MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

Street Address:
18700 Ward Street
Fountain Valley, California 92708

Mailing Address:
P.O. Box 20895
Fountain Valley, CA 92728-0895

(714) 963-3058
Fax: (714) 964-9389
www.mwdoc.com

December 31, 2015

Ms. Debra Whitney
Bureau of Reclamation
27708 Jefferson Avenue, Suite 202
Temecula, CA 92590

Subject: **Notice for Closeout** for Federal Grant Agreement No. R13AP35362 - CII Performance-Based Water Use Efficiency Program

Dear Ms. Whitney:

In August 2013, the Bureau of Reclamation and the Municipal Water District of Orange County (MWDOC) entered into the above referenced agreement for a CII Performance Based Water Use Efficiency Program.

This Final report includes the following items:

- Federal Financial Report SF425 – Marked Final
- Final Progress Report
- Release of Claims Form
- Benefit Form
- Program Evaluation

Should you have any questions regarding the report, please contact me at (714) 593-5023.

Sincerely,

Melissa Baum-Haley

Melissa Baum-Haley
Senior Water Resources Analyst

cc: MWDOC Accounting

FEDERAL FINANCIAL REPORT

(Follow form instructions)

1. Federal Agency and Organizational Element to Which Report is Submitted	2. Federal Grant or Other Identifying Number Assigned by Federal Agency (To report multiple grants, use FFR Attachment)	Page	of
SOUTHERN CALIFORNIA AREA OFFICE OF RECLAMATION	**R13AP35362**	1	1 pages

3. Recipient Organization (Name and complete address including Zip code)

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY, 18700 WARD ST, FOUNTAIN VALLEY, CA 92708

4a. DUNS Number	4b. EIN	5. Recipient Account Number or Identifying Number (To report multiple grants, use FFR Attachment)	6. Report Type	7. Basis of Accounting
873890721	**95-2650400**	**8113**	☐ Quarterly ☐ Semi-Annual ☐ Annual ☑ Final	☑ Cash ☐ Accrual

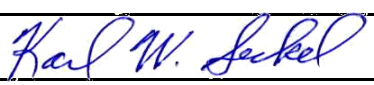
8. Project/Grant Period (Month, Day, Year)		9. Reporting Period End Date (Month, Day, Year)
From: **October 1, 2013**	To: **September 30, 2015**	**September 30, 2015**

10. **Transactions**	Cumulative
(Use lines a-c for single or multiple grant reporting)	
Federal Cash (To report multiple grants, also use FFR Attachment):	
a. Cash Receipts	$ -
b. Cash Disbursements	$ -
c. Cash on Hand (line a minus b)	$ -
(Use lines d-o for single grant reporting)	
Federal Expenditures and Unobligated Balance:	
d. Total Federal funds authorized	$ 97,888.52
e. Federal share of expenditures	$ 97,888.52
f. Federal share of unliquidated obligations	$ -
g. Total Federal share (sum of lines e and f)	$ 97,888.52
h. Unobligated balance of Federal funds (line d minus g)	$ -
Recipient Share:	
i. Total recipient share required	$ 97,888.52
j. Recipient share of expenditures	$ 97,888.52
k. Remaining recipient share to be provided (line i minus j)	$ -
Program Income:	
l. Total Federal program income earned	$0
m. Program income expended in accordance with the deduction alternative	$0
n. Program income expended in accordance with the addition alternative	$0
o. Unexpended program income (line l minus line m or line n)	$0

11. Indirect Expense	a. Type	b. Rate	c. Period From	Period To	d. Base	e. Amount Charged	f. Federal Share
	0	0	0	0	0	0	0
				g. Totals:	0	0	0

12. Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation:

13. Certification: By signing this report, I certify to the best of my knowledge and belief that the report is true, complete, and accurate, and the expenditures, disbursements and cash receipts are for the purposes and intent set forth in the award documents. I am aware that any false, fictitious, or fraudulent information may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)

a. Typed or Printed Name and Title of Authorized Certifying Official	c. Telephone (Area code, number, and extension)
Karl W. Seckel, Municipal Water District of Orange County Assistant General Manager	**714-593-5023**
	d. Email Address shedges@mwdoc.com
b. Signature of Authorized Certifying Official 	e. Date Report Submitted (Month, Day, Year) December 30, 2015
	14. Agency use only:

Standard Form 425 - Revised 6/28/2010
OMB Approval Number: 0348-0061
Expiration Date: 10/31/2011

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Southern California Area Office

Agreement Number
R13AP35362

Agreement Date
September 18, 2013 to
September 30, 2015

RELEASE OF CLAIMS

WHEREAS, by the terms of the above-identified agreement for

Commercial/Industrial/Institutional (CII) Performance Based Water Use Efficiency Program

entered into by the United States of America, hereinafter also referred to as the United States, and the grant recipient whose name appears on the agreement as

Municipal Water District of Orange County

it is provided that after completion of all work, the grant recipient will furnish the United States with a release of all claims;

NOW, THEREFORE, in consideration of the above premises and the payment by the United States to the recipient the total amount of

$97,888.52

the grant recipient hereby remises, releases, and forever discharges the United States, its officers, agents, and employees, of and from all manner of debts, dues, liabilities, obligations, accounts, claims, and demands whatsoever, in law and equity, under or by virtue of the said agreement except:

IN WITNESS WHEREOF, the agreement recipient has executed this release this 30th day of December, 2015.

By Karl W. Seckel
(Signature)

Karl W. Seckel
(Name -- Type or Print)

Assistant General Manager
(Title)

Municipal Water District of Orange County
(Agreement Recipient)

CII Performance-Based Water Use Efficiency Program
Orange County, CA

Final Project Report

R13AP35362
Municipal Water District of Orange County
18700 Ward Street
Fountain Valley, CA 92708
March 10, 2015

Final Report: CII Performance-Based Water Use Efficiency Program

1. Recipient Information:	
Recipient Name:	**Municipal Water District of Orange County** **Joseph M. Berg** **18700 Ward Street, Fountain Valley, CA 92708**
Project Name:	**CII Performance-Based Water Use Efficiency Program**
Assistance Agreement No:	**R13AP35362**
Date of Award: (Month, Year)	**October 1, 2013**
Estimated Completion Date (Month, Year)	**September, 2015**
Actual Completion Date: (Month, Year)	**September, 2015**

2. Final Funding Information	**Funding Amount**
Non-Federal Entities	
1. Municipal Water District of Orange County	$97,888.52
2.	
3.	
Non-Federal Subtotal:	$97,888.52
Other Federal Entities	
1.	
2.	
3.	
Other Federal Subtotal:	*$0*
Requested Reclamation Funding:	*$97,888.52*
Total Project Funding:	*$195,777.04*

3. One Paragraph Project Description:

The Commercial/Institutional/Industrial (CII) Performance-Based Water Use Efficiency Program (Program) was developed by the Municipal Water District of Orange County (MWDOC) to offer Commercial, Industrial, and Institutional (CII) and Large Landscape Turf Removal (LL) sites with incentives in the form of rebates to assist in the reduction of water use. The projects utilized a comprehensive process approach for the one–to-one replacement of high water using devices for water efficient devices. At LL sites, comprehensive landscape projects may include any combination of the following components: the replacement of non-functional turfgrass with climate-appropriate, non-invasive, California-Friendly landscapes or permeable surfaces, conversion of high-water-using spray heads to rotating nozzles, upgrade of conventional irrigation timers to smart timers, and irrigation management services. For CII device replacement the Program facilitated rebates by utilizing Metropolitans southern California Regional rebate Program and for LL project incentives were facilitated by MWDOC's Turf Removal Program. Through a combined effort across all Program sectors the water savings goal is 113 acre-feet-per year (AFY).

4. Final Project Description: *Briefly describe components of the project and the work completed, including each element of the scope of work and the work completed at each stage of the project. Please include maps, sketches, and/or drawing of the features of the completed project, as appropriate. In addition, please describe any changes in the project scope.*

MWDOC begin implementing the Program in October 2013 and when the Grant termed out in September 2015, wrapped up activity. The Program has the six (6) tasks listed below.

Task 1 – Project Administration

Work completed: MWDOC performed the day to day operations for the Program. This involved expending 372 hours over the 24-month Program Term. Six MWDOC Water Use Efficiency Department Staff members were involved with Steve Hedges (254 hours), Melissa Baum-Haley (69.5), and Beth Fahl (42.75) providing the lion's share of the Program activity. The cost for the 372 hours came to $22,450.66 at a rate of $60.35/hour. Across the 24-months an average of 15.5 hours per month.

Task 2 Marketing and Promotion

Work completed: MWDOC designed and produced marketing promotional advertising pieces to be included in monthly targeted trade publications. Promotional pieces and personal outreach encouraged site participation in the Program. Marketing primarily consisted of publication advertisement pages, newsletter articles, personal outreach, participation in green industry events, and posts on water agency websites. MWDOC also promoted the Program through social media outlets, at community outreach events, and on the both MWDOC's water use efficiency microsite (www.ocwatersmart.com) and the Metropolitan Water District of Southern California rebate administration website (www.socalwatersmart.com).

Task 3 – Site Inspections

Work completed: The post-inspections for CII process and LL improvements were conducted at 100% of the sites by MWDOC or personnel acting on MWDOC's behalf. MWDOC currently has Mission Resource Conservation District (MRCD) under contract for LL and CII one-to-one device inspections.

The basic purpose of the site inspection was to validate the installation of the water savings device or the square footage of the turf removed. MWDOC's site inspection contractor, MRCD, would be notified of the installed device by MWDOC, they would then contract the property owner to set up the on-site visit. For WBIC's and HEN's, they would operate the irrigation system to count nozzles and where possible, perform an irrigation distribution uniformity (DU) test to validate the functionality of the WBIC. For turf removal sites, the field inspector would measure the square footage of the turf removal project both before and after construction to establish the basis for the per square foot rebate. Once completed, MRCD would report back to MWDOC the results.

Task 4 – Process and Device Rebate Incentives

Work completed: The Program was designed to encourage the reduction of water use through the offering of financial incentives to property owners for the removal of high water using devices or non-essential turf with high efficiency devices or California Friendly plantings. Incentive payments in the form of rebates from MWDOC were offered to CII and LL sites who successfully installed water savings device improvements.

The incentive rate for comprehensive CII projects is $195 per acre foot of water saved, with a savings life up to 10 years. The incentive rate for CII ne-for-one improvements will follow the Metropolitan Water District of Southern California (MWD) regional rebate rates, with a savings life up to 20 years based on the industry accepted specific device life. The incentive rate for the LL improvements is $150 per acre-foot of water saved, with a savings life up to 10 years.

Task 5 – Reporting

Following the reporting schedule set forth in the agreement, MWDOC submitted semi-annual and final reports that included all required SF forms, a written Project progress narrative, tabular data tables, and all required backup to support the requested reimbursement.

Task 6 – Statistical Project Evaluation

Work completed: The Program Evaluation commenced on October 2015. The purpose of this Program Evaluation was to perform (1) a Process Evaluation of the Program format and (2) an Impact Evaluation of water savings achieved by participants in the Program. In additional to fulfilling a grant agreement requirement, MWDOC looked to determine what successes and challenges came with implementation of the Program. As part of this Program Evaluation, a random sampling of commercial sites where devices were installed was taken and analysis was performed to determine the following: (1) Program participation trends; (2) Program satisfaction and waster savings perception; and (3) impact on water use. For the water savings impact analysis, billing data was requested from participating retail water agencies for a random sample of participating customers. The Impact Evaluation analyzed the water use trends of the customers based on pre/post installation of the device (intervention point). Additionally, the water use was weather normalized to allow for removal of temporal and climatic variability. Finally, these results were compared to previous evaluations MWDOC has performed on past similar Programs.

5. Accomplishment of Project Goals: *Describe the goals and objectives of the project and whether each of these was met. Where appropriate, state the reasons why goals and objectives were not met, and describe any problems or delays encountered in completing the project. Please include whether or not the project was completed within cost.*

The goals of the Program are to achieve water savings totaling 113 acre-feet-year (AFY). To achieve this water savings total, the program was to cause activity in the following areas.

- At CII sites, projects will result in water reduction through comprehensive process improvements and/or the one–to-one replacement of high water using CII devices for water efficient devices.
- At LL sites, comprehensive landscape projects may include any combination of the following components: the replacement of non-functional turfgrass with climate-appropriate, non-invasive, California-Friendly landscapes or permeable surfaces, conversion of high-water-using spray heads to rotating nozzles, upgrade of conventional irrigation timers to smart timers, and irrigation management services.

For CII sites the following high efficiency devices were installed:

- 1 cooling tower
- 442 water flow regulators
- 1,782 high efficiency toilets
- 15,251 high efficiency rotating irrigation nozzles
- 355 weather based irrigation controllers
- 66 water less urinals

In the Large Landscape category, 5 sites removed a total of 336,182 sq-ft of non-essential turf grass. In addition and as a required task there were 230 site inspections performed during the Term of the Program. Devices inspected were commercial Weather Based Irrigation Controllers (WBIC's), High Efficiency Nozzles (HEN'S), and the removal of non-functional turf.

Under Task 6, the Project Statistical Evaluation will look at the actual water savings from each of the above devices and turf removed. This evaluation is attached for reference and shows 411 AFY of actual water savings.

6. Discussion of Amount of Water Conserved, Marketed or Better Managed: *In responding to the questions set forth below, Recipients should rely on the best data or information available. Actual field measurements should be used whenever possible (e.g., baseline data or post-project data derived from measuring devices, diversion records, seepage tests, etc.) Where actual field measurements are not available, water savings (or amounts marketed or better managed) may be estimated based on studies, other similar improvement projects, or anecdotal evidence.*

A. Recipient's total water supply (average, annual, available water supply in acre-feet per year):

The five year average water demand in the MWDOC service area is 589,853 acre-feet (AF). This is the total supply for all retail water agencies in Orange County and is comprised of both imported water from the Metropolitan Water District of Southern California, ground water pumped from the Orange County Water District ground water basin, and recycled water. This water is currently going to single- and multi-family residential users, landscape irrigation, and commercial, industrial and institutional users. Of the total, approximately 55% is used for landscape irrigation and 45% is used indoor.

Imported sources account for 42% (241,000 AF), groundwater accounts for 51% (303,000 AF), recycled water accounts for 6% (37,000 AF), and surface water accounts for 2% (8,000 AF). Imported supplies provided by Metropolitan include the Colorado River and the Bay-Delta via the State Water Project. Approximately 99% of MWDOC's demand is for municipal and industrial purposes, and 1% is for agricultural purposes. Municipal and industrial water use in Orange County is comprised of single- and multi-family residential, commercial, industrial, and institutional users. According to the 2010 MWDOC rates survey, there are approximately 557,000 single family connections, 78,000 multi-family connections, and 72,000 irrigation, commercial, industrial, and institutional connections. There are also 8,000 recycled water connections, primarily for irrigation, and over 100 agriculture connections.

Shortfalls in supply are two-fold. First, the region is experiencing multiple dry-years on the Colorado River, which is inhibiting our ability to access surplus water. Second, on the State Water Project from Northern California, we are experiencing extreme dry-year conditions and pumping restrictions due to endangered species. Over the last three water years California has experienced below normal rainfall, and access to imported water from the State Water Project this year is again limited due to continued dry conditions. Because of these ongoing reductions of imported water supply, water agencies have, in some years, been forced to draw from emergency storage to meet demand. In addition, agencies continue to enforce mandatory water use restrictions such as irrigation time of day and days of the week, no washing of hard surfaces, no runoff, etc.

B. Amount of water conserved, marketed or better managed as a result of the project (in acre-feet per year):

From Program launch, in October 1, 2013, through September 30, 2015, when the Program term ended, a total of 17,897 commercial devices were retrofit in addition to 336,182 square feet of turfgrass removal. Based on the estimated sample set, available for the Impact Evaluation, it is estimated that the water savings is 301 gallons per day per commercial site or 411 acre feet per year of overall Program savings.

Water conserved through implementation of the proposed Project will be retained in regional storage reservoirs or the groundwater basin for future use, thereby improving water supply reliability for Orange County.

C. Describe how the amounts stated in response to 6.B were calculated or estimated:
In responding to this question, please address (1) – (3) below.

(1) Describe the information/data being relied on to calculate/estimate the project benefits. State how that data/information was obtained, if appropriate. Provide any other information necessary to explain how the final calculation/estimate of project benefits was made.

The primary objective of the Program Impact Evaluation was to measure the amount of water saved throughout the course of the CII Performance-Based Water Use Efficiency Program. A statistical analysis of the collected data was performed in order to provide insight into the characteristics of sites that participated in the Program and determine if a reduction of water use was due to device installation. The following information describes the methodology of the Program Impact Evaluation.

Monthly meter read data was requested for each site from the retail water agency. Historical water use was requested for a least three years prior to the intervention point and one year following. The intervention point is designated as the point in time when the device was purchased/installed. Water savings was determined by comparing the gallons per day water use prior to and following the intervention point. This methodology allowed for direct comparison of water use based on comparable irrigation need and system consistency.

Additionally, the water use data was weather normalized. The daily evapotranspiration and precipitation measurements were collected from the California Irrigation Management Information System (CIMIS), weather station number 75 located in Irvine. Spatially interpolated or "Spatial ETo" values were collected for additional areas on the basis of zip code.

(2) As appropriate, please include an explanation of any concerns or factors affecting the reliability of the data/information relied on.

The evaluation sample set was comprised of meter data received from only those water agencies which were able to provide usable data. The number of usable accounts encompasses 82% of the total Program population. This sample size is both sufficient for analysis and comparable to MWDOC's previous irrigation timer evaluations.

The following assumptions were taken:

- The monthly meter read data that was beyond two standard deviations (95.5%) was not included in the analysis as these data encompassed outliers.
- It was assumed that no other significant reduction in water use occurred by the customers during the study period. If the analyses indicated a significant difference in water use after installation, it was assumed that the installation of the device was responsible for the change.
- With respect to the weather normalization, a linear regression relationship was generated for the pre and post periods with their respective water use.

(3) Attach any relevant data, reports or other support relied on in the calculation/estimate of project benefits, if available. Please briefly describe the data/information attached, if any.

MWDOC has a long standing of conducting evaluations at the completion of program terms. As a means to cross check the result found in this evaluation, and to continue to track the long-term success of this type of rebate program, these results are compared. The table below summarizes the previous irrigation timer evaluation results in comparison to this evaluation.

Study Title	Author	Commercial Savings (GPD)
Residential Runoff Reduction Study, 2004	A&N Technical Services, Inc., Thomas Chesnutt, Ph.D.	545
Pilot Implementation of Smart Controllers: Water Conservation, urban Runoff Reduction and Water Quality, 2010	Kennedy/Jenks Consultants, Lawrence Y.C. Leong, Ph.D., QEP	556
MWDOC SmarTimer Rebate Program Evaluation, 2011	A&N Technical Services, Inc., Thomas Chesnutt, Ph.D.	727
Commercial ET-Based Irrigation Controller Water Savings Study, 2006	A&N Technical Services, Inc., Thomas Chesnutt, Ph.D.	601
OC Smart Irrigation Timer Rebate Program, 2014	Municipal Water District of Orange County	320
OC Smart Irrigation Timer Rebate Program, 2015 (this Project's Evaluation)	Municipal Water District of Orange County	337

D. Use of Conserved Water: *Please explain where the water saved, better managed, or marketed as a result of the project is going (e.g. used by the recipient, in stream flows, available to junior water users, etc.*

The Project will improve water supply reliability by being more efficient with existing supplies. As a result, less pumping will occur from the groundwater basin, aiding in refilling the basin more rapidly, and less imported water will be used, allowing unused water to be retained in regional water storage reservoirs for use at a future date. Both these benefits will minimize or forestall shortages due to drought.

The Project promotes and encourages collaboration among all water agencies within the Santa Ana Watershed Project Authority region of Orange County. This portion of MWDOC's service territories, includes 20 retail agencies as well as the cities of cities of Anaheim, Fullerton, and Santa Ana. This partnership is significant as all water agencies in the north Orange County will have a united message of "efficient water use" to water users. Because of this unified approach,

the unfortunate situation of "haves" and "have not" from one city to the next will be avoided – all consumers will have access to one standardized program.

The Project will significantly increase the awareness of water conservation in north Orange County. The Project was promoted through water bill stuffers, water bill messages, newsletters, websites, and social media channels. The Project served as an example of efficiency that can be replicated not only from user to user, but also by water agency to water agency, thereby increasing the capability of future water conservation and efficiency efforts beyond Orange County.

E. Future tracking of project benefits: *Please state whether and how the recipient plans to track the benefits of the project (water saved, marketed or better managed) in the future. If no actual field measurements are currently available to support the estimate of project benefits in 6.B., please state whether actual field measurements will become available in the future. If so, please state whether the Recipient is willing to provide such data to Reclamation on a voluntary basis once it is available.*

As part of the MWDOC water use efficiency program evaluation planning horizon, sites participating in this Project will be assessed under two future evaluations projects: 1) Device Retention Study, with expected to be complete within fiscal year 2015-16, and 2) Device Persistence Study, with an expected completion date to be determined.

7. Discussion of Amount of Renewable Energy Added: *If your project included the installation of a renewable component, please describe the amount of energy the system is generating annually. Please provide any data/reports in support of this calculation.*

Not Applicable

8. Describe how the project demonstrates collaboration, stakeholder involvement or the formation of partnerships, if applicable: *Please describe the collaboration involved in the project, and the role of any cost-share or other types of partners. If there were any additional entities that provided support (financial or otherwise) please list them.*

This Project provided multi-level partnerships within MWDOC's entire service area, including the north subwatershed basins, with benefits yielded by cities, water districts, community, and the environment. The Project was built on established regional integration and coordination with multiple goals across geographic and water resource services.

MWDOC, the Metropolitan Water District of Southern California, and the 20 retail water agencies within the SAWAPA watershed of the MWDOC service area were all proactive in marketing the Program. This Project promoted the region-wide utilization of non-structural Best Management Practices, appropriate to non-point-source pollutants, which aide in the prevention of potential pollutants from entering municipal storm drain systems and aquatic ecosystems, during dry weather.

The water savings achieved through this Project leads to supply reliability and reduction of imported water dependency. MWDOC, in collaboration with its retail agencies, and cities of Anaheim, Fullerton, and Santa Ana, established the OC 20x2020 Regional Alliance as part of MWDOC's 2010 Regional Urban Water Management Plan, where all retail water agencies benefit from pooling their water use efficiency investments.

9. Describe any other pertinent issues regarding the project:

None

10. Feedback to Reclamation regarding the WaterSMART Program: *Please let us know if there is anything we can do to improve the WaterSMART program in general, including the process for applying for or completing a WaterSMART project. Your feedback is important to us.*

The overall WaterSmart process runs very smooth, from the proposal process through to final reporting. MWDOC has enjoyed working with Reclamation throughout. The local field and regional personnel are a tremendous help when needed in understanding the grant agreement requirements. Thanks again.

11. Attachments: *Please attach the following*

- **Any available data or information relied on in responding to paragraph 7, above; Not Applicable**
- **A map or illustration showing the location of the recipient's facilities (see paragraph 4, above);**
- **Maps, sketches, and/or drawings of the features of the completed project, as appropriate (see paragraph 5, above);**
- **Representative before and after photographs, if available;**
- **A table showing the total expenditures for the completed project (please see Sample Final Project Costs Table, below).**

FINAL PROJECT COSTS TABLE.

BUDGET ITEM DESCRIPTION	COMPUTATION		RECIPIENT FUNDING	RECLAMATION FUNDING	TOTAL COST
	$/Unit and Unit	Quantity			
Task 1 - SALARIES AND WAGES					
Joseph Berg	$65.08	4.5	$249.95	$42.91	$292.86
Beth Fahl	$31.25	42.75	$1,140.07	$195.72	$1,335.79
Jessica Ouwerkerk	$39.58	1	$33.78	$5.80	$39.58
Steve Hedges	$50.39	254	$10,924.13	$1,875.39	$12,799.52
Sergio Ramirez	$28.44	.25	$6.07	$1.04	$7.11
Melissa Baum-Haley	$41.84	69.5	$2,481.89	$426.07	$2,907.96
FRINGE BENEFITS					
Joseph Berg	$22.33	4.5	$85.75	$14.72	$100.47
Beth Fahl	$13.08	42.75	$477.21	$81.92	$559.13
Jessica Ouwerkerk	$12.27	1	$10.47	$1.80	$12.27
Steve Hedges	$13.98	254	$3,031.27	$520.39	$3,551.66
Sergio Ramirez	$9.52	.25	$2.03	$.35	$2.38
Melissa Baum-Haley	$12.11	69.5	$718.57	$123.36	$841.93
TRAVEL					
EQUIPMENT					
SUPPLIES/MATERIALS					
Task 2 – Marketing/Promotions			$0.00	$0.00	$0.00
CONTRACTUAL/ CONSTRUCTION					
Task 3 – Site Inspections			$0.00	$20,062.67	$20,062.67
Task 4 – Rebate Incentives			$78,727.33	$74,536.38	$74,296.38
Task 5 - Reporting			$0.00	$0.00	$0.00
Task 6 – Statistical Evaluation			$0.00	$0.00	$0.00
ENVIRONMENTAL AND REGULATORY COMPLIANCE					
OTHER					
TOTAL DIRECT COSTS					
TOTAL PROJECT COSTS			$97,888.52	$97,888.52	$195,777.04

Prepared for:
United States Dept. of Interior
Bureau of Reclamation
Agreement No. R13AP35362

CII Performance-Based Water Use Efficiency Program

Program Evaluation

Prepared by:
Municipal Water District of Orange County
18700 Ward Street
Fountain Valley, CA 92708

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

The Family of Orange County Water Agencies

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Table of Contents

Acknowledgements

The Evaluation of the Municipal Water District of Orange County's Commercial/Institutional/Industrial Performance-Based Water Use Efficiency Program was achieved by the efforts put forth from the Water Use Efficiency Department of the Municipal Water District of Orange County and the local retail water agencies within Orange County. This study would not have been possible without the participation of the participating water retail agencies that provided data for the program evaluation. It was a collaborative effort by all parties involved.

Valuable information and contributions were made by the following staff at the Municipal Water District of Orange County:

- Mr. Joseph Berg
- Mr. Steve Hedges
- Dr. Melissa Baum-Haley
- Ms. Corinne Van Dyke

The agencies that provided funding for the Commercial/Institutional/Industrial Performance-Based Water Use Efficiency Program and this program evaluation through grants:

- United States Bureau of Reclamation
- Department of Water Resources
- Santa Ana Watershed Project Authority - One Water One Watershed

The agencies that provided rebates and incentives to assist with the Commercial/Institutional/Industrial Performance-Based Water Use Efficiency Program:

- Metropolitan Water District of Southern California
- Municipal Water District of Orange County
- The Family of Orange County Water Agencies

Special thanks go out to all retail agencies and customers that supported and participated in the Commercial/Institutional/Industrial Performance-Based Water Use Efficiency Program and this program evaluation.

Executive Summary

The Commercial/Institutional/Industrial Performance-Based Water Use Efficiency Program was developed by the Municipal Water District of Orange County (MWDOC) to offer commercial sites rebate incentives to encourage water reduction through comprehensive process improvements and/or one-to-one replacement of high water using devices for water efficient devices. Comprehensive landscape projects include the replacement of non-functional turfgrass with climate-appropriate, non-invasive, California-Friendly landscapes or permeable surfaces, conversion of high-water-using spray heads to rotating nozzles, upgrade of conventional irrigation timers to smart timers and irrigation management services. MWDOC's Program goals included a water savings goal of 113 acre-feet-per-year (AFY), by targeting 19 AFY for CII comprehensive project improvements, 43 SFY for CII one-to-one improvements and 51 AFY for comprehensive Large Landscape projects. Based on the results of the program evaluation, the actual water savings achieved was 170 AFY for indoor one-to-one improvements and 240 AFY for outdoor landscape projects.

The Program is funded by a Lower Colorado Region – Southern California Area Office Water Conservation Field Services Program Grant Program for FY 2015 provided by the United States Dept. of Interior Bureau of Reclamation (USBR), Department of Water Resources (DWR), Santa Ana Watershed Project Authority (SAWPA) - One Water One Watershed (OWOW) along with additional funding from the Metropolitan Water District of Southern California, and the Family of Orange County Water Agencies. The Program commenced in October 1, 2013 and ran through September 30, 2015.

A key requirement of the USBR grant funding is that a program evaluation be performed to determine the successes and challenges faced by the Program (Process Evaluation) and the actual water savings achieved by the Program (Impact Evaluation). As part of this Program Evaluation, a random sampling of commercial sites was taken and analysis was performed to determine the change in water use of the sites before and after Program intervention, with comparison to a control group.

The sample set comprising this program evaluation included a total of 19,516, device upgrades were installed, yielding a potential water savings of 246 acre feet of water per year. Additionally there was a total of 171,955 sq-ft commercial large landscape upgrades, yielding a potential water savings of 23 acre feet of water per year. The purpose of the Impact Evaluation was to estimate the actual water savings; meaning realized water savings that could be discerned at the meter. A pre/post implementation treatment designation with weather normalization and pairwise analysis was introduced into the analytic framework to keep irrigation need based on site size consistent. Through the Impact Evaluation, it is estimated that the water savings associated with these interventions resulted in 411 AFY. These implementation rates have far exceeded the Program goals resulting in a combined 364% exceedance of the water savings goal.

Introduction

The Municipal Water District of Orange County (MWDOC) commenced the Commercial/Institutional/Industrial (CII) Performance-Based Water Use Efficiency Program (Program) on October 1, 2013. The Program is offered to commercial sites located within the Santa Ana Watershed Project Authority (SAWPA) portion of MWDOC's service territories, which includes 20 retail agencies as well as the cities of cities of Anaheim, Fullerton, and Santa Ana. The purpose of the Program is to offer commercial sites rebate incentives to encourage water reduction through comprehensive process improvements and/or one-to-one replacement of high water using devices for water efficient devices. Comprehensive landscape projects include the replacement of non-functional turfgrass with climate-appropriate, non-invasive, California-Friendly landscapes or permeable surfaces, conversion of high-water-using spray heads to rotating nozzles, upgrade of conventional irrigation timers to smart timers and irrigation management services.

The Program is funded by a Lower Colorado Region – Southern California Area Office Water Conservation Field Services Program Grant Program for FY 2013 provided by the United States Dept. of Interior Bureau of Reclamation (USBR), Department of Water Resources (DWR), Santa Ana Watershed Project Authority (SAWPA) - One Water One Watershed (OWOW) along with additional funding from the Metropolitan Water District of Southern California, and the Family of Orange County Water Agencies. As part of the CII Performance-Based Water Use Efficiency Program, the funding agencies require that a Program Evaluation be performed.

The purpose of this Program Evaluation was to perform an Impact Evaluation of water savings achieved by participants in the CII Performance-Based Water Use Efficiency Program. In addition to fulfilling a grant agreement requirement, MWDOC is looking to determine what successes and challenges came with implementation of the Program. As part of this Program Evaluation, data was collected for all of the commercial sites participating in the Program and analysis was performed to determine the following impact on water use. For this water savings impact analysis, billing data was requested from participating retail water agencies of participating customers. The Impact Evaluation analyzed the water use trends of the customers based on control sites as well as pre/post installation of the device or landscape modification (intervention point). Additionally, the water use was weather normalized to allow for removal of temporal and climatic variability. Finally, these results were compared to previous evaluations MWDOC has performed on past programs as well as industry accepted water savings rates.

Evaluation Need

A key requirement for receiving this grant funding from USBR is the performance of a Program Evaluation to determine either the successes or challenges faced by the Program and the actual water savings achieved. The Program Evaluation began in August 2015. The Program is set to conclude on September 30, 2015. The results from this Program Evaluation will help determine the effectiveness of the water efficient device installation and large landscape conversions. This will provide information on how similar water efficiency rebate programs should be focused in the future.

Program Evaluation Objectives

The goals of the Program Evaluation are to:

1. Evaluate water savings from installed device or landscape modification in the commercial sector.
2. Compare results to previous evaluations MWDOC has performed on past programs as well as industry accepted water savings rates.

Program Summary

The CII Performance-Based Water Use Efficiency Program was developed to assist commercial sites located within the SAWPA portion of MWDOC's service territory with reducing their indoor and outdoor (landscape) water use. MWDOC was awarded the USBR Grant to implement the Program, as a continuation of the suite of existing water use efficiency opportunities. Therefore, MWDOC was able to immediately commence the Program upon the execution of the agreement on October 1, 2013.

Data collection and reporting tools were developed to MWDOC's, MWD's, and USBR's specifications, and rebate funding levels were established. By using grant funds, the Program rebates are enhanced beyond the standard offerings by MWD. Additionally, the retail water agencies contributed funds through the Choice Program in order have access to the MWDOC portion of the rebate.

MWDOC, MWD, and the retail agencies were all proactive in marketing the Program. Components of marketing for involved local retail agencies including bill stuffers informing them of the availability of the enhanced rebates through this Program. Additionally, the program was advertised on the MWDOC, MWD, and local retail agency websites and concurrently MWDOC used a variety of social media platforms as a promotion tactic. MWDOC also promoted the Program at public outreach and industry specific events and presentation.

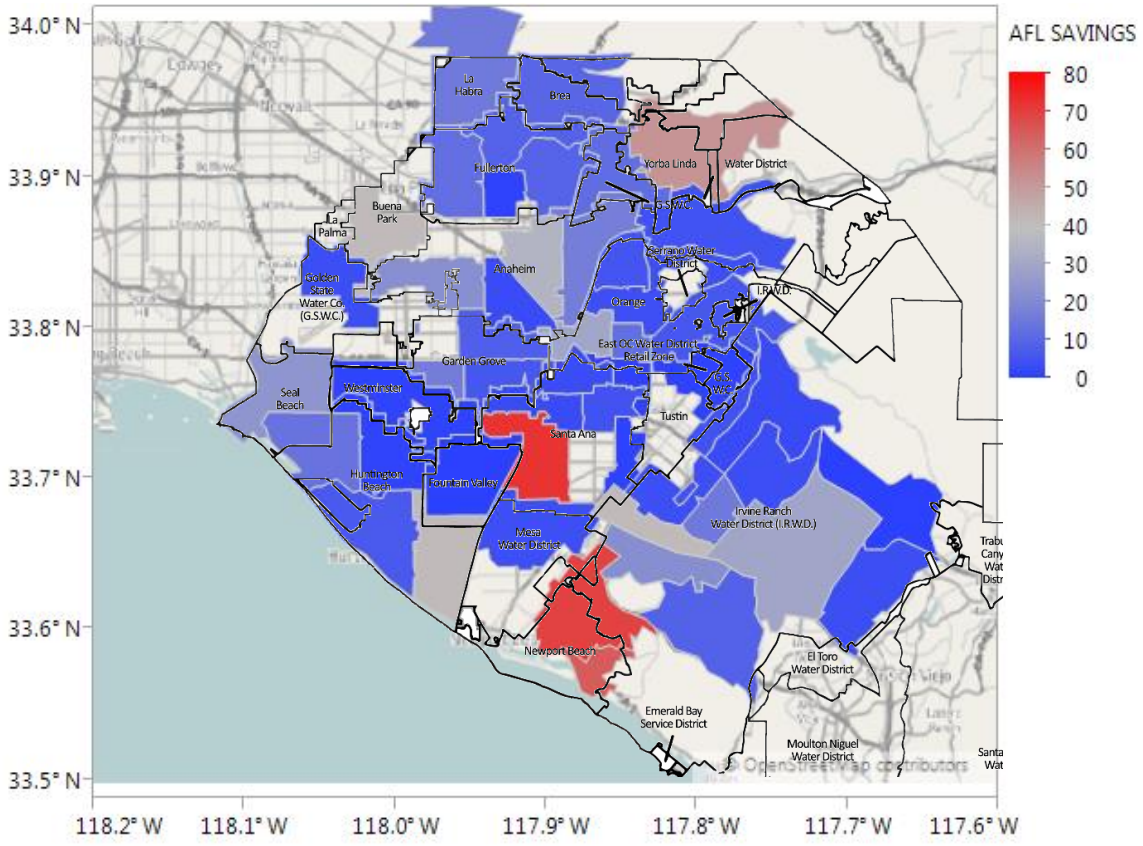


Figure 1. Geographic distribution of device water savings (AFL) installed through this program by zip code.

Program Effectiveness

Since the launch of the CII Performance-Based Water Use Efficiency Program in October 2013 through the completion of the Program evaluation, 19,516 device upgrades and a total of 171,955 sq-ft commercial large landscape conversions occurred. Figure 1 illustrates the geographic distribution of the water savings associated with the Program devices.

Impact Evaluation

The primary objective of the Program Impact Evaluation was to measure the amount of water saved throughout the course of the CII Performance-Based Water Use Efficiency Program. A statistical analysis of the collected data was performed in order to provide insight into the characteristics of sites that participated in the Program and determine if a reduction of water use was due to device installation. The following information describes the methodology of the Program Impact Evaluation.

Monthly meter read data was requested for each site from the retail water agency. Historical water use was requested for a least three years prior to the intervention point and one year following. The intervention point is designated as the point in time when the device was purchased/installed. Water savings was determined by comparing the gallons per day water use prior to and following the intervention point. This methodology allowed for direct comparison of water use based on comparable irrigation need and system consistency.

The evaluation sample set was comprised of meter data received from only those water agencies which were able to provide usable data. The number of usable accounts encompasses 82% of the total Program population. This sample size is both sufficient for analysis and comparable to MWDOC's previous irrigation timer evaluations.

Additionally, the water use data was weather normalized. The daily evapotranspiration and precipitation measurements were collected from the California Irrigation Management Information System (CIMIS), weather station number 75 located in Irvine. Spatially interpolated or "Spatial ETo" values were collected for additional areas on the basis of zip code.

The following assumptions were taken:

- The monthly meter read data that was beyond two standard deviations (95.5%) was not included in the analysis as these data encompassed outliers.
- It was assumed that no other significant reduction in water use occurred by the customers during the study period. If the analyses indicated a significant difference in water use after installation, it was assumed that the installation of the device was responsible for the change.
- With respect to the weather normalization, a linear regression relationship was generated for the pre and post periods with their respective water use.

Water Savings Results

Effect of High Efficiency Toilets

High efficiency toilets (HETs) were delineated into three water categories: HETs, HET within the multi-family sector, and premium HETs. The difference between the general and "premium" HETs was the gallons per flush flow rate. The implementation of HETs reduced the consumption of water by 15%, or 216 gallons per day (GPD) per site, from a mean of 1,463 GPD to 1,246 GPD per site (Table 1). Comparison between pre-implementation and post-implementation project sites show there is not a significant difference with general HETs installed at commercial sites (non-multi-family).

However, the analysis of multi-family HET installations resulted in a significant water savings ($p<0.0001$). The mean water consumption was reduced by 35% or 1,086 GPD per site. The pre- versus post-implementation sample set (n= 814) for daily water consumption reduced from a mean of 3,100 GPD to 2,014 GPD, respectively (Table 1). The premium HETs resulted in the greatest water savings ($p<0.0001$), where the mean water consumption was reduced by 43% or 2,417 GPD per site. The pre- versus post-implementation sample set (n= 814) for daily water consumption reduced from a mean of 5,604 GPD to 3,187 GPD, respectively (Table 1). From this analysis, it can be concluded that HET devices are best suited for incentives when in the multi-family sector at the "premium" level (Figure 2).

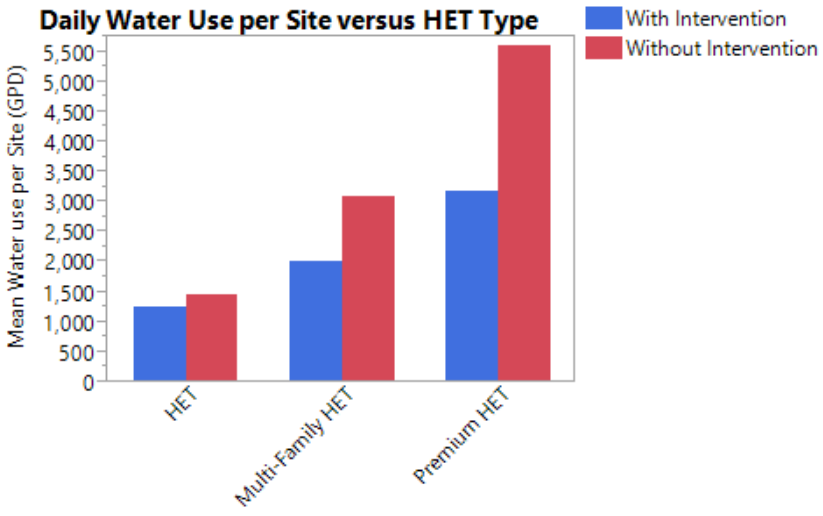


Figure 2. Daily water use per site versus High Efficiency Toilet (HET) type.

Effect of Zero Water Urinal

Zero Water Urinals (ZWUs) resulted in equal water use as prior to installation, with no significant difference between the two amounts. The lack of change seen after installation is potentially due to an error in the manner in which the ZWUs are utilized and maintained.

It has been anecdotally perceived that the manner in which ZWUs and conventional urinals are utilized does not greatly vary. The conventional urinal can function without routine flushing, thereby lowering the actual water use of the device. Further, ZWUs also require some level of rinsing for proper

maintenance and functionality, to reduce caking within the drains and pipes. A final consideration is the placement of the ZWU within the bay of urinals, when not all are replaced. This anecdotal understanding may lead to the limited water savings observed through this analysis.

Effect of Turf Removal

As part of this program, turf removal was implemented at large landscape commercial sites within the project area. For this analysis, the turf removal projects, or treatment sites (TMT), were compared to control sites that were similar in size and location to control for volumetric use. To account for the effects of weather conditions and evapotranspiration rates on water consumption, weather normalizing techniques were used (Figure 3).

The water consumption was reduced by 31% with 450 GPD saved. The average amount of water consumed in project sites was 1018.5 GPD compared to 1468.04 GPD at control sites (Table 1). The analysis depicted resulted in a significant ($p<.0001$) water savings due to this type of landscape conversion.

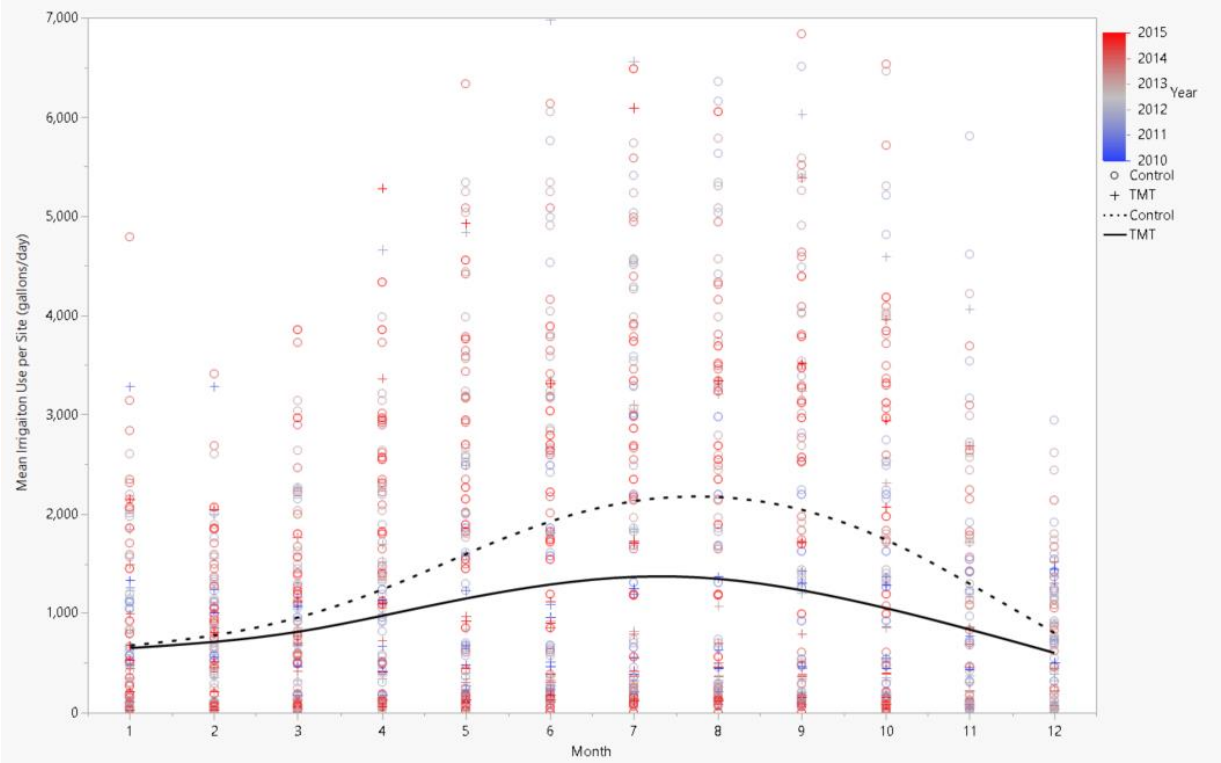


Figure 3. Average monthly irrigation water use at the turf removal treatment sites (TMT) compared to the control sites.

In 2012, prior to the Program commencement, the control and treatment sites used similar amounts of water, as shown by the overlapping of the water consumption lines (Figure 4). The trend of similar water consumption continued into early 2013 until the treatment site began the process of implementing turf removal activity. The treatment sites sustain lower water use following the turf removal. In 2015, the

water use trend of the treatment and control sites realign. Other factors relating to drought messaging may have caused the control site to also reduce their water use in 2015. What is most interesting is that the water use trend for the control sites was lessened rather than the water use of the treatment sites rebounding.

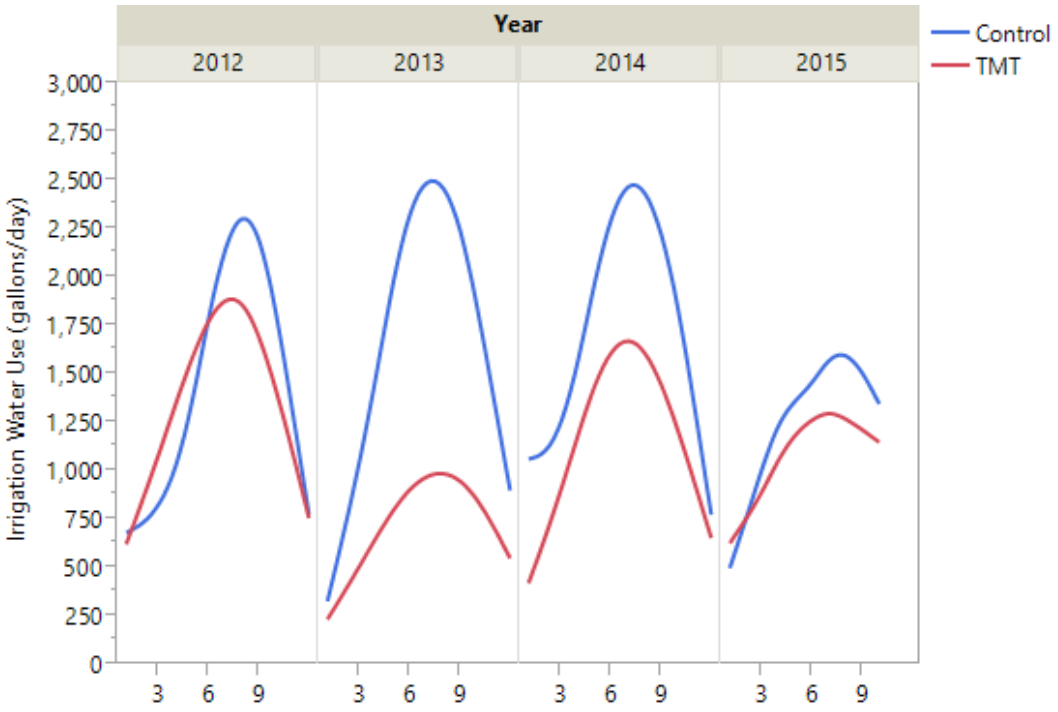


Figure 4. Monthly irrigation water use at the turf removal treatment sites (TMT) compared to the control sites over the program term.

Effect of In-Stem Flow Regulator

The implementation of in-stem flow regulators reduced the consumption of water by 28% or 400 GPD per site. The pre- versus post-implementation sample set (n= 44) for daily water consumption reduced from a mean of 1,435 GPD to 1,046 GPD, respectively (Table 1; Figure 5). Comparison between pre-implementation and post-implementation project sites result in a significant difference (p = .0381).

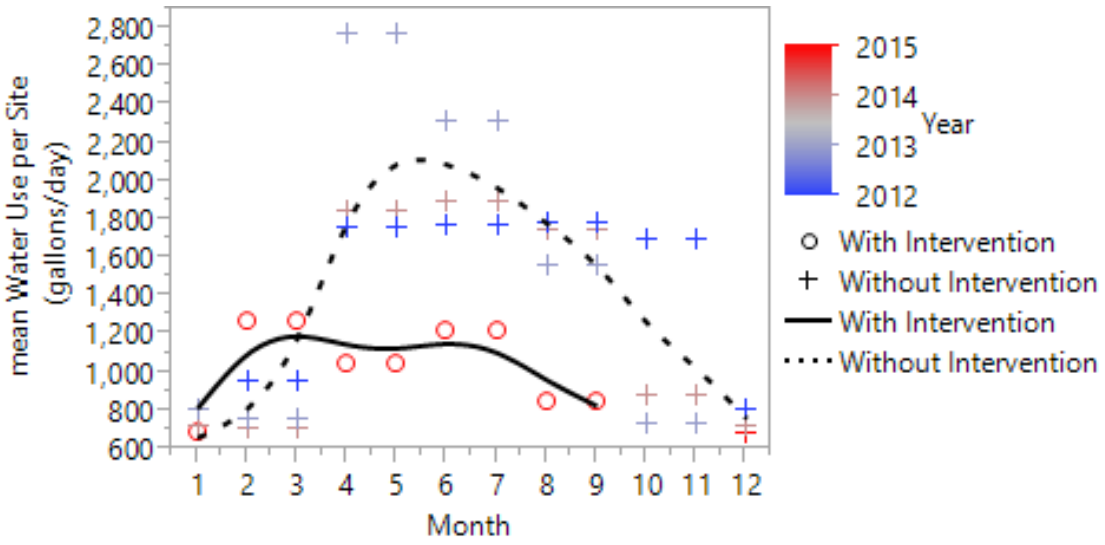


Figure 5. Effect of in-stem flow regulators on mean water use per site.

Effect of Rotating Nozzles

Sites that installed rotating nozzles did not show a significant water savings, and had a reduction of approximately 15 GPD. This concurs with previous evaluations. Where the expected water savings for this device are not fully realized. One reason may be that the schedule was modified (increased) at the time of installation to account for the decreased application rate, resulting in net water savings. Additionally, as illustrated in Figure 6, the water savings appear to be somewhat seasonal, with the majority of the savings occurring in the spring and summer months, this would be a result of scheduling and management.

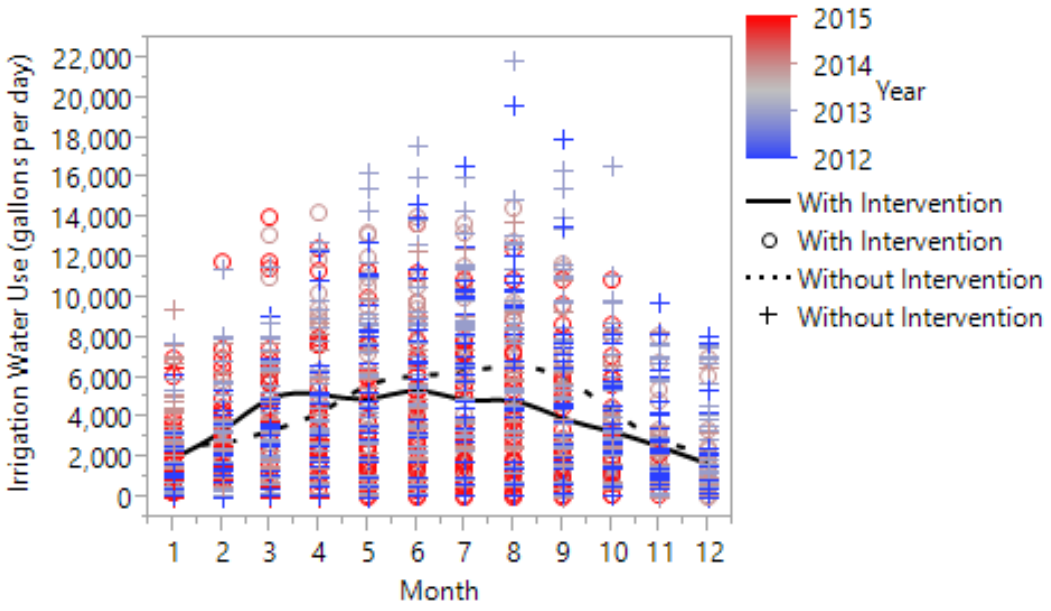


Figure 6. Effect of rotating nozzles on mean water use per site.

Effect of Weather-Based Irrigation Controllers

The net water savings per commercial account (Table 1) is estimated to be 337 gallons per day on average, an approximate 15% reduction. These estimated savings are averages, taken across the entire year, but do not hold true throughout the year (Figure 7). It must always be noted that a cause of reduced water savings observed over time may be a factor of increased temperature as a result of drought conditions in the area. With increases in temperature, and decreases in precipitation, more water is necessary to maintain landscaping areas. Additionally the WBICs must be utilized properly by each project site in order to save water.

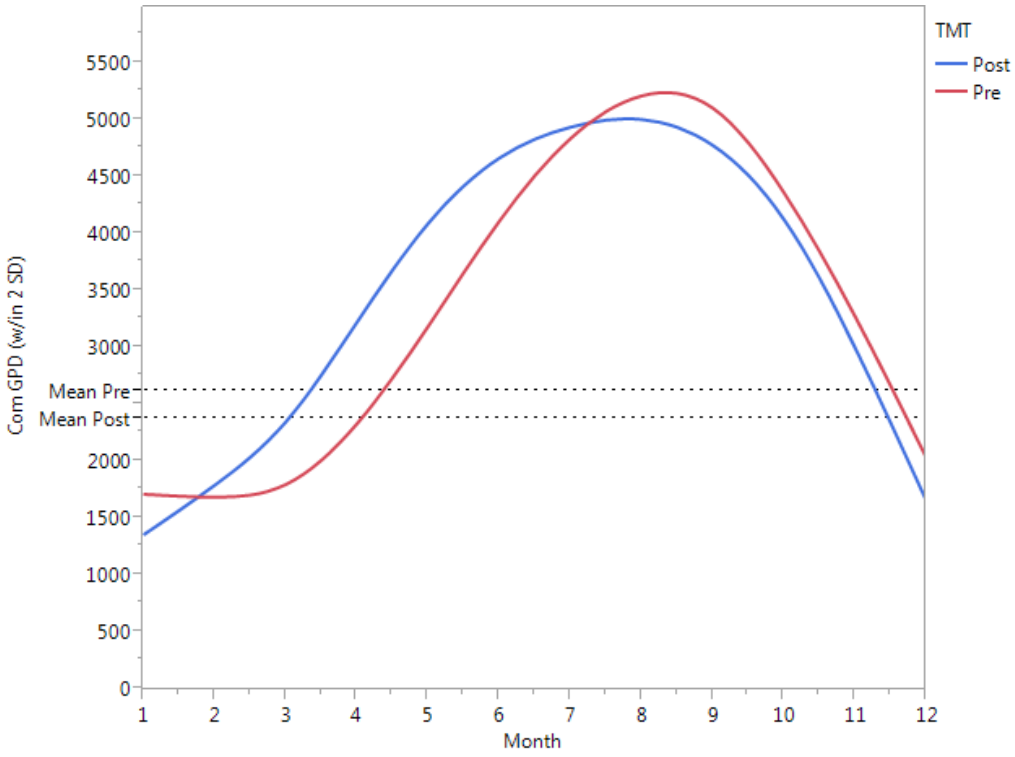


Figure 7. Average monthly irrigation water use for commercial accounts by treatment level.

MWDOC has a long standing practice of conducting evaluations at the completion of program terms. As a means to cross check the result found in this evaluation, and to continue to track the long-term success of this smart irrigation timer rebate, these results are compared. Table 3 summarizes the previous irrigation timer evaluation results in comparison to this evaluation. To visually observe if the results from this evaluation concur with the other evaluations, refer to Figure 8. This figures illustrate the predictive ellipses (α=0.05) generated from the previous evaluation results. Such ellipses are used to estimate what results could be reasonably transferred in another program such as this.

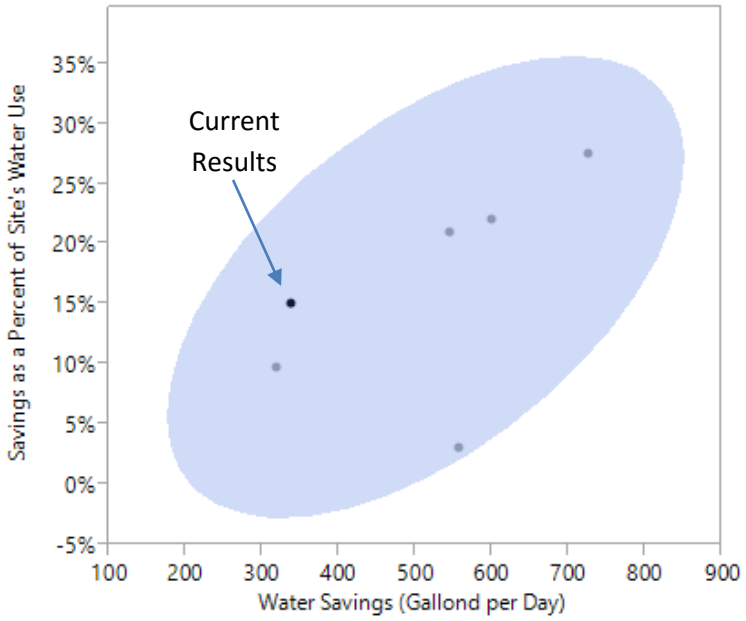


Figure8. Summary of commercial evaluation results including a predictive ellipse.

Table 3. Summary of MWDOC's weather-based irrigation timer evaluation results

Study Title	Author	Commercial Sector		
		Savings (GPD)	No. of Accounts	Percent Savings
Residential Weather-Based Irrigation Scheduling: Evidence from the Irvine "ET Controller" Study,	Western Policy Research, Anil Bamezai, Ph.D.	-	-	-
ET Controller Savings Through the Second Post-Retrofit Year: A Brief Update, 2001	Western Policy Research, Anil Bamezai, Ph.D.	-	-	-
Residential Runoff Reduction Study, 2004	A&N Technical Services, Inc., Thomas Chesnutt, Ph.D.	545		21%
Pilot Implementation of Smart Controllers: Water Conservation, urban Runoff Reduction and Water Quality, 2010	Kennedy/Jenks Consultants, Lawrence Y.C. Leong, Ph.D., QEP	556	209	3%
MWDOC SmarTimer Rebate Program Evaluation, 2011	A&N Technical Services, Inc., Thomas Chesnutt, Ph.D.	727	132	28%
Commercial ET-Based Irrigation Controller Water Savings Study, 2006	A&N Technical Services, Inc., Thomas Chesnutt, Ph.D.	601	896	22%
OC Smart Irrigation Timer Rebate Program, 2014	Municipal Water District of Orange County	320	387	10%
CII Performance-Based Water Use Efficiency Program (This Evaluations)	Municipal Water District of Orange County	337	105	15%

Table 1. Theoretical vs. actual water savings per device, by program total, and per site.

Sector	Device	No. of Devices Installed	Average No. per Site	Theoretical Water Saving			Actual Water Savings			
				Per Device (GPD)	Total (GPD)	Per Site (GPD)	Per Device (GPD)	Total (GPD)	Per Site (GPD)	Percent (%)
Indoor	HET	57	5	22	1,254	251	43	2,462	216	15
	Multi-Family HET	868	28	22	19,096	682	39	33,666	1,086	37
	Premium HET	2,650	56	33	87,450	1,562	43	114,376	2417	
	ZWU	90	15	109	9,810	654	16	1,398	233	-3
Outdoor	Turf Removal	171,955	34,000	0.12	20,635	1	0.013	2,276	450	31
	Rotating Nozzles	15,251	462	0.9*	13,726	30	0.03	495	15	-
	Smart Timers	158	1.5	550*	86,900	57,933	225	35,497	337	15
	In-Stem Flow Reg.	442	1	2.68	1,185	1,185	400	176,800	400	28
				Expected Total: 240,055 GPD 269 AFY 3,923 Lifetime-AF			**Actual Total:** 366,971 GPD 411 AFY 4,819 Lifetime-AF			

*Water saving rate used to the average of all previous evaluations conducted by MWDOC.

Evaluation Conclusion

This Program Evaluation utilized a random sampling of commercial sites to conduct analysis with the following objectives: (1) Evaluate water savings from installed device or landscape modification in the commercial sector and (2) Compare results to previous evaluations MWDOC has performed on past programs as well as industry accepted water savings rates.

From Program launch, on October 1, 2013 through December 30, 2015, when the Program evaluation was, a total of 19,516 device upgrades were installed, yielding a potential water savings of 246 acre feet of water per year. Additionally there was a total of 171,955 sq-ft commercial large landscape upgrades, yielding a potential water savings of 23 acre feet of water per year. The purpose of the Impact Evaluation was to estimate the actual water savings; meaning realized water savings that could be discerned at the meter. A pre/post implementation treatment designation with weather normalization and pairwise analysis was introduced into the analytic framework to keep irrigation need based on site size consistent. Through the Impact Evaluation, it is estimated that the water savings associated with these interventions resulted in 411 AFY. These implementation rates have far exceeded the Program goals resulting in a combined 364% exceedance of the water savings goal.

The cost to benefit ratio is often a metric used to quantify program effectiveness. The USBR grant award totaled $97,888. While MWDOC was only obligated to match $97,888 in funds, the actual cost associated with Program implementation was $486,619. The cost to benefit ratio with respect to USBR's ability to leverage funds through this award opportunity was 1:5. Additionally, based on the total Program cost of $584,507 and the lifetime water savings of 4,819 AF, the cost effectiveness of the Program was $121 per AF.

WATER CONSERVATION FIELD SERVICES PROGRAM
PROJECT BENEFITS

Please check the appropriate water management benefits for agricultural or urban measures that you anticipate addressing in you proposal. Where available, please provide an estimate of the benefit to units (i.e. Acre Feet, Dollars, Percentages)

It is essential to establish benefits of the Program. Please help us with your best estimate.

Reduces Leaks and Seepage _____ Acre Feet/Year

Reduces System Spills _____ Acre Feet/Year

Makes More Water Available __411__ Acre Feet/Year

Reduces Operation Costs _____ $ /Year

Reduces Energy Costs __0.317__ million kWh /Year
(Note: Benefit accrued to Metropolitan as a SWP contractor)

Reduces Waste Treatment Costs _____ $ /Year

Improves Crop Yield _____ Percent/Year

Reduces On-Farm Costs _____ $ /Year

Reduces Per Capita Use __0.78__ Gallons/Capita/Day

Provides Technical Training _1,437__ # of People

Provides Water Conservation Education _6,737__ # of People

Improves Water Supply Reliability _10-20__ Frequency (Years)*
* Estimate of how often the improvement will occur (i.e. 1 = each year)

Delays Construction of New Supplies _____ Years

Reduces Drainage/Erosion _____ Tons

Improves Water Quality __50___ % reduction of irrigation runoff pollutants
(Pollutants include: Nutrients, Pesticides, Herbicides, and Coliform)

Enhances Aquatic/Riparian Habitat _____ Years