Monitoring and assessment costs are estimated at $43,200 for Year 1 only of the Project. Years 2 and 3 will be conducted by each site customer and will not be a cost to the Project .Refer to Section VII. B for detail on the estimated monitoring and assessment costs.

IV. QUALIFICATIONS OF THE APPLICANTS AND COOPERATORS

A. Resumes/Experience

The research team includes experts in end use irrigation design and management, along with experts in economic analysis. The team will collaboratively work to evaluate the sites, install the wireless valve, install the HydroEarth ET controller management system, and manage the Project sites. The lead members of the research team include the following.

- Central Basin Municipal Water District – Gus Meza, Project Manager. Responsible for Task 7, Reporting, and general oversight of all tasks.
- HydroEarth Inc. – Project Manager for installation, management and data compilation. Ted Hunt, Phil Regli and Tom Carr will be responsible for the following Tasks: Task 1) Study Group Selection and Water Agency Data; Task 2) Site Survey and Analysis; Task 3) Purchase, Installation and Configuration of Wireless Valves and ET Controllers; Task 4) Water Management, Data Compilation and Monthly Reporting; Task 5) End Use Management Design and Testing; and collaboration in a portion of Task 7) Reporting.
- Dr Bowman Cutter, UC Riverside – Economic Analysis and cost feasibility projects: Task 6) Economic Analysis and collaboration in a portion of Task 7) Reporting.

Resumes of the Project Management and the Research Team are provided in Appendix C.

Project Management

Gus Meza will act as the Project Manager with general oversight of all Project aspects. He will work closely with the Project team members and the Department of Water Resources, in order to provide the required reports and information. Mr. Meza is the Conservation Coordinator for Central Basin Municipal Water District. He has a Bachelor's Degree and his AWWA Grade 1 – Conservation Practitioner's Certificate. He has over six years implementing conservation programs. Mr. Meza's resume is included in the Appendices.

Research Team

Ted Hunt, MS, JD, will serve as the project manager for installation, set up and data management of the HydroEarth ET Controller management system. Ted Hunt has led the research and field team that has successfully managed all of the ET weather based controller studies and residential runoff reduction studies of the Municipal Water District of Orange County that were conducted in the City of Irvine. Mr. Hunt has a Masters degree in irrigation engineering from Cal Poly Pomona and a Law degree from Western School of Law.

Phil Regli, MS, MBA, will be responsible for the testing of the emergency, drought, and peak interactions of the system with the various water agencies. Phil Regli has over 15 years of water conservation management experience throughout the states of Arizona, Nevada and California. He also has spent five years exploring technological advancements for water conservation and is credited for the invention of environmental rates, environmental conservation and the utility platform, as well as the theory of end use water management. This theory will be tested in the course of this Project. Phil Regli has served on the National AWWA water conservation committee for six years and the AWWA finance rate and charges committee for four years. He has composed three books and a series of articles and presentations on environmental rates and environmental conservation. Phil Regli currently is the CEO of HydroEarth, a water conservation end management controller solution service system. He has a Masters degree in Natural Resource Economics from the University of Arizona, an MBA from Arizona State University, as well as a BS from UC Davis in Applied Economics.

Tom Carr is the president of Hydrosaver and the inventor of the Hydromaster and HydroEarth controller management system. Mr. Carr has over 30 inventions in the field of water management including the first and only ET electronic sensor, the electronic tensionmeters, the ET controller, the wireless valve and the Hydromaster software and management system. Tom Carr will be responsible for ensuring that all the systems are installed properly and the wireless valves, ET sensors, controllers, communication system and servers are operating properly throughout the research study. Tom Carr has been the leading inventor in ET controllers over the last 10 years and his company, Hydrosaver, has over 2,500 ET controllers installed throughout the state of California.

Bowman Cutter, PhD, Assistant Professor, Department of Environmental Sciences, UC Riverside, will be responsible for the economic and environmental analysis of the wireless valve irrigation management study. He will perform an independent analysis of the performance of the wireless valves, the irrigation management system, the study of the traditional water management system, and the end use study of the uses of emergency, drought, and peaking.

Dr. Bowman Cutter and his team will examine the performance of the case and controls for at least three years. The team's first responsibility is to help select case and control sites for the controllers experiment. Then, they will receive and collate data on past water use at the case and control sites from the water agencies, followed by data information including daily water use data from both control and case sites from HydroEarth Management services.

B. External Cooperators

As noted previously, Central Basin will collaborate with three other water agencies to install the HydroEarth ET Controller Systems in their service areas. Central Basin will also collaborate with up to 43 different cities within these service areas and the Los Angeles Unified School District for site selection.

C. Previous Water Use Efficiency Grant Projects

In 2003, Central Basin was awarded a Proposition 13 grant for a Water Use Efficiency Program. In June 2003, Central Basin, along with its program vendor, developed an effective direct install *Water Free Urinal Program* (Program). The Program continues to be successfully implemented and marketed throughout Central Basin's service area.

Within the first quarter of the project timeline, over 300 devices were installed and another 200 are scheduled for installation. The community is well aware of the Program through extensive marketing efforts. In July 2003, Central Basin hosted a "kick-off" luncheon to promote the program and invited local mayors, water agency directors and business leaders. Central Basin also hosted a plumber's workshop where local plumbers were invited to participate in the installation of the water free urinals. The program continues to be marketed to the Commercial, Industrial, and Institutional (CII) sector.

The Program goal is to install 2,600 urinals that will save over 300 acre-feet per year. The water savings will offset the vast demands on imported water from the Bay-Delta. This is a great example of how Proposition 13 state funding is being effectively utilized to conserve water and reduce overall water demands.

Due to the Program's recent success, Central Basin plans on including similar types of marketing techniques to disseminate results in this Proposition 50 proposal, as described in Section V. It is Central Basin's goal to develop an effective program that will utilize state dollars to reduce the amount of water that is being imported from the Bay-Delta.

D. Disadvantaged Communities

Many cities targeted by this project meet the definition of a disadvantaged community. Of the 43 cities and unincorporated areas targeted for the Project, the following are under $38,000 per year median household income per the data prepared by the Los Angeles Almanac compiled from the 2000 U.S. Census, as provided in Appendix D:

Bell Gardens	$30,597
Bell	$29,946
Commerce	$34,040
Compton	$31,819
Cudahy	$29,040
East Los Angeles	$28,544
Florence-Graham	$25,425
Hawaiian Gardens	$34,500
Hawthorne	$31,887
Huntington Park	$28,941
Inglewood	$34,269
Lennox	$28,273
Lynwood	$35,888
Maywood	$30,480
Paramount	$36,749
South Gate	$35,695
Walnut Park	$35,837
West Athens	$35,423
Westmont	$23,323
Willowbrook	$27,811

These disadvantaged communities represent 20 cities of the 43 targeted or 47%. The Project will provide the funding and resources necessary to assist the disadvantaged communities in reducing water consumption. A map of the disadvantaged communities within Central Basin's service area is shown in Map 5, Appendix B.

V. OUTREACH, COMMUNITY INVOLVEMENT, AND ACCEPTANCE

The Project results will be released throughout the entire process to the targeted industries that would utilize successful elements of the new irrigation management model. The results of the Project will also be released through traditional public press releases led by Central Basin. Project information will also be disseminated through the District's Public Information Committee.

If the Project proves successful, the elimination of dry season runoff along with a permanent water savings will be readily implemented. All of these applications can be applied to water sensitive regions throughout the state, especially those located adjacent to river and ocean areas.

Since this is a dynamic process using a two-way system that records all irrigation activity, the data will be available on the internet for the public to view the results. For each of the targeted sites, the Project will promote the changes before and after in real time. Periodic photos of areas

that have natural runoff flows will be taken to show the reduced runoff from Project implementation. The photos will be made public to provide a before and after visual comparison.

A series of articles and presentations on the Project ideas, concepts and results will be given to all of the leading water related and governmental associations that would benefit from both the micro (the wireless valve solutions for solving irrigation problems) and the macro (the reduction of runoff, and emergency, drought and peaking management) end use water management elements.

A Project website and a link for all participating cities and agencies will be available, along with photos and images of each site. The sites will receive live data updates for those who are interested in the projects. Also, there is potential for participating agencies to install a live web-camera to capture water use during the Project.

Project results will also be jointly disseminated through Central Basin and West Basin Municipal Water Districts' strong public outreach programs. The agencies organize and manage a Public Information Committee (PIC), which is made up of Public Information and Public Affairs Officers from cities and water agencies within their service areas. Schools and community organizations receive educational programs to promote the importance of conservation and recycled water, and the success of the Project will be incorporated into these materials, once completed. Central Basin and West Basin Municipal Water Districts are also active in the California Water Awareness Campaign (CWAC), which is an association formed for the purpose of coordinating efforts throughout the state to promote water awareness. The Project results will also be presented through the CWAC and shared with its members.

The participating cities, along with the community at large, accept and support the objectives and goals of the Project. To demonstrate their commitment to participating in the Project, letters of intent were provided by the City of Manhattan Beach, City of Downey, City of South Gate, and the City of Torrance. In addition, the California Urban Water Conservation Council provided a letter to support the Project's development of new technologies and products to reduce outdoor water use. Also, the Project is supported by the private water sector, as demonstrated by the letter of strong support provided by the California Water Service Company. The letters of intent and support are provided in Appendix E.

VI. INNOVATION

This entire research study is based upon a series of innovations that collaboratively work to revolutionize two industries. The concept of end use management is innovative in itself, as it completes the picture of demand management and provides a new set of tools to allow a water agency to control water demand. This ability to control when water is utilized not only allows an agency to address drought, water shortages, emergencies, and peaking, but it also impacts rate design, system design and even the actual role of water utilities. In essence, water utility management would shift from a water provider to a water service provider.

Another innovation is the automatic scheduling engine that is programmable to control runoff. The HydroEarth program utilizes all 19 Irrigation Association BMPs, as recommended by irrigation scientists, in an automatic programmable scheduling engine program. Built into this

program are the factors of soil type and slope, which are crucial in managing runoff. This system will demonstrate and document the reduction and potential elimination of dry season runoff. This technology eliminates the complexity of programming for dry season runoff, which is to difficult for most contractors to control with today's irrigation controller. This system is almost impossible to replicate in the field because it incorporates over 5,000 equations just to perform the scheduling. This is the most advanced scheduling engine ever designed, as it is designed to provide any trained irrigation auditor the ability to program in less than 30 minutes. The system also includes the ability to block out times when families, businesses, schools, or parks are installing the program. For example, if a park has an upcoming fair, the management team can block out a time not to water, and the system will recalculate the watering schedule in order to provide the calculated water amount. The system is geared for both website programming and server programming.

A third innovation is the two-way communication system utilizing 900 MHz radio system. This system makes the communication bandwidth inexpensive to allow homes or business participants due to the reduction in land line telephone costs. The radio system is designed for multiple users so homes, business, parks or schools can all utilize the same radio system at a minimal cost.

The wireless valve technology is the first to communicate from the valve to the controller and to the server, so it can be centrally managed and maintained. It empowers each person the ability to manage sites that would not have been possible due to high costs. However, if wireless valves, which have the ability to communicate to the central system, demonstrate a low maintenance cost, the results would challenge the use of wired systems.

The Hydrosaver weather-based controller is the first ET controller to allow the use of any type of graphic, photo or image to manage the controller. The controller management system is designed in a graphical format – which allows PC or Macintosh application. This makes formatting images easier to accomplish, which allows communication over a particular issue or site. It is the only system in the world that allows common application of end use management.

This Project provides the ability to store every data point and analyze them down to the valve, which has never been accomplished previously. In addition, the Project's ability to evaluate the economic advantages of going to a wireless valve solution over a wired irrigation system has also never been done before. The Project utilizes technology that is designed to record every use at the controller, at the server, and then the recordings are entered into a database for future analysis.

VII. BENEFITS AND COSTS

A. Benefits

The Project will significantly benefit the water industry by serving as a benchmark study on wireless valve communication to a central management system. The Project also provides the first introduction to end use management for the irrigation and utility industry.

The Project data will become available for future studies in energy, emergency, drought, and peak management. If end use management becomes the norm, water savings can be guaranteed by the water utility since the actual end use will be managed at all times. The potential water savings becomes locked into the system once it is calibrated and then managed.

Additional impacts become even more significant if peaking can be leveled off, solving the issue of pressure or energy management.

The Project will benefit the irrigation and water utility industry by producing the following data:

1. Daily use by type of landscape, by valve and the purpose (street median, park, school).
2. Cycle and soak methods for different slopes, soils, plants and weather conditions.
3. Application of emergency (shut off) in multiple situations with a phone call.
4. Research for fire departments for the benefit of shut off capability.
5. Research for water department for the benefit of shut off for pressure loss in a zone.
6. Research for city and end user for the benefit of drought management (adjustment for different degrees of deficit irrigation).
7. Research for the water agency to study for peak management – adjust end use water for peak use in both energy and water savings.
8. Cost/benefit ratio for utilizing wireless valves to a central management system compared to converting to a wired valve central management system.
9. Cost/benefit of an ET end use water management system with professional management compared to the traditional irrigation management system.
10. Evaluation of runoff management methodology built into complex and demanding parks and school systems.
11. Evaluation of water savings on a square foot basis comparing street medians, parks, and schools using end use management systems.

In addition to the Project's benefits to the water industry, Project implementation will directly and indirectly benefit the Bay-Delta, as described in Table C-5 in Appendix F. Since landscape irrigation demands require approximately half of the imported water supply, which is derived from the Bay-Delta, the reduction of landscape irrigation demands will offset the imported water demands. In addition, the Project will reduce overall water demands throughout Southern California for landscape irrigation. If the Project proves successful it may be rapidly implemented in irrigation systems throughout Southern California causing an immediate reduction in the imported water demand.

Consistent with the Bay-Delta goals and objectives, the Project will increase the flow and supply of water in the Bay-Delta, as well as enhance water quality by eliminating dry season runoff from adjacent landscape irrigation. The total amount of runoff reduction will be measured on a site by site basis and will correlate with the reduction in water demand.

Based on a study conducted by the Los Angeles Department of Water and Power (LADWP), it is anticipated that the Project will increase water savings by 18% to 27% of the total irrigation

water demand.[5] The LADWP study showed an average savings of 83 acre feet for 86 total landscape acres, which calculates to approximately 1 acre foot of water per acre of landscape. The study was based on 100% large landscape accounts, some of which showed wasteful irrigation patterns. It is anticipated that the wireless valve research study (Project) would result in these savings since many of the irrigation sites include broken wires or hydraulics that are traditionally more wasteful in water use. As previously stated, the time management to maintain the system is also higher than if the wireless irrigation system is implemented.

Based on the study results that showed savings of 1 acre-foot per acre of landscape, it is estimated that a total of 185 acre-feet per year will be saved. Thus, the total water demand will be reduced by 185 acre-feet per year. Out of the 80 research sites that will have the wireless valve technology implemented, 60 of the sites will be approximately 3 acres, for a total of 180 acre-feet of water saved, while 20 of the sites will be approximately .25 acres, for a total of 5 acre feet of water saved. Combined, the result is 185 acre-feet of water saved. However, this combined amount may be conservative since some of the sites significantly waste water due to broken wires or hydraulic systems. Therefore, water savings and demand reduction may prove more significant than preliminarily determined.

The Project's ability to remotely control multiple irrigation systems from one location will expand the region-wide operations of landscape irrigation, allowing various systems to be regulated for water use efficiency. In addition, the Project allows for efficient water management through immediate notifications of system inefficiencies. The expansion of management capabilities will greatly assist in the local, regional, and statewide benefits by enhancing water use efficiency. The economic feasibility of the Project also encourages rapid conductivity of the management tools and technically innovative systems. The Project may virtually be applied anywhere in the United States, as the system mechanisms adjust to the specific hydrologic characteristics of an area to provide accurate data collection and monitoring of soil moisture. Therefore, the Project may directly benefit the Bay-Delta if the Project is implemented by agencies that pump directly from the Bay-Delta. The versatility of the Project promises indirect and direct benefits to the Bay-Delta, the state, and the country as a whole.

B. Project Costs

Total Project costs are detailed by Task and shown in Appendix F, Table 1 in distinct annual budgets for three years. Total grant request and total matching funds are also detailed. The following presents the Project cost detail, which is also summarized in Table C-1.

Total Project Costs

Total Project costs for all tasks are estimated at $906,822, which includes a 5 percent contingency. Central Basin and the Project partners will provide 46 percent in matching funds, and request $492,155 in Water Use Efficiency Program grant funds.

[5] Bamezai, Ph.D. Los Angeles Department of Water and Power (LADWP), *Weather based Irrigation Controller Pilot Study* (2004).

Year 1 Project costs total $734,398 or 81 percent of total Project costs resulting from project implementation activities, including site selection and preparation, and equipment purchase, installation and configuration.

Years 2 and 3 of the Project include the majority of water management, data compilation, monthly reporting, end use management design and testing, economic analysis, and administration, management and reporting. Year 1 includes a portion of these activities and costs, since installation of controllers are anticipated within 9 months from the start of the Project.

In order to determine costs for Project elements, the following costs were estimated for equipment and specific activities:

ET Station Controller & Communication System (24 station) (each)	$	2,400
Wireless Valve Solution (24 station) (each)	$	2,400
Installation of Wireless Valve (each)	$	2,400
Active Management ($30/month) (annual cost)	$	360
Passive Management (communication system/recording) (annual cost)	$	180
Wireless Valves (each)	$	100
Installation Valve (each)	$	100

Total Matching Funds

MWD Matching Funds

MWD will contribute up to 50 percent of the cost of the ET controllers through its Water Conservation Program. MWD has committed up to $500 per acre of landscape up to 50 percent of the cost of the ET controller. The majority of the Project sites will be parks and schools with two to four acres of landscape, confirming an MWD contribution of approximately $1,500-$2,000 per site. Case samples of street medians would be an exception and would be somewhat less.

MWD Contribution (100 systems x $2,400 x 50% x 1.05) $ 126,000

Central Basin In-Kind Contribution

Central Basin will contribute staff time to assist with controller site visits, conduct grant management, conduct/participate in Project meetings, prepare invoices and quarterly reports, and prepare and distribute the final report.

Central Basin (130 controller sites x 4 hours/site x $66/hour x 1.05)	**$**	**36,037**
Central Basin (Contribution to the End Use Management Study)	**$**	**2,741**
	$	**38,778**

Local City and School District In-Kind Contribution

Local schools and city parks will contribute in both the evaluation of the site, the hiring of contractors and/or will perform the installation of the wireless valve. They will be involved with the management program and the data gathering of both management and water savings. It is anticipated 25 percent of the schools/parks sites will have the ET valves installed by the cities and districts.

Installation of valves is a one time cost, the Management Fee will be charged monthly for a period of two years, and the Communication Line is charged monthly for the three-year Project period.

Site Selection Criteria and Site Selection (4 agencies x 20 hours x $40/hr x 1.05)	$	3,360
Site Preparation (100 sites x 2 hours x $40/hr x 1.05)	$	8,400
Water Audits (50 sites x 4 hours x $40/hr x 1.05)	$	8,400
Upgrade Sites (50 sites x 50% x 4 hours x $40/hr x 1.05)	$	4,200
Management Solutions Training and Water Audit Factors (4 agencies x 3 hours x $40/hr x 2 x 1.05)	$	1,008
Select Sites for Comparative Analysis (4 agencies x 6 hours x $40/hr x 1.05)	$	1,008
Installation of Valves (24 valves x $100 x 25% x 50 sites x 1.05)	$	31,500
Management Fee for Active Sites ($360/year x 80 sites x 2 years x 1.05)	$	60,480
Communication (phone) Line for Controller Group ($180/year x 30 sites x 3 years x 1.05)	$	17,010
Participation in the End Use Management Program Tests	$	2,741
Total City and District Contributions	**$**	**138,107**

HydroEarth Company

HydroEarth and Hydrosaver are the marketing and manufacturing operation for the Valvelink wireless valve. HydroEarth Company will contribute an in-kind match for the following tasks/subtasks: 1) assist cities/districts with site selection criteria; 2) assist water agencies with water audits; 3) train cities/districts on management solutions and downloading water audit factors; 4) management of system installation; 5) water use data compilation and analysis; 6) perform end use management design and testing; and 7) assistance with report development for the Project.

Water use data compilation and analysis includes the following:

- Monthly reports on wireless valve controller water use compared to ET controllers
- Evaluate runoff formula for zero runoff for street medians
- Compare program data to water use meter data for analysis
- Compare site data to other similar sites
- Evaluate runoff formula for zero runoff with flow sensing data
- Compile and prepare an activity report on each controller

Assist Cities/Districts with Site Selection Criteria (20 hours x $50/hour)	$	1,050
Assist Agencies with Water Audits (4 agencies x 3 hours x $50/hour)	$	630
Train on Management Solutions (4 agencies x 3 hours x $50/hour)	$	630
Installation Contractor Coordination (130 sites x 4 visits x $75/visit)	$	1,323
Data Compilation, Analysis and Testing (130 sites x 10 hrs x $50/hour)	$	54,600
End Use Management (Peaking, Drought, Emergency configuration and Testing	$	53,550
Total of HydroEarth In-Kind Contribution	**$**	**111,783**

APPENDIX A – FIGURES

Figure 1 – Valvelink Wireless Valves

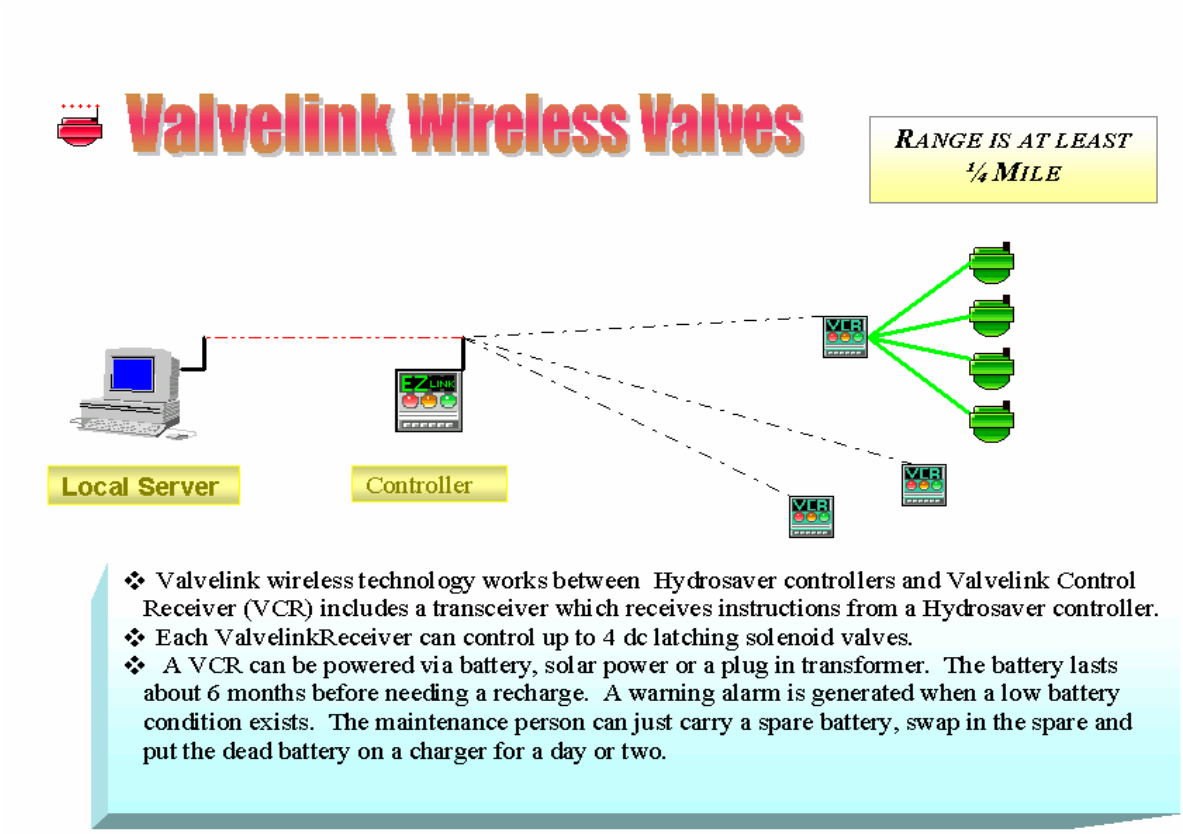


Figure 2 – HydroSaver System Basics

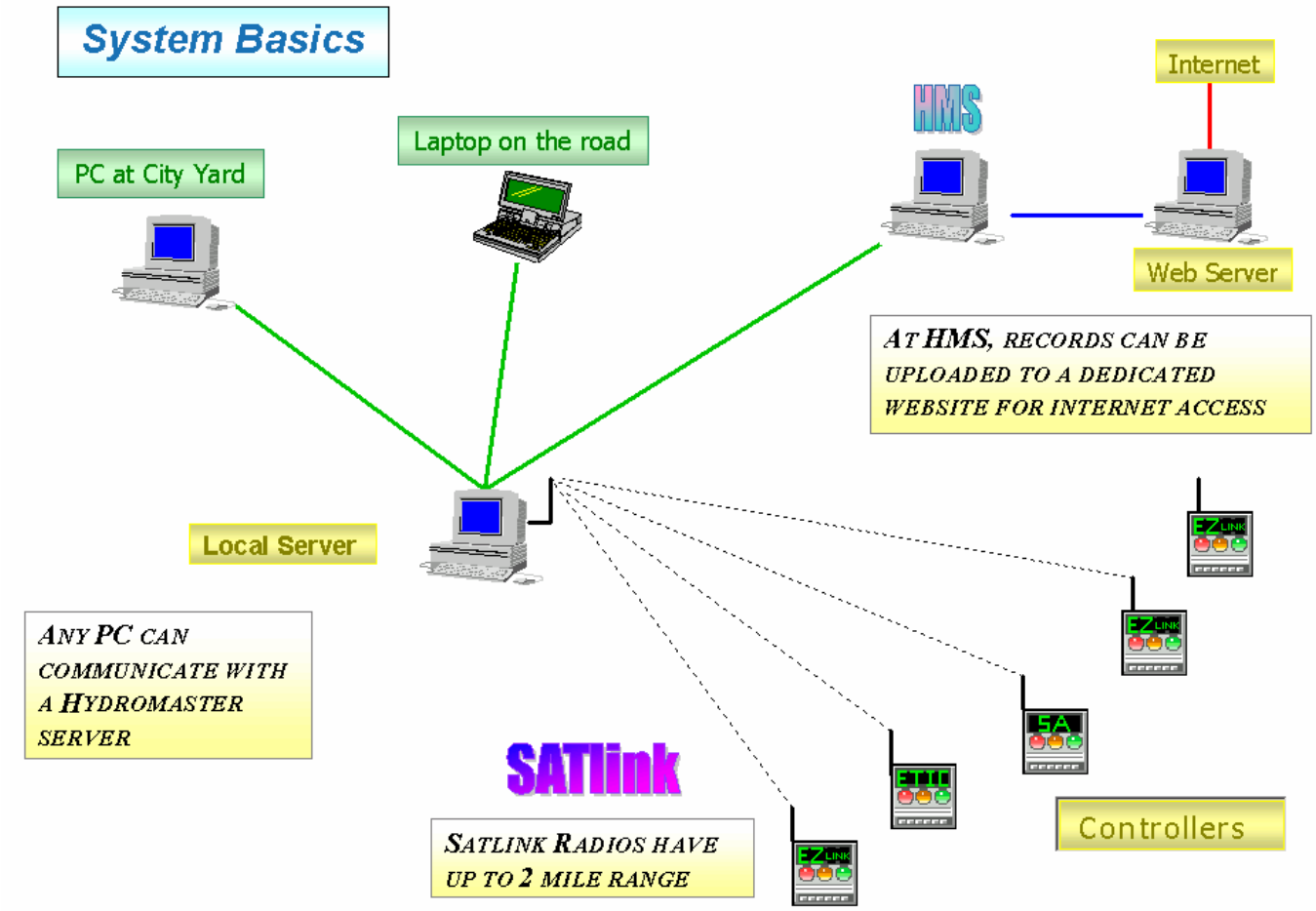
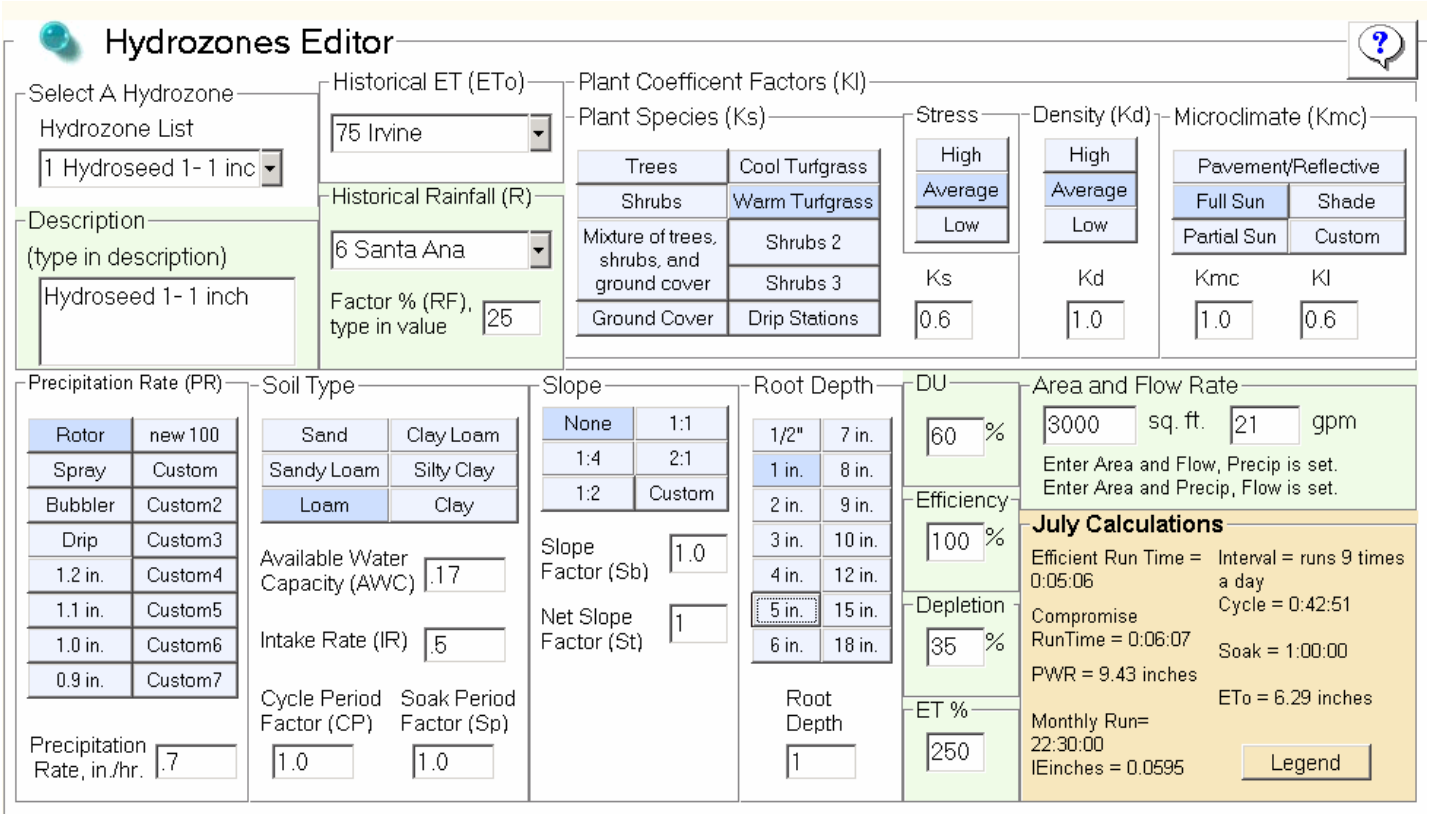


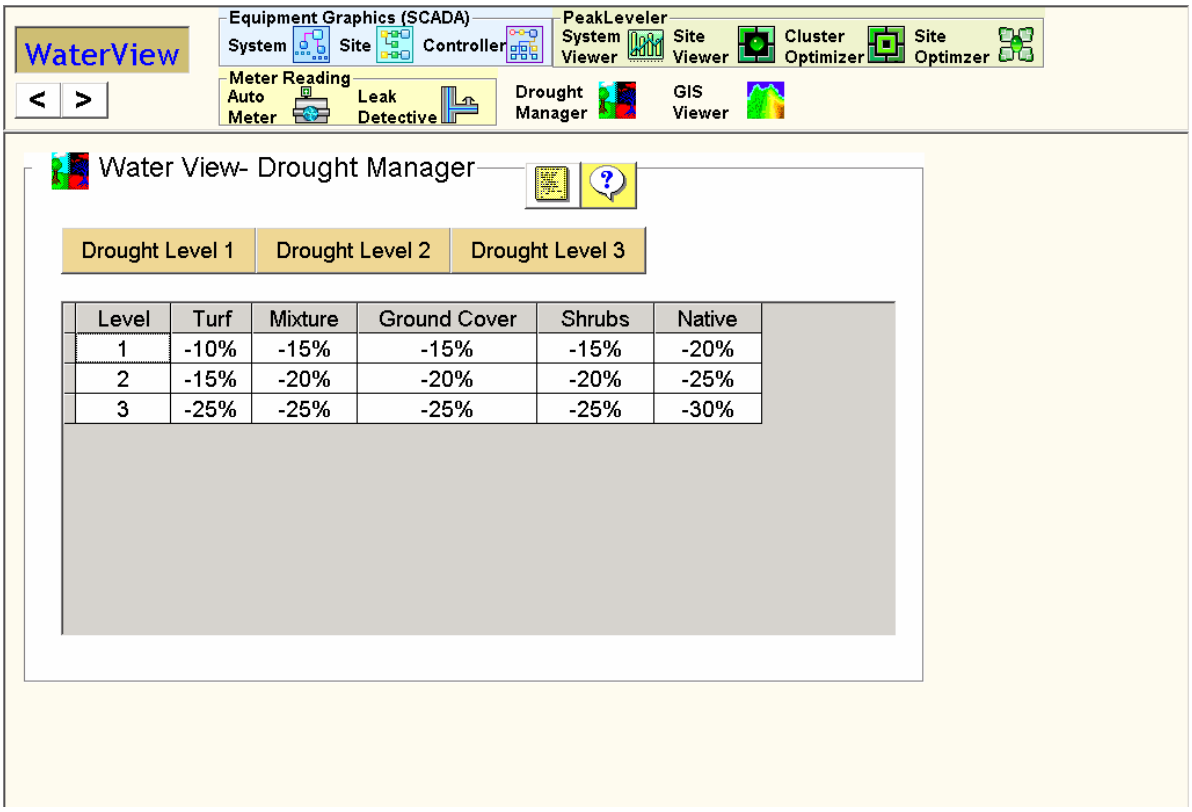
Figure 3 – Hydrozones Editor



Hydrozones Editor System Elements

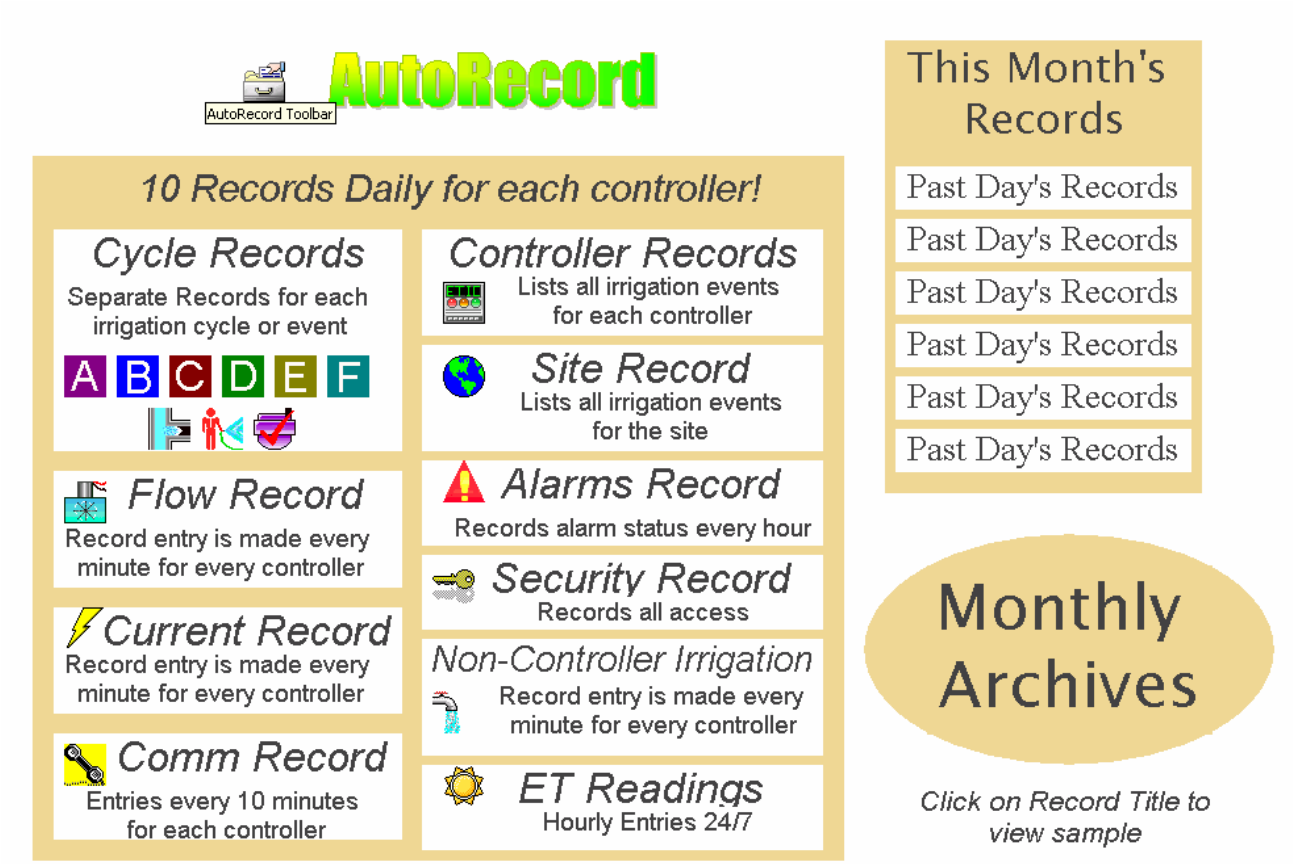
Hydrozone	Cycle Period (CP)
Historical ET (10 year)	Soak Period Factor (Sp)
Historical Rainfall	Slope
Pant Species	Net Slope Factor
Plant Stress	Root Depth
Plant Density	Distribution Uniformity
Plant Microclimate	Water Efficiency of the Irrigation Manager
Precipitation Rate	Depletion
Soil Type	ET %
Available Water Capacity	Area and Flow Rate
Intake Rate	

Figure 4 – Drought Manager



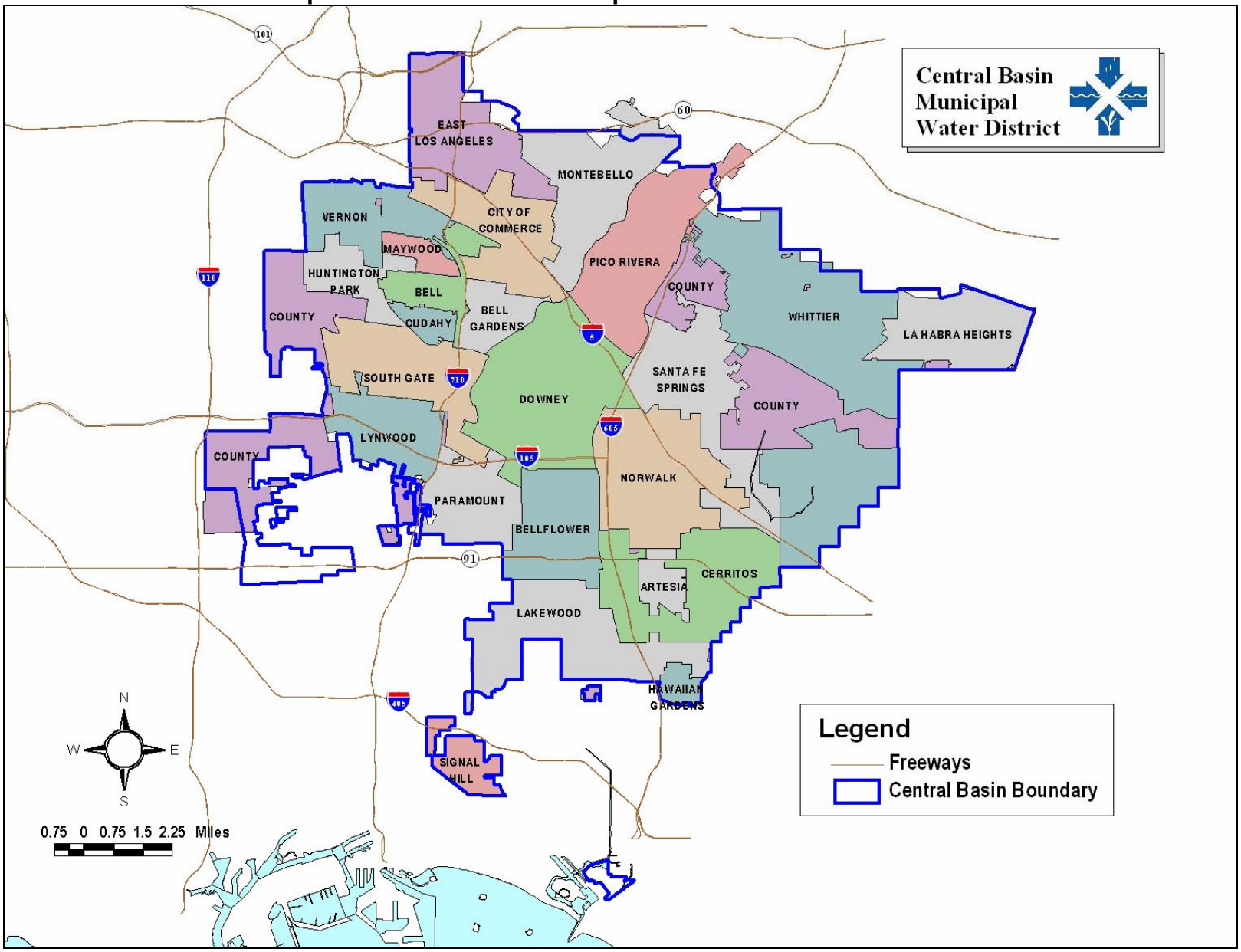
Level	Turf	Mixture	Ground Cover	Shrubs	Native
1	-10%	-15%	-15%	-15%	-20%
2	-15%	-20%	-20%	-20%	-25%
3	-25%	-25%	-25%	-25%	-30%

Figure 5 – AutoRecord

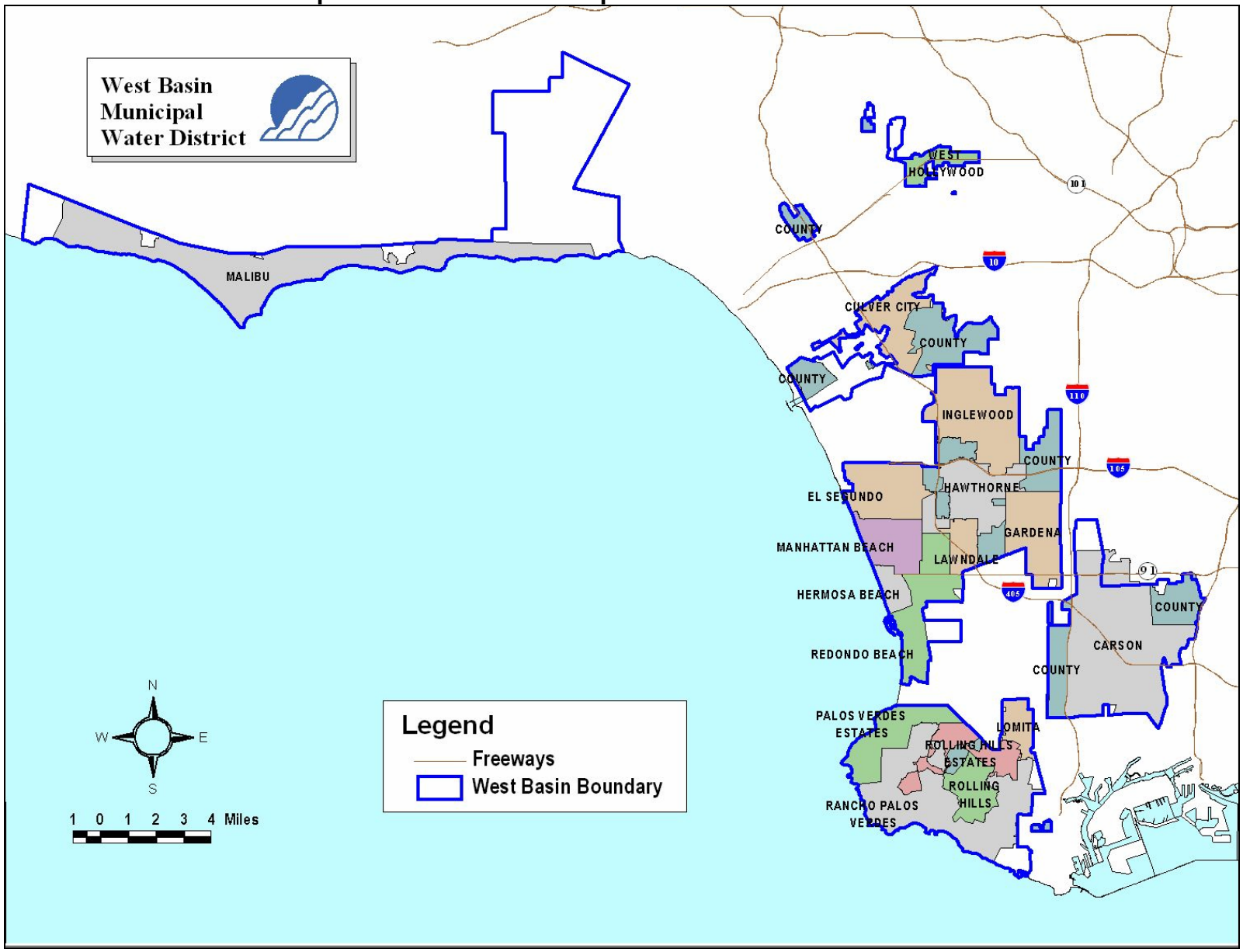


APPENDIX B - MAPS

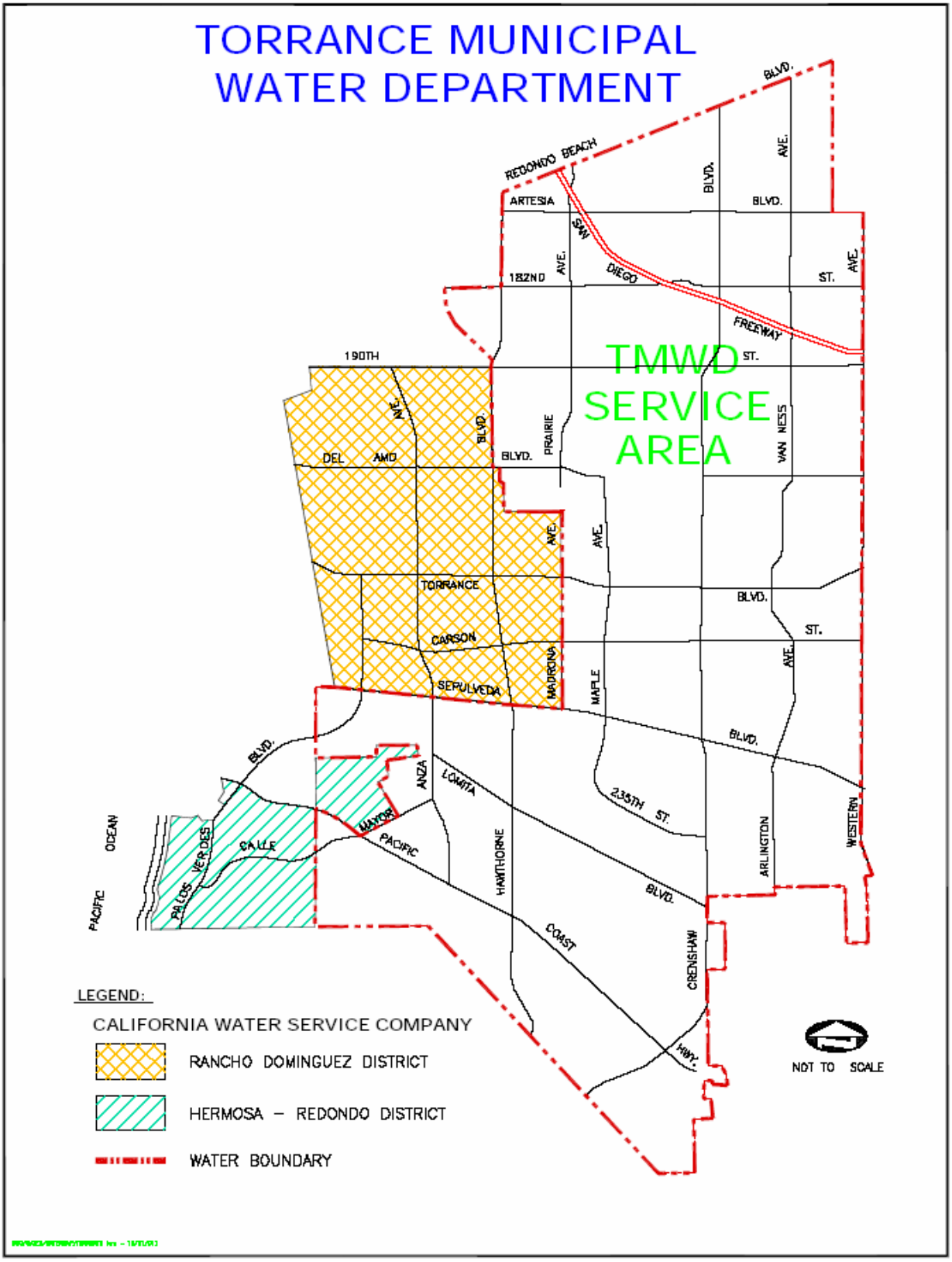
Map 1 – Central Basin Municipal Water District Service Area



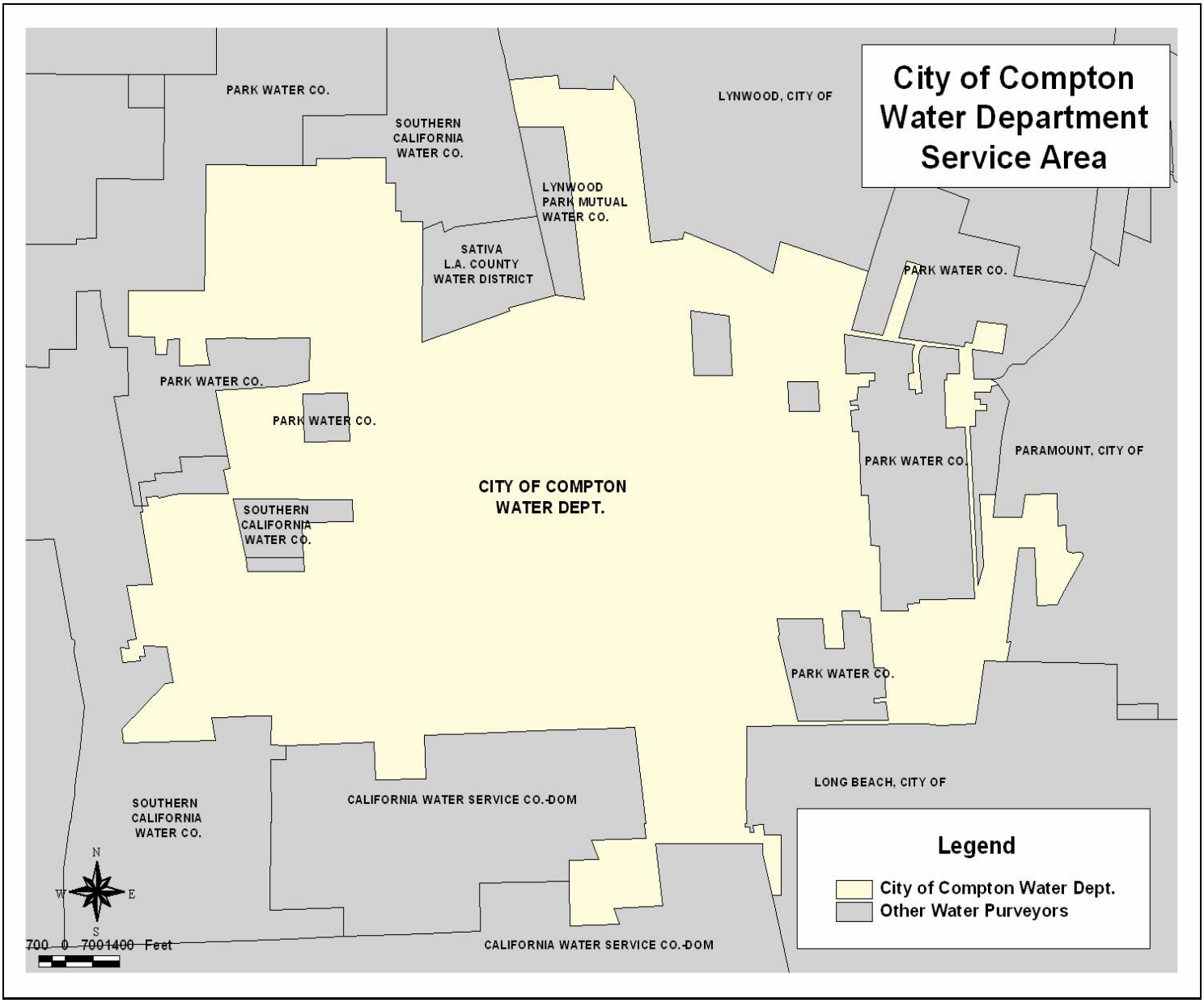
Map 2 – West Basin Municipal Water District Service Area



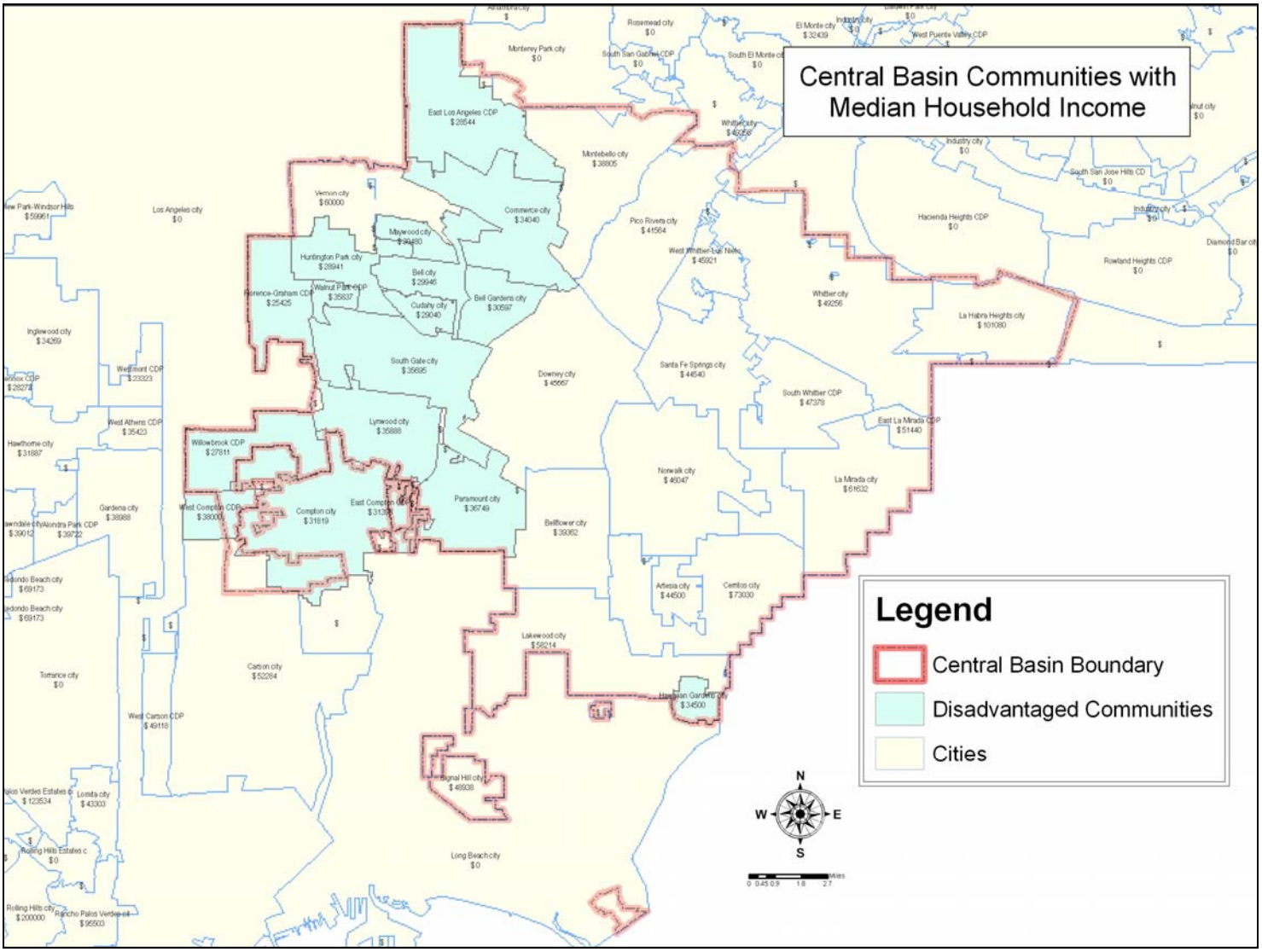
Map 3 – City of Torrance Service Area



Map 4 – City of Compton Service Area



Map 5 – Disadvantaged Communities



APPENDIX C - RESUMES

Gus Meza

3550 Dogwood
West Covina, CA 91792

home phone (626) 965-5407 **work phone (310)660-6209**

PROFESSIONAL EXPERIENCE

Conservation Coordinator February 2002 to Present
Central and West Basin Municipal Water Districts
17140 S. Avalon Blvd., Suite 210
Carson, CA 90746

- Develop and manage conservation programs for both Districts which represent 41 cities throughout the Los Angeles County and South Bay areas.
- Develop, manage and implement various conservation programs including: free toilet distributions, toilet and washer rebates, commercial rebates and landscape programs.
- Assisted in developing a Proposition 13 Water Use Efficiency Grant proposal and was awarded a $780,000 grant for a Waterless Urinal conservation program.
- Establish partnerships with cities and water agencies to conduct cost-effective conservation programs. Partner with the Metropolitan Water District of Southern California.
- Communicate and work with publicly elected officials.
- Attend federal, state, local and environmental meetings to keep informed with current conservation issues and legislative matters.
- Manage and assist contractors with program implementation.
- Provide program reporting results to DWR, MWD, CUWCC, cities, and water agencies.
- Develop and manage the Districts' conservation budgets.

Conservation Coordinator November 1993 to January 2002
Southern California Water Company
1920 West Corporate Way
Anaheim, CA 92801

- Coordinated and implemented various conservation programs Company-wide/Region II.
- Coordinated with the Water Efficiency Manager to develop meaningful conservation programs based on the District's allocated conservation budgets, and customer needs.
- Composed bid documents for contracts and materials.
- Procured materials for various conservation programs, such as; marketing giveaway items, Ultra-Low-Flush-Toilets (ULFTs), showerheads, bathroom and kitchen sink aerators, uniforms, door hanging services, etc. Performed cost benefit analyses to ensure cost effectiveness.

- Administered the following conservation programs for Region II; Single-Family ULFT events, Multi-Family programs, WaterWise school education/conservation programs, Large Landscape/Multi-Family programs, Indoor/Outdoor Water Use Efficiency Survey programs, CII programs, and Rebate programs.
- Coordinated with the Community & Customer Relations Administrator, District Managers, and Superintendents regarding the location, scheduling, and marketing of future events.
- Coordinated with the Community and Customer Relations Administrator, the MWD Municipal Water Agencies, and Community Based Organizations (CBOs), to develop a marketing strategy that derived the best public relations benefit from conservation programs and activities.
- Prepared the Conservation Credit Funding Proposals (CCFPs), and submitted them to the appropriate Member Agencies, in order to receive conservation credits from MWDSC.
- Assured that contractors including subcontractors met all applicable federal, state, and local safety regulations.
- Directed various contractors/vendors, and ensured they complied with SCWC contract requirements and expectations.
- Prepared needed Contracts, Release Orders, General Work Orders, Capital Budget Variance Requests, and Additional Change Authorizations.
- Prepared and submitted invoices to MWDSC Member Agencies for partnership funding.
- Acted as the conservation representative at meetings and events.

EDUCATION AND TRAINING

Bachelor's Degree from the University of La Verne — La Verne, California 2003
Business Administration

Water Conservation Practitioner - Level - 1 — AWWA -1999

Employee Development University — San Dimas, California 1997
SCWC - Train-the-Trainer Program

How to Deal with Difficult People seminar — Anaheim, California 1994
Skills Path

Associate of Arts Degree in Liberal Arts — Walnut, California 1993
Mount San Antonio College

BACKGROUND

- Over 6 years experience in water conservation.
- Over 12 years experience in customer service.
- Bilingual – English/Spanish.

PHILIP REGLI

Water conservation innovator with over 20 years of results-oriented self-starting and team motivating experience in water conservation groups, technology start-ups, corporations and water utilities. Special skills in: innovations, solution development, marketing, product marketing, alliances, partnerships, business development, strategic business planning, and interpersonal relationship building. Recognized as the creator of Environmental Conservation, End use management and leader in the development of Surface Flow irrigation and ET controller irrigation technology.

PROFESSIONAL EXPERIENCE/ACCOMPLISHMENTS

HYDROEARTH, Lake Forest, California **2004-2005**
A leading ET Controller Water Management Solution

Chief Executive Officer
Responsible for the Implementation of HydroEarth Utility platform Technologies to provide ET controller management solutions to resolve urban run off and water waste.

- Invented the concepts on End Use Management and vertical integration.
- Signed up over 10 water agencies and 20 cities and school districts to install over 200 controllers with HydroEarth end use management through HydroEarth services.
- Developed the smart residential irrigation controller platform and develop the standard industrial protocol for communication with weather based irrigation controllers.
- Contract with Jardinier Sub Irrigation systems to develop, promote and implement the Surface Flow irrigation solution.

IRVINE RANCH WATER DISTRICT, Irvine, California **2002-2004**
A multi million dollar water utility

Manager, Water Conservation
Responsible for building the leading environmental conservation department in the United States.

- Invented and developed Environmental Conservation as a business concept.
- Wrote the Smart Irrigation Controller Device and Solution system patent for IRWD (pending)
- Reduced customer Water penalty by $1 million (25% reduction) in 2003.
- Developed Environmental Partnerships with The Irvine Company and the city of Irvine that led to 90% reduction in water use penalty.
- Implemented and managed the largest Wick irrigation project in the nation. Results of the project led to a 50% reduction in water use and 100% elimination of run off.
- Designed new methods for Wick Irrigation implementation to make it cost effective for acceptance.
- Implemented a Fall promotional campaign that led to 45% reduction in penalty use ($400K)
- Establish a 12 month reduction in excess water use (2003).
- Eliminated 70% of the run off using smart irrigation controllers in study group.
- Performed the Commercial ET controller Study

HITACHI DATA SYSTEMS, Santa Clara, California 2001
A Billion dollar company in the Storage Industry

Director, Strategic Global Alliances

Responsible for international channel management, program development and partner technology integration programs, marketing, futures technology and forecasting for strategic and emerging partners with HDS. Managed corporate relationships of software and hardware partners in data base management, storage area networks, system management software, back up and restore software, tape backup solutions and rich media storage solutions.

- Led the integration and promotion of McData throughout Hitachi Data Systems. Moved the partnership into a higher visibility relationship with HDS sales force. Pushed high end SAN technology solutions using McData products (Director class switch product line), sales of McData products increased over 300% in first quarter and continued to increase to become #2 channel partner.
- Managed Tantia Technologies Backup and Restore/File Transfer solutions into HDS Mainframe solution program. Program was accepted and approved by Top staff. Promote the combined solutions to our sales team targeting top 200 accounts.
- Managed Oracle/Hitachi relationships.
    - Technology integration of Oracle next generation of products (check sum) making Hitachi one of two companies with special Oracle micro code for heavy duty Oracle applications.
    - Marketed and made corporate sales presentations on the Oracle 8i Appliance/Hitachi solution to Hitachi sister companies.
    - Developed Experio Oracle Solutions partnership with Hitachi. Promoted solution to Land key strategic account.
- Implemented Tape Backup solution partnerships with Storagetek and ATL.
- Developed the Partner Website and e-marketing campaigns with specific partners.

EXCLAIM TECHNOLOGIES, INC., San Jose, California (Defunct) 1999-2000
A Business to Business ASP Home furnishing & Collectible marketplace (Thomas Kincade)

Director of Product Marketing and Business Development

Responsible for development and execution of strategic alliances, new vertical development, marketing research and sales program for a Business to Business E-commerce ASP software start-up company. Focus on supply chain and e-marketing for the home furnishings marketplace.

- Developed and executed strategic product marketing plans in existing and pending market verticals, incentive and sales programs as well as manage market research. The marketing program resulted in 75-signed accounts representing $250M in wholesale revenue and 70,000 buyers.
- Operated trade shows and promoted events
- Researched and developed buyer incentive programs, hired consultants and managed the strategic Internet relationships for the Buyer programs.
- Managed 4 people in both product marketing and business development.
- Interfaced and worked with all levels of operation throughout the company to implement strategic alliance programs.

- Researched and developed product marketing and program requirements for Internet based data interfacing programs using Oracle databases resulting in a collector's club online proposal for every type of collectible.

FINANCENTER.COM, Tucson, Arizona **1997-1999**
Internet Financial Decision Tool Provider

Director of Business Development
Responsible for sales, business development, market analysis and product marketing programs for decision tool ASP software. Major contributor in making Financenter.com the leading provider of financial decision tools in the Internet world.

- Took a start up Internet based company from $0 to $1.5M in sales in year one with $2m+ in potential sales for year two.
- Developed key strategic reseller partnerships serving the Internet banking industry:
  - Lending Tree (100+ major size institutions)
  - Digital Insight (100+ small / median size institutions).
- Negotiated and managed contracts with Fortune 500 firms and internet providers: including:
  First Chicago, SunAmerica, Principal, Allstate Insurance, ABC News, and NY Times.
- Created and maintained ongoing key Internet relationships with major website developers to promote and push sales that exceed $100,000/yr: i.e. – examples were: US Web, Vignette, Modem media-PoppeTyson.

LAS VEGAS VALLEY WATER DISTRICT, Las Vegas, NV **1993-1996**

Water Conservation Manager

- Developed and implemented Direct Marketing Program to reduce water use by 9%
- Developed LVVWD first Water Conservation department
- Designed the first Data logger project and discovered the in use pattern.
- Implemented a series of water conservation restrictions and laws for commercial buildings, landscapes and programs to reduce water use
- Implemented the cash for grass program that led to a future conversion program that exceeds $10 million a year.

CITY OF SCOTTSDALE, Scottsdale, AZ **1988-1992**

Water Finance and Conservation Manager

- Invented and Developed Environmental Rates (first in the country)
- Developed and implemented the City of Scottsdale Water Conservation Plan
- Developed and implemented the City of Scottsdale Water Resource Plan and Financial Plan

CITY OF PHOENIX, Phoenix, AZ **1985-1988**

Water Conservation Analyst

- Wrote the city of Phoenix Water Conservation Plan, the city of Phoenix Drought Plan, the city of Phoenix Water and Wastewater rates

P&R PUBLICATIONS, San Jose, CA **1988 – Present**

Manage a sports collectible business and publishing house

- Wrote the book "The Collectors Guide to Sports Illustrated and Sports Publications" Beckett (1998)
- Recognized as world authority on sports publications
- Sold over a million dollars in sports memorabilia

EDUCATION/PROFESSIONAL DEVELOPMENT

MBA, Arizona State University, Tempe, AZ
MS, University of Arizona, Agricultural (Natural Resources) Economics, Tucson, AZ
BS, Managerial Economics, University of California, Davis

VOLUNTEER WORK

Director of Job Support Team, Calvary Church: Created a job support network for technology professionals who are looking for work. Developed program from 12 to 450 participants within 7 months. (2001-2002)
Founding Team Member, Saddleback Church: Career and job support network for professionals. Developed program that grew from 10 to 750 participants (2002-2003)
AWWA National Chair on Xeriscape and Landscape (1994-1996)
AWWA National Water Conservation Committee Member (1990-1996)
AWWA National Water Rates and Finance Committee Member (1990-1996)

SELECTED PUBLISHED BOOKS, JOURNALS, ARTICLES AND PAPERS

"Environmental Conservation Planning" AWWA Water Use National Conference. 2004

"Environmental Conservation" IRWD Environmental Conservation Seminar. 2003

"Collectors Guide to Sports Illustrated and Sports Publications" Beckett Publications, Third Edition. 1998.

"Water Rates and Related Charges" AWWA manual – participating member, AWWA, 1996

"Environmental Rate Design", AWWA Joint Management Conference, Feb. 1997.

"Environmental Rate Impact on Water Conservation", The National Regulatory Research Institute Quarterly Bulletin. June 1994.

"Collectors Guide to Sports Illustrated" P&R Publications, First Edition, 1994.

"Environmental Rate Design and Development", 1994 AWWA National Conference. June 1994.

PATENTS PENDING

"System and Method for controlling Irrigation" Patent serial #10/410,562

TED HUNT, MS, JD

Irrigation scientist professional with over 10 years of results-oriented self-starting experience in the area of irrigation design, water conservation and urban run off. Special skills in: site research and measurements. Recognized as the leading research scientist for Irvine Ranch Water District on the Residential Run off Study, ET Controller study and the Wick irrigation research study.

PROFESSIONAL EXPERIENCE/ACCOMPLISHMENTS

HYDROEARTH, Lake Forest, California **2004-2005**
A leading ET Controller Water Management Solution

Operations Manager
Responsible for the site evaluation, installation and management of HydroEarth ET controller management solutions to resolve urban run off and water waste.

- Responsible for HydroEarth dry season run off research work projects
- Responsible for the site evaluations, water audits and water reviews to make sure each site minimize run off and water use.
- Perform the statistical analysis on water use, time of use, peaking, emergency, drought tests
- Perform legal contract functions and research the legal impacts of dry season run off for clients

IRVINE RANCH WATER DISTRICT, Irvine, California **1998-2004**
A multi million dollar water utility

Water Resource and Scientist, IRWD
Responsible for heading up research projects for IRWD.

- Performed the Residential Run off Reduction Study (2000 – 2003) became the benchmark for ET controllers run off reduction (70%)
- Performed the West park ET controller study (1998-2001) became the benchmark for MWD ET controller rebate of $65 and $500/acre per controller.
- Performed the wick irrigation research study in Tustin (2002-2004) – reduced water use by 30% and improved delivery efficiency to 80%
- Commercial ET controller study (2003-2004) – evaluated all ET controllers in the market and showed a savings of 28% with ET controllers
- Microfiltration wastewater reclaim study (2001)
- Chlorine residual environmental impact study (2003)
- Selenium removal from natural treatment systems (2003)

MODERN IRRIGATION **1996-1998**
CAL POLY FOUNDATION **1996-1998**

- Wick irrigation Study (invented Wick irrigation with Dr. Hung, Cal Poly Pomona)
- Water Conservation Methodology (advanced irrigation design)
- Central Control Systems (development of the automatic Scheduling engine utilized in future controllers)

EDUCATION/PROFESSIONAL DEVELOPMENT

JD, Western State University of Law, Fullerton, CA
MS, Cal Poly Pomona, Engineering Science – Environmental Engineering, (Pending Thesis)
BS, Cal Poly Pomona, Agricultural Engineering

SELECTED ARTICLES AND PAPERS

"Wick Irrigation" Irrigation Association National Conference. 2003
"Commercial ET Controllers – research study" Irrigation Association National Conference, San Diego 2003

Dr. W Bowman Cutter
Assistant Professor
Department of Environmental Sciences
University of California
Riverside, CA 91711
951-827-2088
Bowman.Cutter@ucr.edu

Education

Ph.D.., University of California, Los Angeles, CA , December 2002.
University of California Toxic Substances Research and Teaching Program Graduate Fellowship, 2000-2002.

M.A., University of California, Los Angeles, CA, July 1999.
University of California, Los Angeles, Research Mentorship Scholarship, 1999-2000.

B.A. with Honors, Macalester College, St. Paul, MN, September 1993.
Senior Honors Thesis, *Common Property: The Economic Foundations*.

Research

My research interests include political economy, incentive-oriented environmental regulation, water valuation, and valuation of natural resources under uncertain future demand/supply conditions. The last topic is particularly relevant to this research as it involves the economic techniques for valuing goods or resources when future prices are uncertain.

Selected Recent Publications

Cutter W.B., M. Federman, et. al. 1996. "What Does it Mean to be Poor in America?" *Monthly Labor Review*. Volume 119(5). pp. 3-17.

Cutter, W.B. 2003. "California Water Supply Trends that Nurseries Should Notice." *CORF News: Floriculture Education from the Kee Kitayama Research Foundation.* Voume7(3). pp.1-2.

Cutter, W.B. 2003. "TMDL's –A New Approach to Water Quality Regulation." *WaterWise.* Winter 2003. pp 1-2.

Cutter, W.B. 2003. "Incentive-Based Regulation for TMDL's." *WaterWise.* Summer 2003.

Tom Carr

CEO HydroEarth, Inc.

(949) 636-7749

Education

University of California, Davis, Environmental Applied Economics
University of Arizona, Davis, MS Natural Resource Economics – Master Thesis Phoenix Water Demand
Arizona State University, MBA,

Career

CEO of HydroEarth 2004
Water Conservation Manager, IRWD 2002-2003
Director of Corporate Alliances, Hitachi Data Systems
Director of Product Marketing, Exclaim Technologies
Director of Business Development, Financenter.com
Water Conservation Manager, Las Vegas Valley Water District
Water Conservation and Finance Manager, City of Scottsdale, Arizona
Water Conservation Analyst & Finance Analyst, City of Phoenix, Arizona

Accomplishments in Water Conservation

Creator of the Own 11 patents relating to water conservation, rain, soil moisture and water monitoring.

1992 Invented adjustable electronic tensiometer marketed with the product name Hydrovisor 2. This sensor measures soil moisture content over a range from 12-28 centibars, the usable range for landscape plant soil moisture. This device controlled 1 valve. Thousands were installed throughout the country.

1993 Invented first tensiometer based irrigation controller, marketed with the product name NBIC (need based irrigation controller). Sensors reported data using the same wires used to turn valves on. System had variable set points and 7 day record. Become the nation electronic standard tensiometer.

1994 Discovered algorithm to achieve Evapo-transpiration calculations equal to Penman-Montieth formula with results having tolerance of 1/100 of an inch per day.

1994 Invented first electronic Evapo-Transpiration (ET) sensor which used solar, temperature, humidity and wind sensors. Evapo-transpiration is measured in thousandths of an inch on an active basis every second 24/7/365 electronically.

1995 Invented first ET based irrigation controller ETIC (Evapo-transpiration irrigation controller). Adjusted irrigation based on the weather.

1996 Invented first electronic sensor based soil stabilization system for stabilizing soil moisture levels beneath building foundations, marketed with the name Aqua-Level.

1999 Created Hydrosaver Suite PC software to work with remote Hydrosaver controllers.

1999 Invented remote monitoring system for irrigation systems which allows users to control and monitor irrigation real time from any location.

2000 Invented first PC based irrigation controller marketed with the product name HydroMaster.

2001 Invented FlowTracker monitoring system which allows irrigation controllers to be used as data loggers and monitoring flow every minute 24/7 for any number of irrigation sites simultaneously.

2001 Invented interactive irrigation graphics module which integrates GIS, CAD, photos and standard graphic formats in hierarchal system where data is accessed through reference objects within the graphic.

2002 Invented Valvelink wireless valves that can be operated remotely from any location.

2002 Invented HydroCalc irrigation scheduling software which uses IABMP to calculate irrigation schedules. The schedule is then downloaded to controllers automatically and irrigation is controlled dynamically based on the weather without any human intervention.

2003 Invented first SCADA style irrigation interface, suitable for linking and integration to any existing SCADA system (Modbus protocol).

2003 Invented Peak Leveler which can dynamically adjust multiple landscape irrigation schedules so that the peak demand is never surpassed.

2003 Invented Voice Command Irrigation controller which is operated by voice commands and acknowledges commands verbally.

2004 Invented Irribus communication protocol for communication of irrigation control and data between products from different companies.

APPENDIX D – DISADVANTAGED COMMUNITY DEMOGRAPHIC AND HOUSING PROFILES

Insert page 1 of Demographic and Housing Profile info

Insert page 2 of Demographic and Housing Profile info

APPENDIX E – Letters of Intent / Support

Insert letter of intent from City of Manhattan Beach

Insert letter of intent from City of Downey

Insert Letter of Intent for City of South Gate

Insert letter of intent for City of Torrance

Insert letter of support from California Urban Water Conservation Council

Insert Letter of Support from California Water Service Company

Appendix F– COST TABLES

Table 1 – Project Costs

Central Basin Municipal Water District
Commercial Landscape Wireless Valve End Use Management Research Project
Estimated Project Costs

Task		Project Costs	5% Contingency	Total Project Costs	Year 1	Year 2	Year 3	Total Grant Request	Total Matching Funds	Matching Funds Detail			
										MWD *Funds*	Central Basin *In-Kind*	Cities/School Districts *In-Kind*	HydroEarth *In-Kind*
1	**Study Group (Site) Selection and Water Agency Data**												
1.1	Prepare Site Selection Criteria	$ 4,200	$ 210	$ 4,410	$ 4,410	$ -	$ -	$ -	$ 4,410	$ -	$ -	$ 3,360	$ 1,050
1.2	Perform Site Selection for Wireless Valve Systems	$ 4,000	$ 200	$ 4,200	$ 4,200	$ -	$ -	$ -	$ 4,200	$ -	$ -	$ 4,200	$ -
1.3	Perform Site Selection for Two-Way Communication Systems	$ 4,000	$ 200	$ 4,200	$ 4,200	$ -	$ -	$ -	$ 4,200	$ -	$ -	$ 4,200	$ -
	Total Task 1	**$ 12,200**	**$ 610**	**$ 12,810**	**$ 12,810**	**$ -**	**$ -**	**$ -**	**$ 12,810**	**$ -**	**$ -**	**$ 11,760**	**$ 1,050**
2	**Site Survey and Analysis**												
2.1	Perform Water Audits	$ 8,600	$ 430	$ 9,030	$ 9,030	$ -	$ -	$ -	$ 9,030	$ -	$ -	$ 8,400	$ 630
2.2	Upgrade Sites	$ 4,000	$ 200	$ 4,200	$ 4,200	$ -	$ -	$ -	$ 4,200	$ -	$ -	$ 4,200	$ -
2.3	Train on Management Solutions and Downlead Water Audit Factors	$ 1,560	$ 78	$ 1,638	$ 1,638	$ -	$ -	$ -	$ 1,638	$ -	$ -	$ 1,008	$ 630
2.4	Select Sites for Comparative Analysis	$ 960	$ 48	$ 1,008	$ 1,008	$ -	$ -	$ -	$ 1,008	$ -	$ -	$ 1,008	$ -
	Total Task 2	**$ 15,120**	**$ 756**	**$ 15,876**	**$ 15,876**	**$ -**	**$ -**	**$ -**	**$ 15,876**	**$ -**	**$ -**	**$ 14,616**	**$ 1,260**
3	**Purchase, Installation and Configuration of Wireless Valves & ET Controllers**												
3.1	Purchase Wireless Valves (50 - 24-station valves x $2,400)	$ 120,000	$ 6,000	$ 126,000	$ 126,000	$ -	$ -	$ 126,000	$ -	$ -	$ -	$ -	$ -
3.2	Purchase 130 ET HydroEarth Controllers (130 x $2,400)	$ 312,000	$ 15,600	$ 327,600	$ 327,600	$ -	$ -	$ 201,600	$ 126,000	$ 126,000	$ -	$ -	$ -
3.3	Install Wireless Valves and ET Controllers, and Standard ET Controllers (50 x $2,400)	$ 120,000	$ 6,000	$ 126,000	$ 126,000	$ -	$ -	$ 94,500	$ 31,500	$ -	$ -	$ 31,500	$ -
3.4	Management of Installation, Configure ET Controllers and Create Website for Each Site	$ 39,000	$ 1,950	$ 40,950	$ 40,950	$ -	$ -	$ 39,627	$ 1,323	$ -	$ -	$ -	$ 1,323
	Total Task 3	**$ 591,000**	**$ 29,550**	**$ 620,550**	**$ 620,550**	**$ -**	**$ -**	**$ 461,727**	**$ 158,823**	**$ 126,000**	**$ -**	**$ 31,500**	**$ 1,323**
4	**Data Compilation, Water Management and Monthly Reporting**												
4.1	Data Compilation	Included											
4.2	Water Management	in											
4.3	Monthly Reporting	Task Total											
	Total Task 4	**$ 126,100**	**$ 6,305**	**$ 132,405**	**$ 54,495**	**$ 54,075**	**$ 23,835**	**$ 315**	**$ 132,090**	**$ -**	**$ -**	**$ 77,490**	**$ 54,600**
5	**End Use Management Design and Testing**												
5.1	Design Emergency Capability Test	$ 7,440	$ 372	$ 7,812	$ 7,812	$ -	$ -		$ 7,812		$ 756	$ 756	$ 6,300
5.2	Perform Emergency Capability Testing	$ 3,300	$ 165	$ 3,465	$ 3,465	$ -	$ -		$ 3,465		$ 158	$ 158	$ 3,150
5.3	Design Drought Capability Test	$ 19,440	$ 972	$ 20,412	$ -	$ 20,412	$ -		$ 20,412		$ 756	$ 756	$ 18,900
5.4	Perform Drought Capability Testing	$ 3,300	$ 165	$ 3,465	$ -	$ 3,465	$ -		$ 3,465		$ 158	$ 158	$ 3,150
5.5	Design Peaking Mangement Module Test	$ 19,440	$ 972	$ 20,412	$ -	$ 20,412	$ -		$ 20,412		$ 756	$ 756	$ 18,900
5.6	Perform Peaking Management Module Testing	$ 3,300	$ 165	$ 3,465	$ -	$ 3,465	$ -		$ 3,465		$ 158	$ 158	$ 3,150
	Total Task 5	**$ 56,220**	**$ 2,811**	**$ 59,031**	**$ 11,277**	**$ 47,754**	**$ -**	**$ -**	**$ 59,031**	**$ -**	**$ 2,741**	**$ 2,741**	**$ 53,550**
6	**Economic Analysis**												
6.1	Prepare Year One Economic Analysis	$ 7,667	$ 383	$ 8,050	**$ 8,050**	$ -	**$ -**	$ 8,050	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
6.2	Prepare Year Two Economic Analysis	$ 7,667	$ 383	$ 8,050	**$ -**	**$ 8,050**	**$ -**	$ 8,050	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
6.3	Prepare Year Three Economic Analysis	$ 7,666	$ 383	$ 8,049	**$ -**	**$ -**	**$ 8,049**	$ 8,049	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
	Total Task 6	**$ 23,000**	**$ 1,150**	**$ 24,150**	**$ 8,050**	**$ 8,050**	**$ 8,049**	**$ 24,150**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
7	**Administration, Management and Reporting**												
7.1	Administration and Management of Grant Project	$ 30,000	$ 1,500	$ 31,500	$ 10,500	$ 10,500	$ 10,500	$ -	$ 31,500	$ -	$ 31,500	$ -	$ -
7.2	Prepare/Submit Quarterly Fiscal/Programmatic Reports	$ 2,400	$ 120	$ 2,520	$ 840	$ 840	$ 840	$ 1,260	$ 1,260	$ -	$ 1,260	$ -	$ -
7.3	Prepare Final End Use Management and Wireless Valve Report	$ 5,700	$ 285	$ 5,985	$ -	$ -	$ 5,985	$ 3,705	$ 2,280	$ -	$ 2,280	$ -	$ -
7.4	Final Report Publication and Distribution	$ 1,900	$ 95	$ 1,995	$ -	$ -	$ 1,995	$ 998	$ 998	$ -	$ 998	$ -	$ -
	Total Task 7	**$ 40,000**	**$ 2,000**	**$ 42,000**	**$ 11,340**	**$ 11,340**	**$ 19,320**	**$ 5,963**	**$ 36,037**	**$ -**	**$ 36,037**	**$ -**	**$ -**
	TOTAL PROJECT COSTS	**$ 863,640**	**$ 43,182**	**$ 906,822**	**$ 734,398**	**$ 121,219**	**$ 51,204**	**$ 492,155**	**$ 414,667**	**$ 126,000**	**$ 38,778**	**$ 138,107**	**$ 111,783**

Table C-1: PROJECT IMPLEMENTATION COSTS (Budget)

APPLICANT: Central Basin Municipal Water District
Project Title: Commercial Landscape Wireless Valve End Use Management Research Project

	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	$30,000	5	$31,500	$31,500	$0	0	0.0000	$0
	Fringe benefits	$0	0	$0	$0	$0	0	0.0000	$0
	Supplies	$0	0	$0	$0	$0	0	0.0000	$0
	Equipment	$0	0	$0	$0	$0	0	0.0000	$0
	Consulting services	$0	0	$0	$0	$0	0	0.0000	$0
	Travel	$0	0	$0	$0	$0	0	0.0000	$0
	Other	$0	0	$0	$0	$0	0	0.0000	$0
(a)	Total Administration Costs	$30,000		$31,500	$31,500	$0			$0
(b)	Planning/Design/Engineering	$27,320	5	$28,686	$28,686	$0	0	0.0000	$0
(c)	Equipment Purchases/Rentals/Rebates/Vouchers	$432,000	5	$453,600	$126,000	$327,600	10	0.0000	$0
(d)	Materials/Installation/Implementation	$159,000	5	$166,950	$32,823	$134,127	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)	$0	0	$0	$0	$0	0	0.0000	$0
(l)	Monitoring and Assessment	$205,320	5	$215,586	$191,121	$24,465	0	0.0000	$0
(m)	Report Preparation	$10,000	5	$10,500	$4,537	$5,963	0	0.0000	$0
(n)	**TOTAL**	$863,640		$906,822	$414,667	$492,155			$0
(o)	Cost Share -Percentage				46	54			

Table C- 5: Project Annual Physical Benefits (Quantitative and Qualitative Description of Benefits)

QUALITATIVE DESCRIPTION - REQUIRED OF ALL APPLICANTS[1]				QUANTITATIVE BENEFITS –(where data are available) [2]
Description of physical benefits (in-stream flow and timing, water quantity and water quality) for:	**Time Pattern and Location of Benefit**	**Project Life: Duration of Benefits**	**State Why Project Bay-Delta benefit is Direct[3], Indirect[4] or Both**	**Quantified Benefits (in-stream flow and timing, water quantity and water quality)**
Bay-Delta: Increase in supply and improvement in the water quality by the elimination of dry season run-off from landscape irrigation. Total amount of water demand and runoff reduction will be measured on a site by site basis. On average, water savings will equal 1 acre-foot per acre of landscape.	Project benefits will occur throughout the 43 cities within the Project service area and have potential for state-wide and country-wide benefits.	15+ years	Direct: The Project will significantly reduce the demand on imported water originating in the Bay-Delta since much of the current water supply is imported from the State Water Project. Indirect: The Project will reduce overall water demands throughout Southern California for landscape irrigation.	1 acre-foot of imported water from Bay Delta per acre-foot of landscape. Out of the total 130 sites, 80 research sites will have the wireless valve technology implemented. Out of the 80, 60 of the sites will be approximately 3 acres, for a total of 180 acre-feet of demand reduced, while 20 of the sites will be approximately .25 acres, for a total of 5 acre feet of demand reduced. Combined, the result is 185 acre-feet of water conserved.
Local: Increase in water savings (18-27%), reduction in runoff, and water savings estimated at 1 acre-foot per acre of landscape.	Project benefits will occur throughout the 43 cities within the Project service area.	15+ years	**Not Applicable**	1 acre-foot of imported water from Bay Delta per acre-foot of landscape, for a total of 185 acre-feet per year. It is possible the total water savings will be significantly higher due to the broken and old irrigation systems that the wireless valve systems will be applied to.

[1]The qualitative benefits should be provided in a narrative description. Use additional sheets to describe the benefits.
[2] The project benefits that can be quantified (i.e. volume of water saved or mass of constituents reduced) should be provided.
[3] Direct benefits are project outcomes that contribute to a CALFED objective within the Bay-Delta system during the life of the project.

[4]Indirect benefits are project outcomes that help to reduce dependency on the Bay-Delta system. Indirect benefits may be realized over time.