CII
TOOL SERIES

LESSONS LEARNED

Dedicated Irrigation Meter Management for CII Accounts DECEMBER 2019

CALIFORNIA
WATER EFFICIENCY
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A Chapter of the Alliance *for* Water Efficiency

Alliance *for* Water Efficiency

PARTNERS FOR A WATER-EFFICIENT CALIFORNIA

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Prepared by California Water Efficiency Partnership with funding from the California Department of Water Resources

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DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

ACKNOWLEDGEMENTS

The Guidebook Team is grateful for the assistance provided by California water suppliers that enabled us to compile this Guidebook summarizing their experiences. The following nine water suppliers provided us with detailed information during in-depth case interviews:

1. Contra Costa Water District: Chris Dundon
2. East Bay Municipal Utility District: Charles Bohlig, Richard Harris, Dave Langridge
3. Irvine Ranch Water District: Amy McNulty, Fiona Sanchez
4. Moulton Niguel Water District: Lindsey Stuvick, Drew Atwater, Gregg Hooper; Rhonda Himley
5. City of Roseville: Bobby Alvarez
6. City of Petaluma: Chelsea Thompson
7. Sacramento Suburban Water District: Greg Bundesen
8. Santa Margarita Water District: Nate Adams, Karla Guardado
9. Western Municipal Water District: Rob Whipple

In addition, 56 other water suppliers participated in an online survey which provided very helpful information. The results of both the case study interviews and the surveys are summarized in this Guidebook. Detailed documentation can be found on the CalWEP website, **calwep.org**.

PREFACE

This "Lessons Learned" Guidebook was made possible through a contract with the California Department of Water Resources. It builds on landscape irrigation management resources previously developed by the California Urban Water Conservation Council, the California Water Efficiency Partnership, and others.

This Guidebook is not intended to duplicate these extensive background resources that have already been published, and which should still be consulted when designing a dedicated irrigation meter management program for commercial, industrial, and institutional customers (See Appendix 3a). Instead, this Guidebook is meant to provide urban water conservation program managers a summary of the experience of water suppliers in designing and managing these programs. Although much of the resulting information is anecdotal, the responses have given us a look at how dedicated irrigation meter management programs are currently being operated.

We hope that you will find this Guidebook useful. Thanks to the California Department of Water Resources for making this project possible.

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SECTION 1: INTRODUCTION

WHAT ARE DEDICATED IRRIGATION METER MANAGEMENT PROGRAMS?

A dedicated irrigation meter management program allows customers and suppliers to compare a property's outdoor water usage with what is actually needed to maintain their landscape. They are typically deployed for commercial, industrial, and institutional (CII) sites with large landscape areas. A program commonly integrates three conservation tools:

Dedicated irrigation meters. A dedicated irrigation or sub meter is a water meter that exclusively meters water used for irrigation. For many years, water suppliers have installed these meters for parks, medians, sports fields, and other large landscapes not associated with significant indoor water usage. But recently, it has become more common to see dedicated meters at any commercial site with significant irrigation demand. These meters aid property owners and suppliers in understanding their outdoor water usage.

Water budgets. A customized, site-specific water budget estimates the amount of water a landscape actually requires. The water budget takes into account landscape area, plant type, plant water needs, local weather, efficiency of the irrigation system, and the purpose and functionality of the landscape. Water budgets may or may not be incorporated into a purveyor's rate structure.

Customer communication and engagement. Communication and engagement can take many forms from education to financial incentives. Strong communication can provide the customer the necessary information and motivation to better manage their water use resulting in reduced water use.

Many water suppliers have seen great success with irrigation meter management programs. Benefits include:

- Accurate independent measurement of outdoor water usage.
- Effective way to engage customers and educate them on the appropriate and efficient use of water for their property.
- Ability to set rates and send a price signal for customers to stay within efficient use.
- Some reported water savings of 20% or more.
- Fair and equitable way to bill customers.

THE FUTURE OF DEDICATED IRRIGATION METER MANAGEMENT PROGRAMS

Knowing irrigation meter management is an effective conservation tool, in 2018 the California Legislature passed SB 606 and AB 1668 (the Conservation Framework), which includes mandates for outdoor water use standards for dedicated irrigation meters and CII water use. The mandates and deadlines for implementation are as follows:

- By May 30, 2022 the State Water Resources Control Board must identify proposed standards for outdoor irrigation of landscape areas with dedicated irrigation meters in connection with CII water use, with performance measures for CII water use, a CII water use classification system for significant water uses, thresholds for requirement of a dedicated irrigation meter, and best management practices.

- By November 1, 2023, each urban water supplier must calculate its urban water use objective, which must include the estimated efficient outdoor irrigation of landscape areas with dedicated irrigation meters or equivalent technology in connection with CII water use.
- In managing dedicated irrigation meters, water efficiency requirements will be set to be equivalent to those contained in the Model Water Efficiency Landscape Ordinance (MWELO). An urban retail water supplier using this approach shall use satellite imagery, site visits, or other best available technology to develop an accurate estimate of landscaped areas.

The exact format and content of the standards and requirements has not yet been determined. But it is clear that water suppliers will be required to follow new guidelines for managing dedicated irrigation meters in the future.

Urban water supplier means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually.

THIS GUIDEBOOK

With upcoming expansion of irrigation meter programs, it is important to take a step back and analyze known information about the real-world application of these programs.

The California Water Efficiency Partnership conducted detailed interviews with nine diverse water suppliers from all regions of the state to take into account demographic and climatic differences. We further surveyed 56 additional water suppliers via an online survey. Our aim was to find answers to the following questions:

- How many suppliers have already implemented a dedicated irrigation meter management program?
- What were their experiences?
- What have they learned?
- What is still unknown?
- Are meter management programs effective?

And more specifically:

- Experiences with measurement and verification of the landscape area.
- Experiences with creating appropriate budgets for that landscape area.
- How to include any landscape still being irrigated and counted on the master meter.
- Views on best practice management of landscapes with dedicated irrigation meters.
- Any information on what urban water suppliers have found to be the most cost-effective options.

Results are divided into five components of implementing irrigation management programs: 1) Installation of irrigation meters, 2) Measurement of the irrigated area covered by dedicated irrigation meters, 3) Designing water budgets, 4) Utilizing water budgets, and 5) Engaging with customers.

SECTION 2: BACKGROUND

Nine water suppliers were chosen for in-depth case study interviews. To obtain a well-rounded perspective the nine suppliers were chosen due to their diversity. They were chosen to represent:

- Diverse demographic and climatic territories
- A wide range in number of total connections
- Regions with high- and low-density commercial areas
- Varying examples of ways suppliers implement irrigation meter management programs

Details of each interviewed supplier are below:

WATER SUPPLIER	RETAIL / WHOLESALE	TOTAL NO. OF CONNECTIONS	WATER BUDGET RATE STRUCTURE	WATER BUDGET BASED RATES FOR CII CUSTOMERS	NO. OF COMMERCIAL ACCOUNTS
Contra Costa Water District*	Wholesale/Retail	61,721	No	N/A	2,800
East Bay Municipal Utility District	Retail	390,000	No	N/A	20,000
Irvine Ranch Water District	Retail	127,435	Yes	Yes - All	6,326
Moulton Niguel Water District	Retail	55,121	Yes	Yes	5,628 CII accounts (of which 2,685 are dedicated irrigation)
City of Roseville	Retail	45,675	No	N/A	2,155
City of Petaluma	Retail	20,656	No	N/A	2,507
Sacramento Suburban Water District	Retail	47,455	No	N/A	2,207
Santa Margarita Water District	Retail	57,300	Yes	Only dedicated irrigation meters	5,250 (2,900 of which are irrigation meters)
Western Municipal Water District*	Wholesale/Retail	24,382	Yes	Only dedicated irrigation meters	1,011

*Both a retail and wholesale agency. For the purposes of this interview the answers pertain to the retail area.

In addition, an online survey was sent out to all CalWEP water supplier members to build on the findings from the interviews. Fifty-six water suppliers responded sharing their experience with dedicated irrigation meters and water budgeting.

SECTION 3: CASE STUDY & SURVEY RESULTS

INSTALLATION OF DEDICATED IRRIGATION METERS

It is clear that the Conservation Framework Legislation envisions increasing the number of dedicated irrigation meters installed statewide. This begs the question- how many have been installed so far?

The water suppliers that we surveyed covered a wide range in the number of their dedicated irrigation meter installations. Some water suppliers had zero dedicated irrigation meters, or only a few (less than 10). Others had large numbers of them (one supplier had over 7,600). Most suppliers surveyed had less than 1,500 dedicated irrigation meters.

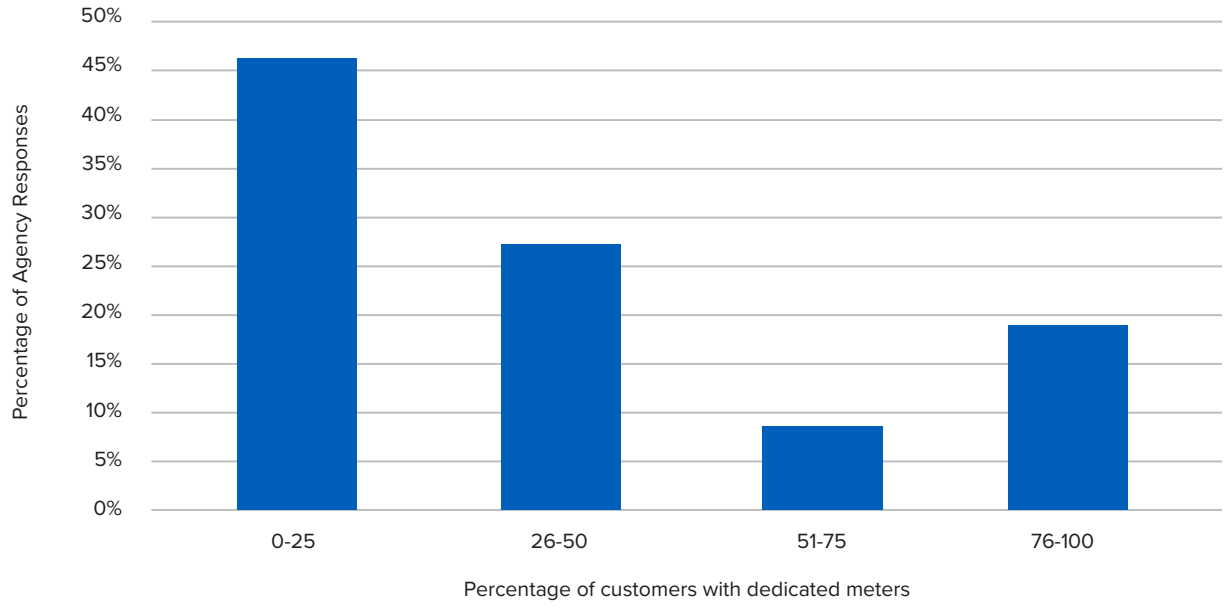
But more important is knowing what percentage of a water supplier's CII customer base this represents. It is not an easy percentage to compute, as most of our respondents said that their CII customers had both dedicated irrigation meters as well as mixed use meters. **Most of our respondents indicated that less than 50 percent of their CII customer base had a dedicated irrigation meter.** Only 10 suppliers indicated that 80 to 100 percent of their CII customers had dedicated irrigation meters. Twenty-nine suppliers said the number was 30 percent or less. These survey results are shown below.

Another important question is what percentage of the CII water use does this represent? Again, we found a wide range. In our nine case studies, it ranged from a low of 5 percent to a high of 99 percent — a very wide variability even among the leading adopters of irrigation meter management programs. Among the 56 suppliers in the online survey, only four said that 75 percent of more of their CII water use is covered with a dedicated irrigation meter. Thirty suppliers said that it was 50 percent or less.

Key Findings on Installing Dedicated Irrigation Meters:

1. The majority of CII irrigation water use is not separately metered.
2. The highest percentages of dedicated irrigation meter installation were in those water suppliers that paired their dedicated irrigation meter accounts with water budget-based rates.

What Percentage of Your CII Customers Have Dedicated Meters?



MEASURING DEDICATED IRRIGATION METER LANDSCAPE AREAS

Measuring dedicated irrigation meter landscapes accurately is vital for creating accurate and fair water budgets. We asked suppliers about how they measured, what they measured, and the cost of conducting measurements.

Measuring landscape areas can be accomplished in a number of ways. Staff can conduct a field measurement by using an odometer wheel or GIS (Geographic Information System) tablet. Measurement can be done through the use of aerial imagery. In many cases it was a combination of both. **For many, aerial imagery provided the first cut of the landscaped area, and site visits using an odometer wheel or GIS tablet enabled a further field verification of the landscape measurements.** This seemed to be the preferred approach. One water agency measured all the dedicated irrigation meter properties by hand using an odometer wheel. With over 1,200 irrigation meters, it took three years to get all the measurements done. Another water agency completes a two-step process where the first step is to determine the area covered by a dedicated irrigation meter, in coordination with the on-site owner or landscape contractor, and then once the irrigable area is defined, the second step is then to accurately measure it with an odometer or spatial analysis.

WATER SUPPLIER	TYPE OF LANDSCAPE MEASUREMENT
Contra Costa Water District	Combination
East Bay Municipal Utility District	Combination
Irvine Ranch Water District	Combination
Moulton Niguel Water District	Field
City of Roseville	Combination
City of Petaluma	Did not measure
Sacramento Suburban Water District	Combination
Santa Margarita Water District	Combination
Western Municipal Water District	N/A

A number of water suppliers do not have landscape measurements for their dedicated irrigation meter accounts. Forty-two percent of the online survey respondents did not measure the landscape areas.

Aerial Imagery Measurements

Among supplier responses, there was wide variation in how aerial imagery is used. Some suppliers use a private GIS firm, but many do this work in-house with GIS staff, conservation staff, or GIS interns. A partnership between the Regional Water Authority and Sacramento Area Council of Governments was mentioned by a number of Northern California water suppliers as having been a lower cost way to conduct aerial imagery measurement. Two water suppliers indicated that they purchased parcel data on their own.

- *"For a long time, we used a free program called FindLotSize. Now we use in-house GIS parcel data."*
- *"We use City and County property/parcel maps (available online publicly) and Google Earth to help estimate parcel size and features as needed, but not in a systematic way."*

Ground Truthing Aerial Imagery

Most water suppliers who use aerial imagery follow up with some type of field verification and measurement, at least on a random spot check basis. Particularly when a CII customer is over budget, a field audit to measure the landscape is conducted by many water suppliers as a matter of best practice. Some water suppliers share the landscape area measurements and maps with their CII customers, who can then identify needed corrections. The biggest issue in ground-truthing is the alignment of parcel information with the irrigated area measurement.

- *"Various processes were used to ground truth the aerial imagery data including drive by, near infrared, and multiple map source verification (Google, City, County, etc.)."*
- *"We go into the field if the aerial photos are hard to decipher. We also ground truth the measurement once the customer is in our water budget system and we see issues with them being way over/under budget."*
- *"We used in-field measurement of length of slope, then in-office correction using ArcMap software."*
- *"We compared aerial imagery to previously completed field work. In general, the aerial imagery was very accurate."*
- *"When there was any doubt about the aerial imagery staff first used Google Street View then site visits (with or without the water customer)."*

Field Measurements

Field measurement is clearly the most expensive part of landscape area measurements. We wanted to learn how water suppliers were conducting the measurements and who was performing the measurements.

In terms of personnel to do the measurements, what we learned is that six out of our nine case study suppliers used existing conservation staff, meter readers, or interns to do this labor-intensive work. Only three hired outside consulting services.

WATER SUPPLIER	MEASUREMENT RESOURCES
Contra Costa Water District	Conservation Staff & Consultants
East Bay Municipal Utility District	Conservation Staff
Irvine Ranch Water District	Conservation Staff & Consultants
Moulton Niguel Water District	Utility Staff & Interns
City of Roseville	Conservation Staff
City of Petaluma	Does Not Have Water Budgets
Sacramento Suburban Water District	Conservation Staff
Santa Margarita Water District	Conservation Staff
Western Municipal Water District	Consultants

Of the 56 suppliers surveyed online, 40 percent did not use field measurements at all, and of those that did measure, over 60 percent used conservation staff, meter readers, or interns. One supplier used the CII customer's landscape contractor and property manager to do the field measurements. Two suppliers refined their aerial landscape measurements with field measurements that were done during audit program site visits.

In terms of field measurement techniques, the odometer wheel was consistently used by eight of the case study water suppliers, and by 48 percent of our online survey respondents. The next most popular measurement tool was measuring tape, which was used by 29 of the online respondents. Pacing a property was also used. GIS tablets and laser measurement were more expensive options and were only used by two suppliers.

Using Customer-Supplied Measurements

Most water suppliers do not rely on customer-supplied measurements, unless the measurements are subsequently verified by conservation staff. In some cases, the customer measurement comes in through a budget variance request, but the landscape measurement is still verified by a staff field inspection. Only five water suppliers among the total surveyed indicated that they used customer-supplied information without verification.

- *"We compared their information to recent GIS imagery and measurements."*
- *"Self-reported data is notoriously inaccurate. Some of our programs require self-reported areas for qualification purposes. However, we administer the programs based on actual field measurements."*

Irrigated versus Irrigable Measurement

A key question to the water suppliers was what did they actually measure? In our nine case studies, five water suppliers measured the irrigated area only. Three measured both irrigated and irrigable.

WATER SUPPLIER	MEASURED IRRIGATED, IRRIGABLE OR BOTH
Contra Costa Water District	Irrigated
East Bay Municipal Utility District	Both
Irvine Ranch Water District	Both
Moulton Niguel Water District	Irrigated
City of Roseville	Both
City of Petaluma	Does not have budgets
Sacramento Suburban Water District	Irrigated
Santa Margarita Water District	Both
Western Municipal Water District	Irrigated

- *"We measured all areas that appear to be irrigated via the aerial map and those identified by the customer or some knowledgeable source. Areas removed from the measurements include building footprints, concrete regions, and area visibly non-irrigated."*

Measuring Slopes

Slopes can be tricky to measure, so we were interested in how water suppliers measured them. Most suppliers indicated that they did not address slopes specifically in their measurements. A couple of the case studies stated that they measured slopes in the field if the slope area was sizable.

WATER SUPPLIER	BEST PRACTICES FOR MEASURING SLOPE
Contra Costa Water District	N/A
East Bay Municipal Utility District	Field Measure
Irvine Ranch Water District	Field Measure
Moulton Niguel Water District	N/A
City of Roseville	N/A
City of Petaluma	Does not have budgets
Sacramento Suburban Water District	N/A
Santa Margarita Water District	N/A
Western Municipal Water District	N/A

Below are sample anecdotal answers to "What best practices did you employ for measuring sloped areas?":

- *"We incorporated a slope factor into the area measurements, based upon data from a topographic/slope layer in GIS."*
- *"We employed Smart practices for slope. Including a GIS elevation change and known slope correction factors/ percentages."*
- *"Orthorectification is needed when working with aerial imagery in GIS. Automated water budget calculations can be generated with an expected variance up to 10 percent from actual. We then used field measurements to manually adjust these measurements."*

Measuring Plant Zones or Plant Classifications

Do water suppliers also measure landscape plant zones or plant classifications when measuring landscape area for dedicated irrigation meter accounts? Most suppliers indicated that they do not. If and when they do measure them, they break them out mostly into turf versus non-turf areas.

Exempt Areas from Measurement and Water Budgets

How do water suppliers deal with landscaped areas that are exempt from the more restrictive water budget requirements of dedicated irrigation meters – areas such as recreational areas or areas permanently and solely dedicated to edible plants?

We found that **more than half of the respondents did not exempt any of these areas.** Only one of the nine case study suppliers indicated that they exempted some areas such as parks and cemeteries. **Most indicated that instead of exempting these areas, these areas received a higher budget allowance.** For example, parks and other "special recreational areas" would get 100 percent of ET, rather than 70 percent (regular CII accounts) or 80 percent (recycled water irrigated).

- *"We develop water budgets for each site based on specific areas devoted to turf and shrubs/trees. We don't exempt any area."*
- *"If they have recycled water or functional turf areas (play areas) then these customers get a higher budget allowance."*

WATER SUPPLIER	EXEMPT ACCOUNTS (YES/NO)
Contra Costa Water District	N/A
East Bay Municipal Utility District	ET Adjustments
Irvine Ranch Water District	ET Adjustments
Moulton Niguel Water District	ET Adjustments
City of Roseville	ET Adjustments
City of Petaluma	N/A
Sacramento Suburban Water District	No
Santa Margarita Water District	ET Adjustment (Recycled Water)
Western Municipal Water District	ET Adjustments

Key Findings of Measuring Irrigated Areas:

1. Measurement accuracy is vital for fair water budgets.
2. Alignment of parcel information with irrigated area is critical for aerial measurements. In many instances, parcel boundaries do not align with the coverage areas of dedicated irrigation meters.

3. The most accurate method of measurement is "on the ground" field measurements.
4. Field measurement are the most time consuming and costly.
5. Combining aerial imagery with subsequent field measurement is the preferred approach for measuring landscape areas.
6. Most suppliers did not exempt special landscape areas but instead provide an additional budget allocation factor.
7. Nearly all suppliers verified customer-supplied measurement data.

DESIGNING WATER BUDGETS

Water budgets utilize the measured irrigated landscape area, plant type, plant water needs, irrigation system efficiency and local weather to create a "budget" or a maximum amount of water needed to maintain the landscape. We asked suppliers whether they had water budgets and how they were created.

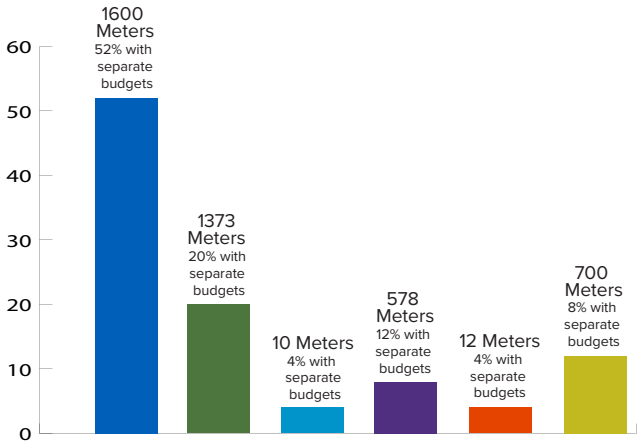
How Many Dedicated Meters Have Water Budgets?

This answer had surprising results. **The majority of suppliers do not have water budgets for all of their dedicated irrigation meters.** In the nine case studies, only four of the respondents said 100 percent of their meters had separate water budgets. The remaining five answers ranged from zero to eighty percent.

WATER SUPPLIER	PERCENT OF DEDICATED METERS WITH WATER BUDGETS
Contra Costa Water District	27%
East Bay Municipal Utility District	75%
Irvine Ranch Water District	100%
Moulton Niguel Water District	100%
City of Roseville	80%
City of Petaluma	0%
Sacramento Suburban Water District	17%
Santa Margarita Water District	100%
Western Municipal Water District	100%

In the online survey, 42 percent of the suppliers stated they did not set water budgets at all for their dedicated irrigation meter accounts. Results from the survey are shown below.

What Percentage of Your Dedicated Meters Have a Separate Water Budget?



What Guidance Did You Use to Set the Water Budgets?

Most water suppliers set water budgets for dedicated irrigation meter accounts using staff calculations. A few hired a consultant to do the water budget calculations.

Similar results were found from the survey. Of those with water budgets, the most common guidance reported was staff calculations followed closely by consultants and MWELO.

All of the budgets used some combination of:

- ETo – Evapotranspiration (water loss) from both the soil and plant.
- Landscape area – Irrigated and/or Irrigable area..
- Plant Factor or ET Adjustment Factor – Amount of water needed for types of plants.

Below are the budget formulas shared during agency interviews.

WATER SUPPLIER	HOW SET BUDGETS	BUDGET FORMULA
Contra Costa Water District*	Consultants & Staff	Area * (KL / IE) * (ETo - ERain) * C
East Bay Municipal Utility District	Consultants, BMP 5 Handbook, MWELO & Staff	(3121 * 1.00 + 0 * 0.00 + 9268 * 0.45 + 0 * 0.00) *0.44*(748/1200)/14 = 142.84591619 GPD
Irvine Ranch Water District	BMP 5 Handbook	ETo x Irrigated Acres x ET adjustment factor; ET adjustment factor is based on cool season turf and irrigation system efficiency requirements
Moulton Niguel Water District	Consultants	ET x ET adjustment factor x Irrigation Efficiency (sf) x Conversion Factor .62 / 748 Gallons Plant factor 0.7 for potable water, 0.8 for recycled water and 100% for public spaces
City of Roseville	MWELO & Staff	Total Eto (in) * ((Total Area (gis) *0.7)/7.4805) else Total ETO (in) * ((turf/7.2) + (Non Turf/7.2))
City of Petaluma		Did Not Implement Budgets
Sacramento Suburban Water District	MWELO and staff	N/A
Santa Margarita Water District	MWELO and staff	Irrigable Area x ET x ET Adjustment Factor / Conversion Factor ET adjustment is 0.8 for potable water and 100% for recycled water
Western Municipal Water District	Consultants	Area * ET * ETAF/1200 + Outdoor Variance

Storage of Water Budget Information

Water suppliers varied in their methods for storing dedicated irrigation meter data. But by far the most prevalent form of storage was a database keyed to parcel number and meter account number. Excel spreadsheets, CIS (Customer Information System), GIS, and an AMI customer portal are all in use as well. Most said they did not store the data in their GIS systems.

WATER SUPPLIER	BUDGETS STORED WITHIN GIS SYSTEM APPLICATION
Contra Costa Water District	N/A
East Bay Municipal Utility District	Yes
Irvine Ranch Water District	Yes & CIS
Moulton Niguel Water District	CIS
City of Roseville	Yes
City of Petaluma	Did Not Implement Budgets
Sacramento Suburban Water District	No
Santa Margarita Water District	Yes & CIS
Western Municipal Water District	Yes & CIS

Key Findings of Designing Water Budgets:

1. Almost half of suppliers contacted do not have water budgets associated with their dedicated meters.
2. All of the budgets used some combination of evapotranspiration, landscape area and irrigated and/or irrigable area.
3. The water budgets are generally not GIS parcel system-driven.

UTILIZING WATER BUDGETS

We asked water suppliers how they were actually using or enforcing compliance with water budgets and received varied responses. Suppliers implement the programs in a variety of ways. Examples include:

- One-time budgets as part of an audit program
- Utilization of customer engagement and usage analytics vendors (e.g. WaterSmart)
- Regular or one-off reporting of budget performance
- Budget-based rates

Tracking Water Budget Compliance

Eight of the nine water suppliers in the case studies stated they track compliance with their dedicated irrigation meter account water budgets on at least a quarterly basis. Most stated they have to manually query the billing system for reports on which dedicated irrigation meter accounts are over budget. Very few systems automatically flag those accounts not complying.

WATER SUPPLIER	HOW MEASURE AND REPORT COMPLIANCE
Contra Costa Water District	WaterFluence
East Bay Municipal Utility District	Monthly/Bi-monthly Report
Irvine Ranch Water District	Billing Statements
Moulton Niguel Water District	Billing Statements
City of Roseville	High Use Notices
City of Petaluma	Did Not Implement Budgets
Sacramento Suburban Water District	Billing Statements
Santa Margarita Water District	Billing Statements
Western Municipal Water District	Billing Statements

The online survey responses were similar. Twenty-five suppliers responded and the majority do not track compliance. Their responses are listed below.

HOW DO YOU MEASURE CUSTOMER COMPLIANCE WITH THE BUDGET?	NUMBER OF RESPONSES
By individually tracking dedicated meter consumption for each billing period.	8
By having the billing system kick out those accounts not complying.	2
We don't track customer compliance with the budget.	12
We do not have water budgets.	3

This seems to be different from the automatic leak alerts that are routine in AMI customer notifications. One issue to explore is tying dedicated irrigation meter water budgets into the AMI customer portals so that notification is as automatic as the leak alerts are.

Customer Notifications

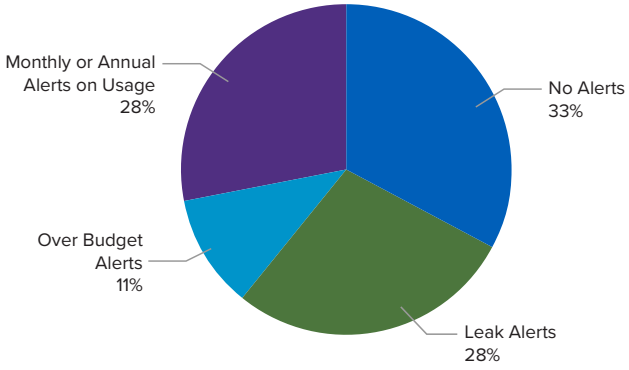
We were very interested in what notifications the water suppliers send to their CII customers related to their water usage vs. water budget. In particular, we wanted to know if alerts were sent to those who are over their water budget allocation. We found that there is wide variation in the nature and frequency of the notifications or alerts that are sent.

Some suppliers send regular water budget reports every month which compare actual vs. budget water consumption. Other suppliers say that they don't send alerts, as their tiered billing system is their method of alerting customers to high use and ensuring compliance.

In interviews, the most common form of an alert is when the allotted budget is exceeded by a defined percentage. Numerous water suppliers also indicated that they use WaterSmart Software to send the alerts.

From the survey, the most common response was "no alerts" followed by monthly or annual alerts, leak alerts and over budget alerts. This is shown in the figure below.

What Types of Alerts Do You Send The Customer?



What did become clear is that suppliers customized alerts to meet their own defined thresholds or frequencies.

- *"Accounts flagged in automated meter system as having potential leaks are called within two working days."*
- *We notify "alert" customers with 7 gallons per hour or more constant consumption.*
- *"Customers can sign up for a once a month alert; otherwise they just see their bills."*
- *"Once a year, beginning of the irrigation season, we send them a budget report for their performance over the last year."*

- *"We issue high use alerts if water use doubles from one month to the next."*
- *"More frequent communication occurs with customers with multiple Dedicated Irrigation Meter accounts."*
- *"We currently make hourly consumption and budget data available through an online portal. This allows customers to set up budget and leak text and email alerts."*

Is There A Correlation of Overirrigation to Site Type?

We wanted to learn if water suppliers were seeing a correlation of what types of CII landscape sites were typically over-irrigating. **Most water suppliers were not doing any analysis by CII site type, as their billing systems don't track the type.** However, a few of our case study suppliers had observations to share. One supplier thought schools typically under-irrigate. Another said that golf courses are good compliers.

- *"Parks and schools are usually under their water budgets, because they can't afford to go over. Golf courses and very large irrigated areas are typically well managed because they have professional staff overseeing irrigation. Small commercial accounts are the sites that typically overwater the most."*

One supplier shared a detailed analysis that they recently completed from 2018 consumption data. Here are their inefficient CII customers as compared with their efficient ones:

Inefficient customers

- Water Efficient Landscape Ordinance (WELO) customers: 184% of budgeted amount.
- Hotels: 183% of budgeted amount.
- Shopping Centers: 153% of budgeted amount.
- Lawn Strips: 148% of budgeted amount.

Efficient customers

- Northern California Regional Transportation System: 15% of budgeted amount.
- Statewide Transportation Agency: 38% of budgeted amount.
- Golf Courses: 59% of budgeted amount.
- Recycled Water: 64% - 75% of budgeted amount.
- Cities: 68% of budgeted amount.
- Home Owner Associations (HOAs): 90% of budgeted amount.

Any CII Landscape Parcels with a Dedicated Irrigation Meter AND a Mixed-Use Master Meter?

Having both dedicated and mixed-use meters serving a site makes water budgeting difficult. Sometimes the dedicated irrigation meter is actually a submeter to the master meter, and sometimes the landscape use is split between the two meters. Fixing it requires on-site surveys to make the determination of what landscape use is not covered by the dedicated irrigation meter.

Of the nine case studies about half said that they have sites with both meter types. One water supplier said that it was about 30 percent of their CII sites, but that was not a typical response.

The problem is finding that these sites exist. Once found, it can only be addressed by watching the irrigation controllers as they are running and matching them to the correct meters. It usually takes two field inspectors to do this accurately, sometimes three. In addition, the customer often has to be present to identify the areas served.

Key Findings on Utilizing Water Budgets:

1. Very few suppliers automatically flag accounts for using over their water budget allocation – the noncompliance has to be queried by staff and individually tracked.
2. Integration into billing and GIS systems is an effective way to compile a comprehensive customer and site profile.
3. There is a wide variation in the use of customer alerts when a dedicated irrigation meter water budget is exceeded.
4. The most common form of data storage for dedicated irrigation meter accounts is a database keyed to premise-specific number and dedicated irrigation meter account number.

COMMUNICATING WITH CII CUSTOMERS

One of the consistent messages received during our interviews was that it is important to maintain good communications with the CII customer, the onsite landscape manager, and/or other individuals involved in the site's landscape management. It takes the collaboration of all parties working together to be most successful. Communication needed to start early and often to build trust and ensure customers understood that the water budget allocations were fair.

We asked suppliers about challenges associated in working with CII customers including:

- Identifying and communicating with decision makers and other stakeholders
- Coordinating site visits
- Effective methods of communication

For the most part, CII customers welcome being given information on their landscape water consumption and adherence to a budget.

Working with the Landscape or Property Manager

In order to get accurate field measurements of dedicated irrigation meter landscape areas, it is often necessary to work with the landscape or property manager rather than the actual account holder. Sixty percent of survey respondents said they had to contact the property or landscape manager. When asked whether this was difficult, the responses varied a great deal. Many of the water suppliers said that this was not a difficult problem, although it is a labor-intensive one. One water supplier said that their staff spent thousands of hours making appointments and these were often difficult to get scheduled.

- *"In general, it has been easy to work with property managers. Especially with our price points where customers are charged more when they go over budget."*
- *"Every site is different. Some managers are responsive, some are not."*
- *"Some property managers are proactive in reaching out to staff to increase irrigated area measurements."*
- *"Showing "draft" or sample water budget reports help. In most cases, property and facility managers are very eager to receive water budget reports. Landscape maintenance staff too. In some cases, it takes time to finally get the square footage data."*

Working with Other Stakeholders

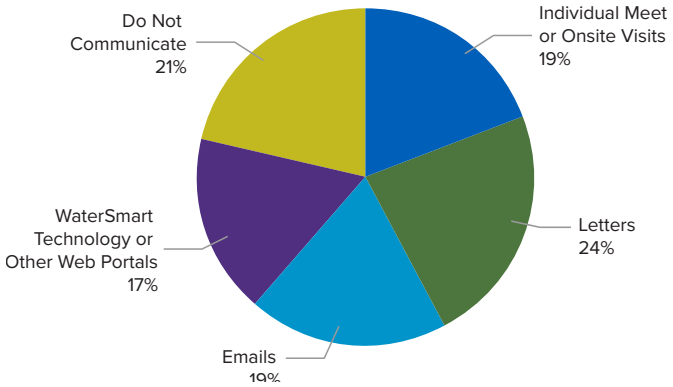
Another unique challenge for CII sites is that numerous individuals and groups can be involved in one site's management. Many suppliers interviewed and surveyed encountered this issue. In addition, working with so many stakeholders often slowed down progress.

- *"It works best to have the account payer, facility manager and landscaper all working together, and having everyone's email address."*
- *"Numerous challenges remain due to separation of water bill/payment among accounting offices and site managers."*
- *"It is always difficult. For large sites, the account holder is seldom the person who is most familiar with landscaping. Often times you simply have to call the business manager and find out who is responsible for landscape maintenance."*
- *"It can be extremely difficult to garner the attention of the HOA's let alone set up a meeting to review outdoor irrigated areas. Part of this is because the landscape company is a key participant in determining these areas, and their time is often at a premium."*
- *"Finding local contacts is sometimes difficult if the bill payer on record is not a local address (i.e. corporate out-of-state address)."*
- *"…there were long wait times to enroll in programs (e.g., HOA Boards meet monthly). It's not uncommon for these to require 2 to 4 months of lead time before making any program commitments."*

Communication Methods

Once key players are identified, various forms of communication were used by water suppliers in managing CII dedicated irrigation meter accounts. Letters and emails were the most prevalent form of communication among the suppliers interviewed, although many water suppliers also conduct individual customer meetings and site visits. Those water suppliers with web-based customer portals used those as well. Among the 56 suppliers surveyed, the most common method listed was "letters" at 24%. The second most common response was that there was "no regular communication" with customers about their water budget (21%).

How Did You Communicate With Your Customers?



Key Findings on Communicating with CII Customers

1. Water budgets and performance against those budgets provides an opportunity for on-going communication with customers and landscape managers.
2. There are multiple players involved in managing CII landscapes. Each plays a unique role and requires involvement at some level.
3. Identifying and getting the attention of the right people to communicate with can be difficult and time consuming.
4. It is necessary to create a relationship with the customer to build trust.
5. Communicating with all stakeholders improves results.
6. Educate the customer on the value of including the landscape service providers, even if it means initial out-of-pocket expense

METER MANAGEMENT PROGRAM EFFECTIVENESS

There are two key components when evaluating the effectiveness of dedicated irrigation meter management programs. First, whether customers reduced their water usage after receiving a water budget. And second, whether the amount of reduction was achieved at a cost-effective price to water suppliers.

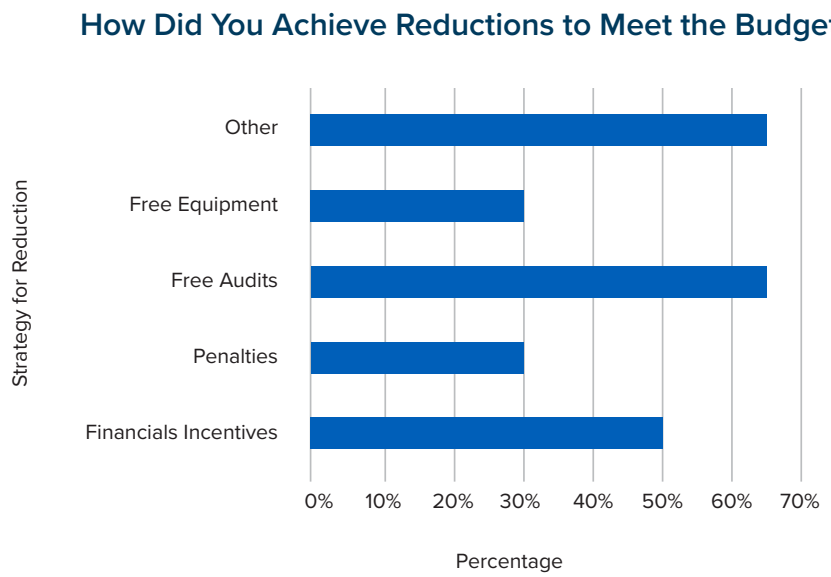
Reduction in Water Usage

Water suppliers believe dedicated irrigation meter management programs save water and had varying reasons for why they believed that their program achieved reductions. We asked suppliers:

"Where CII customers are complying with their budgets, to what do you attribute their compliance?"

A number of reasons were given as to why CII customers comply with their water budgets. The most prevalent answer was the high cost of compliance, particularly where water suppliers have budget-based rates with high penalty tiers or where water rates are rising. Other reasons given were:

- *"Anecdotally it's the customer. If the customer cares and it's a priority, it will happen."*
- *"Clients pay double price for each unit out of budget. That's an incentive to comply!"*
- *"Drought biggest factor in water reduction. Increased water costs and bill reduction savings also key factors."*
- *"Company willingness and having the landscaper on board."*
- *"Rate Structure."*
- *"Fiscally in their best interest."*
- *"Water budget-based rate structures, more sophisticated onsite managers".*
- *"Main driver is financial impact of water budget-based rates. Landscapers often have to pay over allocation charges. Lots of outreach trainings for landscapers."*
- *"Regular performance evaluation provides motivation for managers to improve."*
- *"In normal water years, our water budget is educational in nature and there is no financial consequence other than the cost of overwatering on their utility bill. In drought years 2014 and 2015 we dramatically reduced their budgets and instituted penalties for watering over budget."*
- *"Penalties were enacted during the drought when mandatory irrigation restrictions were in place. Financial incentives are only for sites over half an acre that qualify for our large landscape grant program, or for community gardens."*
- *"Option to meet budget to avoid imposition of drought restrictions."*



One water supplier explained that they do not fine or penalize customers for not meeting their water budget. Instead they achieve good customer compliance through progressive education and giving a business value proposition for CII customers.

We asked the nine interviewed suppliers whether they achieved reductions from: financial incentives (e.g. rebates), penalties, free audits, free equipment (e.g. smart controllers), or "other" strategies. The most common answers were penalties, free audits, and financial incentives.

Forty-eight suppliers answered this question in the on-line survey. For these suppliers, the most common response was "other" and "free audits," both with 65%.

Strategies that were shared under "other" included not tracking whether customers met the budget (7 suppliers) or penalties that only occurred during drought (2 suppliers).

Cost Effectiveness

One of the conclusions we hoped to provide in this Guidebook was an assessment as to whether dedicated irrigation meter management was a cost-effective program. Unfortunately, this was not possible as most suppliers did not assess the cost effectiveness of their programs. None of the case study suppliers interviewed assessed cost effectiveness. Of the 56 suppliers surveyed, only 4 stated that they assessed cost effectiveness and 3 of those focused only on the costs of landscaped measurement.

Several reasons were given for this from the case study suppliers including:

- *"Correctly calculating the benefit is difficult. How do you measure the return on investment on increased water supply reliability?"*
- *"Separating the costs and benefits from just the dedicated irrigation meter program and water budget-based rates proved difficult, since the program costs and benefits overlapped. As an example, one agency's water budget-based rates reduced consumption by 20 percent. How much of this was due to the dedicated irrigation meter program?"*
- *"We didn't want to find out if it wasn't cost effective."*
- *"Now does cost effectiveness even matter? This program will be required anyway under the Conservation Framework Legislation."*

The most difficult information to obtain was the cost of measuring each parcel. Most water suppliers did not break out the cost separately, since in most cases utility staff did the measurement and individual costs were not tracked. When we asked for per parcel estimates we received a very wide range, from $50 per parcel to $300 per parcel, or one to four hours of staff time per parcel. One water supplier indicated that they had spent close to $500,000 to measure all of their dedicated irrigation meter landscapes and design water budgets.

- *"The cost depends on the size. For measurement done by water conservation inspectors, assume 1 inspector for 2 hours at total labor cost of about $220; assume 2 inspectors for 4 hours for total labor cost of about $880;*

assume 2 inspectors for 7 hours for large site for cost of about $1,540. We only utilize landscape architect consultant services for large sites over half an acre that warrant providing a detailed report that estimates the cost of improvements; generally, the full cost of conducting the onsite assessment and full report is $5,000 or more a site."

- *"6 interns placed at 5 suppliers created 1,242 budgets and GIS computer-based landscape area measurements at a direct cost of $60,000, or under $50 per service. Professional full-service landscape audits cost about $650 for 1 to 4 acres and $1,000 for more than 4 acres."*
- *"GIS-Based cost is $1 to $15 for each parcel depending on setup processes, and 4 to 10 times that for field measurements."*

Those suppliers that reviewed cost effectiveness of landscape measurement had the following lessons to share:

- *"Using aerial photos was way more cost-effective."*
- *"…tools employed (GIS tech and project manager) were far more effective than field measurements. With improvements in mapping technologies (LIDAR, Near Infrared, 3-d Topography) the efficiency should be improved."*

Key Findings on Program Effectiveness:

1. Irrigation meter management programs reduce water usage.
2. Financial incentives (e.g. increased rates or penalties) are a significant factor in successfully utilizing water budgets to drive down usage.
3. The highest water saving was achieved when coupled with water budget-based rates.
4. Implementing irrigation meter management programs is costly.
5. Most suppliers did not assess cost effectiveness.

LESSONS TO SHARE DIRECT FROM SUPPLIERS

We asked the suppliers if they had any recommendations on best practices to share. Below are their comments grouped into four main categories.

Landscape Measurement

- *"Use GIS and aerial imagery. It will be more cost effective than just doing field measurements. But have a GIS consultant or auditor do spot checks in the field of several properties to verify and ground truth the aerial estimations."*
- *"Manual field measurements are slower and more expensive but more accurate than automated measurements."*
- *"Always fix parcel data before beginning measurements. If possible, collect as many different categories as possible... you can always roll it up later depending on what you're doing with the data. Measure the size of the planter (not the size of the plants) because the irrigation system waters the entire planter regardless of how small/big the plants are."*
- *"Determining accurate water budgets per meter is extremely difficult on parcels served by multiple meters. Rather than attempting to be exact, try creating a parcel water budget and then equally allocate that budget over however many meters are serving the parcel."*
- *"Measure all properties rather than allowing the customer to do it, as likely the customer won't care too much about getting the measurement right. If you want the most accurate data for the irrigated areas, you will need to measure on-site."*
- *"Train in-house staff to provide clear guidance and consistency on how to address various issues, such as tree canopies that extend beyond the parcel boundary, etc. Without training there can be significant variations in staff measurements for the same parcels."*
- *"Engage a full-time field auditor for landscape area measurements."*

Water Budget Design

- *"Don't change the MWELO ET adjustment factor based on the year built. Go with .8 to start with and then reassess."*
- *"In creating a budget for a customer, create it for the property, not the account. If there are multiple irrigation accounts, combine them. Give it a common parcel name or number that the two irrigation accounts link to. Keep it simple – how much turf, how much non-turf. Use your local ETO."*
- *"Consider a centralized database that links GIS data to the billing system and has the capability to generate automated water budgets. Fine tune this output by means of field inspections and manual adjustments."*
- *Our landscape water budgets are provided to our customers as a service/tool to help them manage their water. This is different than an agency that has rates associated with budgets. It changes what you include in the measurement as well. For example, for our program we use plant factors for lawn and shrubs/plants. By doing it this way, it makes the budget more 'horticulturally' accurate, but also tighter. But since it is a tool for them, this is the correct way. However, if instead we had budget-based rates, we would not use plant factors, we would just use total square footage. This would then give an incentive for customers to replace lawn with water wise plants.*

Customer Engagement

- *"Provide a way for customers to help themselves and to monitor their own budgets and landscape area measurements."*
- *"Get to the right person – usually the property manager. Visit the site when the landscaper is there."*
- *"When there are penalties and real money involved, the property owner will be very interested in making sure you measured the area correctly."*
- *"Offer to meet with property owners to help the budgets be more accurate. We had the most success in leaving phone call messages with advice on how much they could be saving in gallons and dollars."*
- *"Create trust with the property owner and help them understand what is happening. They can be fairly supportive once they go through the process. Outreach is critical to making that happen."*
- *"Encourage training in QWEL or other programs to promote fundamentals at the landscape contractor level."*
- *"Track landscape contractors on how well they are doing in terms of managing water within budget. Create a Landscaper Leader Board."*

Cost Effectiveness

- *"Find cost effective incentives for customers to switch to dedicated irrigation: funds for partial or whole offset of meter installation costs."*
- *"Map the site prior to the site visit, have mandatory site meetings, including with the landscaper. Depending on size of the site, have a staff member at the controller, one at the meter, and one doing the mapping. Use cell phones or radios to communicate with each other."*
- *"Look into improvements in mapping technologies: LIDAR, Near Infrared, and 3-d Topography."*
- *"Get started soon! This is a very labor-intensive program, especially in the measuring of landscapes, and answering customer phone calls."*
- *"Develop financial incentives for irrigation equipment and landscape conversion programs to make the customer interested in participating."*

SECTION 4: CONCLUSION

Although much of the resulting information is anecdotal, the water supplier experiences in the case study and survey responses have given us a look at how dedicated irrigation meter management programs are currently being operated.

We know that dedicated irrigation meter management programs are an effective way to promote the efficient use of water. They provide:

- Accurate independent measurement of outdoor water usage.
- Effective way to engage customers and educate them on the appropriate and efficient use of water for their property.
- Ability to set rates and send a price signal for customers to stay within efficient use.
- Water savings.

And generally speaking, suppliers utilize the same parameters for setting water budgets which most customers find fair and equitable.

However, there are numerous barriers to scaling these programs statewide.

- The majority of CII irrigation water use is not separately metered, and most suppliers do not have water budgets associated with their existing dedicated meter accounts.
- The most accurate method of measurement is "on the ground" field measurement; however, this is the costliest method. Most suppliers have utilized a combination of aerial and field measurements.
- Very few suppliers automatically flag accounts for using over their water budget allocation or regularly report actual use to the budget – the noncompliance has to be queried by staff and individually tracked.
- The optimal program design has integration into GIS and billing systems and regular reporting. It is rarely done and when done it's expensive.
- There are numerous stakeholders involved in managing the landscape use at CII sites (property owners, property managers, accounting individuals, landscape managers, tenants, and governing boards or committees). It takes the collaboration of all parties working together to be most successful. Identifying and communicating with each of them can be time consuming.
- Actual costs have not been tracked and therefore cost effectiveness is unknown at this time.

Moving into the future, an irrigation meter management program that includes: 1) dedicated irrigation meters, 2) fair water budgets, 3) automated tracking of budget performance and 3) robust customer communication offers the greatest opportunity to achieve significant water savings.

APPENDICES AVAILABLE ONLINE AT CALWEP.ORG

Appendix 1 – Summary Data

Appendix 2 – Water Agency Interviews (Anonymized)

Appendix 3a – CUWCC BMP 5 Handbook

Appendix 3b - CUWCC Landscape BMP Guidebook

Appendix 3c – CUWCC Large Landscape Programs 2014

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