



Landscape BMP Implementation Guidebook

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Contents

Introduction	6
Importance of Improving Outdoor Water Use Efficiency.....	6
Landscape BMP Objective.....	7
Landscape BMP Summary.....	7
Standard Implementation.....	8
Implementation Schedule.....	9
Coverage Requirements.....	9
Requirements for Documenting BMP Implementation.....	10
Flex Track Menu	11
Gallons per Capita per Day Compliance	11
Chapter 2 Water Use Budgets	13
BMP Requirement.....	13
Inventory of CII Accounts with Dedicated Irrigation Meters.....	13
Landscape Area	14
Landscape Area Measurement	15
Climate Data.....	16
Water Budget Development.....	18
Equation	18
Calculation Considerations	20
Water Budget Calculators	21
Distributing Water Budgets	22
Including Water Budget Information in Billing Statements.....	22
Water Budget Presentation	23
Targeting Decision Makers	23
Customer Communication Tools	23
Monitoring and Tracking Data	26
Integrating Water Budgets with Water Pricing	26
Program Costs.....	27

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Chapter 3 Technical Assistance 31

- BMP Requirement..... 31
- Types of Assistance 31
- Approaches to Providing Assistance 31
- Monitoring and Evaluation 33

Chapter 4 Water Use Surveys 34

- BMP Requirement..... 34
- Inventory of CII Mixed-Use Accounts..... 34
- Targeting 36
- Water Use Analysis 36

 - Site Management..... 37
 - Preliminary Surveys 37
 - Marketing..... 37
 - Mailing Approaches 38
 - Landscape Contractor Coordination 38
 - Other Approaches 39

- Survey Implementation 39

 - Contractors versus In-house Staffing..... 39
 - Technical How-to 40

- Follow-Up Activities 43
- Monitoring and Tracking Data 44
- Program Costs 44

Chapter 5 Flex Track Program..... 48

- BMP Requirements 48
- Technical Landscape Resources and Training..... 48
- Provide information and resources 48

 - Perform landscape and irrigation audits 49
 - Sponsor or support landscape workshops and trainings 49

- Financial Incentives..... 50

 - Landscape budget-based rates 50
 - Conversion of mixed use meters to dedicated landscape meters 51

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Sub-meters to separate landscape water use	51
Irrigation efficiency improvements	51
http://www.cuwcc.org/Portals/0/BMPResources/Landscape/mcwg_water-wise_2010-winter.pdf	52
High water use plant replacement	52
Potable to recycled water	53
Alternative sources of landscape irrigation water.....	54
Local and Regional Planning and Regulatory Activities	54
Stakeholder Advisory Committee	54
Regional Efforts.....	56
Holistic Approach	57

Introduction

In December 2008, the California Urban Water Conservation Council (CUWCC) updated the Best Management Practices (BMPs) required under the Memorandum of Understanding Regarding Urban Water Conservation in California (MOU)¹, incorporating a broader approach to achieving water savings, improving water use efficiency, and measuring progress. In the past, agencies were limited to meeting specific implementation and reporting requirements in order to comply with the Landscape BMP. However, significant progress has been made in water conserving technologies and practices over the past decade, allowing for a much broader approach going forward. Agencies may now choose to comply with the MOU through BMP implementation, Flex Track alternatives, or performance demonstrated by a reduction in gallons per capita per day (GPCD) over time.

This guidebook has been written to assist urban water agencies with understanding and successfully administering landscape conservation programs in accordance with the Landscape BMP. The intended audience is the Water Conservation Coordinator responsible for implementing the BMPs. It describes programs and practices to be implemented for dedicated irrigation meters, mixed use meters and accounts without meters. Program examples and references are included to assist coordinators in developing and implementing successful programs within their service areas.

Importance of Improving Outdoor Water Use Efficiency

Landscape irrigation represents a significant percentage of urban water use within California; therefore improving outdoor water use efficiency is an essential component of a comprehensive water conservation program. Few areas in California receive sufficient, reliable rainfall to sustain urban landscapes needing high-to-medium amounts of water, particularly in the warmer months. As a result most areas rely on supplemental irrigation to maintain plant health and aesthetics. In some areas, rainfall is inconsequential and not even considered in a water budget. The extensive use of highly irrigated landscapes within the urban environment is the result of many factors: aesthetic standards that originated in areas of the country with more abundant water supplies; property values and cultural norms that place high importance on lush environments; the availability of low cost irrigation systems that are poorly designed, installed, and maintained; the ability to grow and ship high water use plant materials across regions; and comparatively low water rates.

¹ The Memorandum of Understanding and Best Management Practices, as amended December 10, 2008, are available in the Resource Center at www.cuwcc.org.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

While irrigated landscapes serve their intended purpose of improving aesthetics and providing recreation areas, the resulting water demand is impacting water supply reliability. This is compounded by inefficient irrigation, which requires greater water use than necessary to maintain plant health and contributes to costly urban water quality, infrastructure and energy impacts. Irrigation runoff is a major cause of water quality degradation due to the pollutants it carries. It is also a primary cause of asphalt deterioration in roadways. On a broader scale, water-related energy comprises approximately 20 percent of total energy use within the state of California.

Improving outdoor water use efficiency is challenging as it occurs through changes in landscape and irrigation system design and maintenance practices. Unlike installing new indoor fixtures or equipment, it requires an ongoing commitment from the property owner and/or landscape manager to manage the landscape for efficient water use. Many local agencies are establishing sustainability goals as a means to maintain the quality of life within their community. Outdoor water use efficiency is fundamental to achieving a sustainable balance between water supply and demand.

Landscape BMP Objective

The objective of this BMP is that irrigators, with assistance from a water agency, will achieve a higher level of water use efficiency consistent with the actual irrigation needs of plants. Reaching this objective would reduce overall demand for water, reduce demand during peak summer months, and still result in healthy and vibrant landscapes for California.

Better irrigation management will also result in reduced irrigation runoff and non-point source pollution, creating a great opportunity for water agencies and storm-water permit holders to work together in meeting their respective goals for greater irrigation efficiency and watershed protection.

Landscape BMP Summary

Water agencies have three compliance options: 1) standard implementation of the BMP list; 2) Flex Track Menu alternatives; or 3) achieving and sustaining a reduction in GPCD (gallons per capita per day). Regardless of the compliance option chosen, the water savings goal for the Landscape BMP is the same: compliance with the Model Water Efficient Landscape Ordinance (MWELO; addressed in **Chapter 2 Water Use Budgets**) by affected accounts (defined in section 1.4.1, below). Program evaluations have quantified water savings potential between 15-20 percent.

To get started, reference the CUWCC's BMP (<http://www.cuwcc.org/Resources/Memorandum-of-Understanding/Exhibit-1-BMP-Definitions-Schedules-and-Requirements/BMP-5-Landscape>). The agency must define its savings goal by applying the Standard Implementation approach to the water use

characteristics of the affected accounts. Once this step is complete, the agency can decide which compliance option makes the most sense for its service area. Standard Implementation is defined in section 1.4.1.

Standard Implementation

Agencies shall provide non-residential customers with support and incentives to improve their landscape water use efficiency. Credit for prior activities, as reported through the BMP database, will be given for documented water savings achieved through 2008. This support shall include, but not be limited to, the following:

1) Accounts with Dedicated Irrigation Meters

- a) Identify accounts with dedicated irrigation meters and assign ETo-based water use budgets equal to no more than an average of 70% of ETo (Reference Evapotranspiration) of annual average local ETo per square foot of landscape area in accordance with the schedule below. This percentage is specifically for landscapes installed on or after January 1, 2010. Earlier-installed landscapes may use up to 80 percent of ETo, and special landscapes (playing fields, food gardens, and others – defined below) may use up to 100 percent of ETo. There is more on this in the Water Budgets Chapter on page 13.

Recreational areas (portions of parks, playgrounds, sports fields, golf courses, or school yards in public and private projects where turf provides a playing surface or serves other high-use recreational purposes) and areas permanently and solely dedicated to edible plants, such as orchards and vegetable gardens, may require water in addition to the water use budget. (These areas will be referred to as “recreational”) The water agency must provide a statement designating those portions of the landscape to be used for such purposes and specifying any additional water needed above the water use budget, which may not exceed 100% of ETo on an annual basis. If the California Model Water Efficient Landscape Ordinance is revised to reduce the water allowance, this BMP will be revised automatically to reflect that change.

- b) Provide notices each billing cycle to accounts with water use budgets showing the relationship between the budget and actual consumption.
- c) Offer site-specific technical assistance to reduce water use to those accounts that are 20 percent over budget in accordance with the schedule given in Section B; agencies may choose not to notify customers whose use is less than their water use budget.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

- 2) **Commercial/Industrial/Institutional (CII) Accounts without Meters or *with Mixed-Use Meters***
 - a) Develop and implement a strategy targeting and marketing large landscape water use surveys to commercial/industrial/institutional (CII) accounts with mixed-use meters.
 - b) In un-metered service areas, actively market landscape surveys to existing accounts with large landscapes, or accounts with landscapes which have been determined by the purveyor not to be water efficient.
- 3) **Offer financial incentives to support 1) and 2) above.**

Implementation Schedule

- 1) Implementation shall commence no later than July 1 of the first year following the latter of either: 1) the year the agency signed or became subject to the MOU, or 2) the year this Exhibit is amended.
- 2) Per year at least 9 percent of accounts with dedicated meters and 1.5 percent of all mixed-use or non-metered accounts will receive the assistance detailed in Section A. 1) and 2) above. At least 90 percent of all dedicated meters and 15 percent of all mixed-use and non-metered accounts will receive the assistance over a ten year period.

Coverage Requirements

Coverage shall consist of:

- 1) ETo-based water use budgets developed for 90 percent of CII accounts with dedicated irrigation meters at an average rate of 9 percent per year over 10 years.
- 2) Offer site-specific technical assistance annually to all accounts that are 20 percent over budget within six years of the date implementation was to commence.
- 3) Complete irrigation water use surveys for not less than 15 percent of CII accounts with mixed-use meters and un-metered accounts within 10 years of the date implementation is to commence. (Note: CII surveys that include both indoor and outdoor components can be credited against coverage requirements for both the Landscape and CII BMPs.)

An agency will be considered on track if the percent of CII accounts with mixed-use meters receiving a landscape water use survey equals or exceeds the following: 1.5 percent by the end of the first reporting period (year two) following the date implementation is to commence; 3.6 percent by the end

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

of year four; 6.3 percent by the end of year six; 9.6 percent by the end of year eight; and 13.5 percent by the end of year ten.

Agency may credit 100 percent of the number of landscape water use surveys for CII accounts with mixed-use meters completed prior to July 1, 2007 that have received a follow-up inspection against the coverage requirement; agency may credit 50 percent of surveys that have not received follow-up inspections. Agency may credit 100 percent of the number of landscape water use surveys completed for CII accounts with mixed-use meters after July 1, 2007 against the coverage requirement.

- 4) Agency will implement and maintain a customer incentive program(s) for irrigation equipment retrofits.

Requirements for Documenting BMP Implementation

1) Dedicated Landscape Irrigation Accounts

Agencies shall preserve water use records and budgets for customers with dedicated landscape irrigation accounts for at least four years. This information may be used by the Council to verify the agency's reporting on this BMP.

- a) Number of dedicated irrigation meter accounts.
- b) Number of dedicated irrigation meter accounts with water budgets.
- c) Aggregate water use for dedicated non-recreational landscape accounts with budgets.
- d) Aggregate acreage assigned water budgets and average ET for dedicated non-recreational landscape accounts with budgets.
- e) Number of Accounts 20 percent over-budget.
- f) Number of accounts 20 percent over-budget offered technical assistance.
- g) Number of accounts 20 percent over-budget accepting technical assistance
- h) Aggregate acreage of recreational areas assigned water budgets and average ET for dedicated recreational landscape accounts with budgets.

2) CII Accounts without Meters or with Mixed-Use Meters

- a) Number of mixed use and un-metered accounts.
- b) Number, type, and dollar value of incentives, rebates, and no- or low-interest loans offered to, and received by, customers.
- c) Number of surveys offered.
- d) Number of surveys accepted.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

- e) Estimated annual water savings by customers receiving surveys and implementing recommendations.

1.1.1. Water Savings Assumptions

Assume landscape BMP will result in a 15-20 percent reduction in demand for landscape irrigation by affected accounts, as defined in Section C: Coverage Requirements.

Flex Track Menu

The Flex Track Menu compliance approach provides agencies with added flexibility compared to standard BMP implementation (Standard Compliance method). The added flexibility comes with the ability to implement any combination of items on the Flex Track Menu at a rate that will achieve equal or greater water savings to the Standard Compliance method. Water savings estimates for the Flex Track Menu items will be maintained and regularly updated in the MOU Compliance Policies and BMP Guidebook. See Table 1: Flex Track List on page 12.

Gallons per Capita per Day Compliance

A third alternative method to satisfy the BMP requirements in the MOU is Gallons Per Capita Per Day (GPCD) Compliance. This approach offers maximum flexibility to an agency implementing the BMPs. Agencies set a target of an 18 percent reduction in per capita water use by 2018 (82 percent of baseline GPCD); progress is measured through changes in GPCD. Information on the GPCD compliance option is available in the Resource Center at www.cuwcc.org.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Table 1: Flex Track List

Landscape Flex Track Menu
(revised July 9, 2010)

2010 Landscape Flex Track List.pdf

	<i>Measure</i>	<i>Documentation</i>	<i>Water Savings</i>	<i>References/Comments</i>
1.	Monitor and report on landscape water use			
1a.	Measure landscapes and develop water budgets for customers with dedicated landscape meters. Provide timely water use reports with comparisons of water use to budget (through bills, electronically, by mail or other means) that provide customers the information they need to adjust irrigation schedules.	# number of sites with dedicated meters, number of sites with landscape measurements and water budgets, number of sites to be measured and provided water budgets each of the next 10 years, estimated water savings	Range: 178 gpd per acre to 374 gpd per acre	Evaluation of the Landscape Performance Certification Program 2004 (MWDOC) 178 gpd per acre consisted of faxing the monthly reports to the customer 374 gpd per acre consisted of posting the info on-line and password protected access A notation should be included to not include water savings from recycled water to avoid double counting. Agencies should report this in 3f, conversions from potable to recycled water.
1b.	Measure landscapes and develop water budgets for customers with mixed meters. Provide timely water use reports with comparisons of water use to budget (through bills, electronically, by mail or other means) that provide customers the information they need to adjust irrigation schedules.	# number of sites with mixed meters, number of sites with landscape measurements and water budgets, number of sites to be measured and provided water budgets each of the next 10 years, estimated water savings	Same savings as 1a	Evaluation of the Landscape Performance Certification Program 2004 (MWDOC) 178 gpd per acre consisted of faxing the monthly reports to the customer 374 gpd per acre consisted of posting the info on-line and password protected access
1c.	Establish agency-wide water budget.	# water budget, amount of water used (AF/acre)	Measured water savings	For retail agencies to report by sector, such as SF, MF, dedicated meters, etc.
1d.	Establish agency-wide, sector-based irrigation goal to reduce water use, based on seasonality.	# minimum irrigation goal (AF/acre compared seasonally)	Measured water savings	
2.	Provide technical landscape resources and training			
2a.	Upon customer requests, provide landscape irrigation management and landscape design information and resources: provide assistance, answer customer questions, respond to run-off and high-bill calls.	# number of contacts: calls in person, over the phone, or via e-mail, estimated water savings	Measured water savings for residential. Commercial 200 gpd per acre declines within 3 yrs	Santa Rosa has commercial data and does not include those high bill calls that resulted in an audit.
2b.	Perform landscape & irrigation audits: including irrigation scheduling, plant information, and landscape area measurement.	# number of audits conducted per year, measurement of square footage of turf, nonturf areas, estimated water savings	Residential: 25.9 gpd w/timer and 12.2 gpd without timer per site, 60% decay, life of 4 yrs. Commercial: 0.55 AFY per acre, life span of 2 yrs	SD Residential Water Audit Program 1994 Reference Document: Program Design Tool and Savings Estimate, prepared for MWD, 1997 A notation should be included to not include water savings from recycled water to avoid double counting. Agencies should report this in 3f, conversions from potable to recycled water.
2c.	Sponsor, co-sponsor, promote, or support landscape workshops, training, presentations and other	# number of events, number of participants, list title or type of events	Measured water savings	Committee expressed that there is a difference between water savings from training and water

Chapter 2 Water Use Budgets

Figure 1: Steps in Developing a Water Budget Program

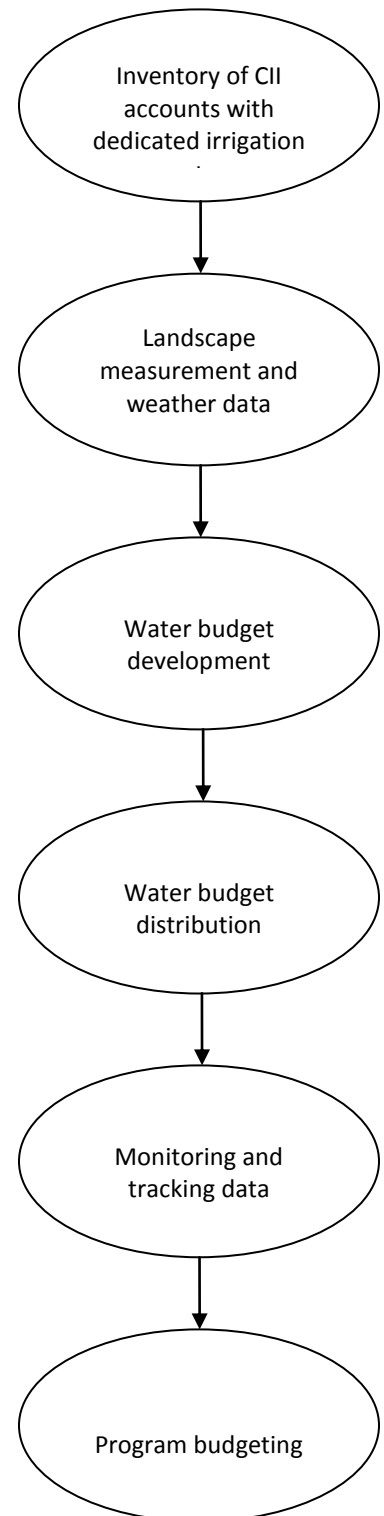
BMP Requirement

The Landscape BMP requires water agencies to assign ETo-based **water use budgets** to their customers with **dedicated irrigation meters**. The budget must not exceed an average of 70 percent of ETo (Reference Evapotranspiration) of annual average local ETo per square foot of landscape area. Recreational areas and areas permanently and solely dedicated to edible plants (as defined in the Landscape BMP) may be assigned a water budget that does not exceed 100 percent of ETo on an annual basis. Each billing period, customers are to receive notices comparing their water budgets with actual water use.

The landscape water budget is a management tool for both agencies and customers; it sets a site-specific benchmark that can be used to identify excessive water use. The goal is to have customers that are over budget work to lower their water use by improving irrigation system performance and management. If an agency is interested in making changes to customers’ plant palate, changing the irrigation system, or otherwise changing what the customer has, rather than simply completing a water budget, more information on these options is available in [Chapter 5 Flex Track Program](#). This chapter offers a step-by-step approach to assist agencies with the implementation of water budget requirements as shown in Figure 1. The following chapters discuss how water budgets can be integrated with other landscape irrigation programs to offer a comprehensive set of services to landscape customers.

Inventory of CII Accounts with Dedicated Irrigation Meters

The first task is to identify the number of accounts with dedicated irrigation meters served by the agency. This is one of the data elements included in the Landscape BMP reporting requirements. Most water agencies have billing systems that contain a customer code field identifying these accounts. In some cases, a combination of data fields will be needed to isolate them. For example, one field may identify accounts and another field may identify that they do not pay a wastewater charge (a common motivation for establishing a dedicated irrigation account). Remember that multifamily residential accounts and home owner associations can have



LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

dedicated irrigation meters, and these should be included in this program.

The next task is to identify sites with multiple dedicated irrigation meters. Many sites, especially those over three acres or where nighttime water main delivery pressures are low, will have more than one irrigation meter. Water budgets are typically calculated at the site level, since landscape area associated with individual meters can be difficult to determine. If the landscape area associated with a specific meter can be easily determined, however, individual budgets can be developed for each meter.

In addition, many customers such as banks, restaurants, park districts, school districts, and government agencies may have multiple sites spread throughout a service area. Agencies have the option of identifying these customers and creating comprehensive multiple-site water use budgets. This aggregation may be useful to site managers who are likely to make multiple-site changes related to irrigation performance, or those needing to prioritize efforts. In any event, knowing the relationships between accounts, sites, and customers can often expand water budgeting options and capabilities.

Landscape Area

The main input affecting the water budget is the size of the landscape area. It can be defined in different ways and with varying degrees of differentiation. The exact definition used will be a key decision for each water agency in developing their water budget program.

The State Model Water Efficient Landscape Ordinance defines “landscape area” as the following:

All the planting areas, turf areas, and water features in a landscape design plan subject to the Maximum Applied Water Allowance calculation. The landscape area does not include footprints of buildings or structures, sidewalks, driveways, parking lots, decks, patios, gravel or stone walks, other pervious or non-pervious hardscapes, and other non-irrigated areas designated for non-development (e.g., open spaces and existing native vegetation).²

When defining landscape area for BMP compliance, an agency should review the definition in the local water efficient landscape ordinance. Water budgets for new and rehabilitated landscape projects will be prepared according to this definition as required for project approval. For consistency, it may be appropriate to use the same or substantially similar definition.

² California Code of Regulations, Title 23 Division 2 Chapter 2.7 Section 491

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Typically, landscape area equals the area of plant material that regularly receives water through an irrigation system. Plant materials include turfgrass, groundcovers, shrubs, trees, and annuals. Depending on the site, one must also consider water features such as fountains and pools. If there are large animals (such as horses) on the site, water may be provided through the irrigation meter so their needs may need to be factored in as well. This may be done through the budget or through a variance. The landscape area definition allows for creation of water budgets that best represent the specific landscape water requirements at the site.

Some water agencies use a more expansive definition of landscape area to include all irrigable area. The difference in landscape area associated with these two definitions may not be great; where sites have substantial undeveloped or non-irrigated landscape areas, however, the difference can be large – the impact being that water budgets will be in excess of what is actually required to irrigate efficiently. In these situations, the undeveloped and non-irrigated areas should be excluded from the landscape area to ensure a more accurate water budget. Note that the landscape area difference between the two definitions generally decreases with the level of urbanization.

The decision of how to define landscape area will largely depend on a water agency's options and costs related to landscape measurement, as described in Section 2.4. Using the tax assessor records or self-reporting options tends to favor using the “all non-hardscape” definition. Using aerial photography or multispectral digital images favors the irrigated landscape definition. Hence, the conservation coordinator needs to explore and consider the landscape measurement task in conjunction with defining the landscape area.

Another important issue regarding landscape area concerns hydrozoning (meaning grouping plants by their water use, usually “low, medium, and high”). The Landscape BMP does not require that plant materials be differentiated in the water budget process (however, the Model Water Efficient Landscape Ordinance does, for all landscapes subject to the ordinance installed after 1-1-2010). An agency may choose to differentiate plant materials into two or more groupings to develop water budgets that more closely match the actual water requirements at a site. This is practiced mainly to separate out and quantify turfgrass areas, which are more water intensive. However, the added complexity of groupings must be weighed against the increased difficulties in landscape measurement: this can get an agency a much more accurate measure of appropriate water use, in the end, but can be more time consuming at the beginning. Regardless of whether plant material is differentiated or not, the water budget must not exceed the BMP requirements for average percentage of ETo as described in Section 1.4.

Landscape Area Measurement

In order to prepare a water budget, the size of the landscape area must be determined. This information may be available for newer accounts if the data was collected in the application for service or during plan review. When the information is not available, an agency will need to collect and verify the data. As an initial step, the agency can request that dedicated irrigation

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

meter customers submit landscape area measurements. The landscape area can be used as an initial estimate for the water budget, and verified by the agency. The verifications should be prioritized based on water use that is significantly over budget, or measurements that seem inaccurate based on neighboring properties or overall property size.

If using staff (agency or contractors), landscape area measurements for existing landscapes are best taken using a site plan and measuring wheel. An alternative is to use aerial imagery and GIS technology. Google Earth® is available free of charge, and it has an area measurement tool. However, the measurements should be ground-truthed for accuracy. Except for high resolution images (images with photo resolution of at least one foot or less), measurements taken from aerial images will be approximate at best. Furthermore, slopes and other landscape areas that should be included in the water budget, such as areas under rooflines, cannot be determined using aerial images. As described above, landscape areas in multiple meter sites should be determined by meter if possible.

East Bay Municipal Utility District (EBMUD) has developed a method using GIS and aerial images to calculate landscape area. Members can access this tool through the Council's Landscaping Programs page:

<http://www.cuwcc.org/Resources/BMP-5-Landscape-Programs..>

Climate Data

The other main input affecting water budgets is climate. In order to calculate a water budget, the evapotranspiration rate of the site must be known.

Definition of Evapotranspiration: Derived from the Department of Water Resources California Irrigation Management Information System (www.cimis.water.ca.gov)

Evapotranspiration (ET) is the loss of water to the atmosphere by the combined processes of evaporation (from soil and plant surfaces) and transpiration (from plant tissues). It is an indicator of how much water one's crops, lawn, garden, and trees need for healthy growth and productivity. Since there are so many factors affecting ET, it is extremely difficult to formulate an equation that can produce estimates of ET under different sets of conditions. Therefore, the idea of reference crop evapotranspiration was developed by researchers. Reference ET (**ET_o**) is the ET rate of a reference crop expressed in inches or millimeters. It is a measure of the effect of weather on the need for water by landscape plant materials. The California Information Management Irrigation System (**CIMIS**) uses a well-watered, actively growing, tall fescue grass, clipped at 4 to 6 inches, that is completely shading the soil as a reference crop at most of its 120-plus weather stations.

The Landscape BMP states that agencies need to create ET_o-based water budgets, and that water budgets cannot exceed on average 70 percent of ET_o per square foot of landscape area with the exception of 100 percent ET_o for recreational areas as defined in the BMP. For an agency example of this as implemented "on the ground," please see the City of Santa Rosa's

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

case study http://www.cuwcc.org/Portals/0/BMPResources/Landscape/City_of_Santa_Rosa_landscape_water_budgets.doc.

Historical and current ET_o data for areas throughout California are available in electronic format from CIMIS. The Department of Water Resources provides reference evapotranspiration (ET_o) reports that can be queried using a Google maps interface or by zip codes. More information on CIMIS can be found on the website:

<http://www.cimis.water.ca.gov/cimis/welcome.jsp>.

When calculating water budgets, a water agency can use either some historical average of ET_o or actual ET_o observations. It is recommended that actual ET_o observations be used wherever possible so that water budgets reflect real-time irrigation demands. Significant fluctuations in weather from normal, such as events like El Niño, illustrate the importance of using real-time ET_o and will minimize criticisms that water budgets do not reflect actual site conditions.

It is possible to use non-CIMIS weather stations to estimate ET_o . Data can be obtained from on-site weather stations for weather-based controllers, private company websites, or National Oceanic and Atmospheric Administration (NOAA); the website has more information available here: <http://www.ncdc.noaa.gov/oa/ncdc.html>. In some cases a NOAA station may be in a more representative location than the closest CIMIS station. However, NOAA stations rarely collect all of the data needed to calculate ET_o (i.e., net radiation, air temperature, wind speed, and humidity). NOAA stations usually are limited to temperature and precipitation, and sometimes pan evaporation. Although it is possible to use formulas that estimate ET_o solely from temperature or pan evaporation, these formulas provide less accurate results. Any gain derived from closer proximity to a NOAA stations will be negated by inaccuracies in ET_o estimation. Unless the agency is confident with the accuracy of the data, it is recommended that agencies use CIMIS ET_o data in almost all cases.

Rainfall may be included in the water budgeting process at the agency's discretion. Rainfall naturally supplies a portion of the ET_o -based water needs of plants. Not all rain offsets ET_o , however, as some is lost as runoff or percolates past relatively shallow root zones (e.g., turfgrass). Moreover, California receives most of its rain in the winter when ET_o is low. In general, only about 20 to 50 percent of annual rainfall is effective at offsetting ET_o in California.

Although including rainfall can increase the precision of water budgets to reflect real water needs, most agencies may find integrating rainfall to be more trouble than it is worth. When considering whether to include effective precipitation into water use budgets, agencies should consider the following:

- In California, most rain occurs in the winter when ET_o is low. Including rainfall will have minimal impact on water budgets during the high-irrigation summer months.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

- Rainfall and ETo at a CIMIS weather station may be quite different from that at a nearby landscape site.
- Effective rainfall depends on a number of site factors, such as soil type, which can be difficult to identify.
- Effective rainfall varies with the frequency, duration, and intensity of rainfall events, and is not easy to measure.

Hence, for most water agencies starting a water budget program, it is suggested that effective precipitation not be included as part of the water budget calculation.

Water Budget Development

Once the size of the landscape area and the reference evapotranspiration have been determined, the water budget can be calculated. As an example of this process, Helix Water District has completed a water budget program for their service area over the 2009 and 2010 years. For more information, see Helix Water District Water Budgets and Rates:

[http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Helix Water District water budgets and rates.doc](http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Helix_Water_District_water_budgets_and_rates.doc).

Equation

The basic water budget equation prescribed by the Landscape BMP is illustrated below:

$$\text{Water Budget} = \frac{(\text{ET}_o) (\text{adjustment factor}) (\text{landscape area})}{1200}$$

where:

- | | | |
|-----------------|---|--|
| Water budget | = | Volume of water in <i>cubic hundred feet</i> (common billing unit) budgeted for billing period |
| Landscape area | = | Total amount of landscape in square feet |
| ET _o | = | Depth in inches of ET _o estimated for site during billing period |

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Adjustment factor = Scaler ranging between 0% and 100% (in decimal form) that indicates percentage of ET_o to be used in water budget

1200 = Conversion factor to convert ET_o from inches to feet and the water budget from cubic feet to hundred cubic feet or ccf (typical water agency billing unit)

Or

Water Budget = (ET_o) (adjustment factor) (landscape area) (0.62)

where:

Water budget = Volume of water in *gallons* budgeted for billing period³

Landscape area = (Same as above)

ET_o = (Same as above)

Adjustment Factor = (Same as above)

0.62 = Conversion factor to convert ET_o from inches to feet and the water budget from cubic feet to gallons

Example Water Budget Calculations

To convert to CCFs:

Landscape area = 35,000 ft²

ET_o = 6 inches

Adjustment factor = 0.70

Water budget = $\frac{(35,000 \text{ ft}^2) (6 \text{ inches}) (0.70)}{1200}$

= 122 CCF (cubic hundred feet)

Or

To convert to gallons:

Landscape area = 35,000 ft²

ET_o = 6 inches

Adjustment factor = 0.70

Water budget = $(35,000 \text{ ft}^2) (6 \text{ inches}) (0.70) (0.62)$

= 91,140 gallons *or* 91 Thousand-Gallon Units

Useful Conversion Factors:

1 acre = 43,560 ft²

1 CCF = 748 gallons

³ There is also an example in "gallons" in the City of Santa Rosa's case study: <http://www.cuwcc.org/Portals/0/BMPResources/Landscape/City of Santa Rosa landscape water budgets.doc>.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

The adjustment factor lowers the percentage of ET_o used to calculate the water budget. The Landscape BMP states that the adjustment factor must be an average of 70 percent of ET_o . If an adjustment factor of 70 percent is selected, for example, then water budgets would be based on 70 percent of ET_o .⁴ The specific adjustment level selected by water agencies to calculate water budgets will depend on various factors. For example, agencies facing water shortages may be inclined to use a lower adjustment factor.

In addition, some agencies may choose to develop more complex budgets, adjusting ET_o to account for specific plant types or including precipitation as an adjustment factor.

Calculation Considerations

Water Budget Calculation for Mixed Use Sites

If an agency wants to offer irrigation water use budgets to *mixed-use meter* sites (meters recording both indoor and outdoor use), all of the above principles of meter assignment, area measurement, and budget calculation still apply. The one important distinction comes with tracking actual use: a reasonable estimate of the split between indoor and outdoor use must be made.

A common way of making this distinction is to assume that indoor water use throughout the year equals winter water use (e.g., December, January, February). In the winter, outdoor landscape irrigation in California is minimal in most areas. This approach, however, is predicated on indoor water use being stable throughout the year. For customers with seasonal indoor water demands (e.g., caused by seasonal patterns in tourism or other business activities), assuming indoor water use equals winter water use may not be valid. In these cases, especially where outdoor irrigation is significant, installing dedicated irrigation meters may be a preferable option.

Customers will appreciate agencies' recognition that some sites may require more water than is estimated due to any variety of reasons (plant type, use of the area, etcetera). Helix Water District provides their customers a form to fill out for this "variance request." It doesn't guarantee that the customer will be allowed a larger budget, but provides them an avenue to ask. For more information, see Helix Water Budget Variance Request:

http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Helix_Water_Budgets_Variance_Request.doc

Revolving Meter Read Dates

⁴ Water budgets calculated under the State Model Water Efficient Landscape Ordinance (2010) are based on an adjustment factor of 0.70 for landscapes installed after January 1, 2010 and 0.80 for landscapes installed prior to that date.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

A complication in creating water budgets is that most agencies use some type of revolving meter reading program. Hence, billing periods vary with individual accounts. In this case, if water budgets are to reflect actual weather conditions over a billing period, agencies will need to create individual customer water budgets using calculations of ET_o (and potentially rainfall) based on daily observations over the actual days contained in a billing cycle. Fortunately, CIMIS ET_o values are provided on a daily basis.

Here are some tips on creating water budgets for accounts with varying revolving meter read dates.

1. Water Budgets Monthly/Bimonthly: Calculate a daily consumption rate and use those approximate values to calculate the consumption for the monthly period (since the start/end read dates do not happen on an exact monthly basis)
2. Single Account with Multiple Meters (which in many cases do not have the exact same start/end read dates): Factor in a X day tolerance to group different date periods together (to get the date period between the earliest meter read date to latest end read date)
3. Aggregate Reports: Use the daily consumption value calculated for each account in order to generate aggregate reports (compare) across many customer accounts (since start/end read dates vary).

For an example water budget program, please see the City of Santa Rosa's case study:

<http://www.cuwcc.org/Portals/0/BMPResources/Landscape/City of Santa Rosa landscape water budgets.doc>

Establishment Period

Additional water is often allotted for the establishment period because there is an assumption that the plants need the additional water during this time. Plants don't actually need more water, but do need to be watered more frequently because their root systems are not fully developed. The landscape design must meet the water budget at all times, including the establishment period. A common occurrence, however, is that this modified irrigation schedule is not changed when plants are finally established. Including the establishment period in the budget should not be a hardship for most projects, and there should always be a program component ensuring that the correct irrigation schedule is being used.

Water Budget Calculators

There is an excellent and user-friendly water budget calculator available on the CUWCC's H2Oouse website:

<http://www.waterbudgets.com/ConserVision/CUWCC/DataInput.htm>

The Irrigation Association also has resources available on its website for completing

water budgets in compliance with WaterSense:

<https://www.irrigation.org/waterbudget/>

Distributing Water Budgets

Once water budgets are developed, they need to be distributed to customers. Sending notices to customers requires some interaction or integration with the agency's customer billing system. This can be complicated by revolving meter reading dates and by the fact that individuals receiving water bills are not necessarily landscape managers. It is also possible to have water budgets tied to water rate structures. These topics are discussed in this section.

Including Water Budget Information in Billing Statements

The Landscape BMP states that agencies are to provide notices each billing cycle showing the relationship between the water budget and actual consumption. An obvious way to meet this requirement is to add water budget information to the water bill itself. The advantage of this approach is that it automates the process. The disadvantage of this approach is that it could require significant changes to the billing process. Factors to consider are:

- Adding or linking water budget data inputs to the billing database
- Changing billing software to calculate water budgets
- Changing bill design and layout to show water budget information
- Dealing with site budgets corresponding to multiple irrigation meters
- Dealing with customers with multiple landscape accounts
- Sending copies of the bill to multiple parties (e.g., landscape managers)
- Including and explaining water rates associated with different levels of water consumption

In some cases, it may be more effective for agencies to create a separate water budget document that can be distributed as an addition or attachment to the water bill or as a separate mailing. This can be accomplished using a web-based tool with either email or direct mail notices. This approach will allow for more flexibility in addressing some of the factors listed above. If not constrained by water bill layout, agencies will have greater ability to add graphical exhibits and supply information relevant specifically to landscape accounts. Such information could promote other landscape programs such as water surveys and financial incentives, and could provide advice such as reminding customers to decrease irrigation days in the fall.

Some agencies have gone to web-based reports. The Municipal Water District of Orange County's Landscape Performance Certification Program (<http://www.waterprograms.com/wb/>) allows regular delivery of information to the landscape managers of sites enrolled in the program via their website. See a program description here:

http://www.cuwcc.org/Portals/0/BMPResources/Landscape/MWDOC_landscape_certification.doc

Water Budget Presentation

Water use budgets need to be presented to customers in a format that is readily understood. Budgets can be shown in both tables and graphs. They can cover the current billing period, historical observations, and future predictions of water use. Water use budgets are to be presented in volumetric units of water (e.g., thousands of gallons), but can also be shown in lost dollars. To allow the customer to really understand the water budget, a measurement such as “applied inches” could also be used. Examples of water budget presentations over a 12 month period (both from the City of Santa Rosa) can be seen in Figure 2 and Figure 3 (pages 24 and 25, both show).

Targeting Decision Makers

It is critical, especially with commercial sites, for agencies to contact customers to identify the name and contact information of the key decision maker regarding landscape management at a site. Although it is an additional data burden, it means that the landscape conservation information and messages are getting to the right person rather than being sent to some accounting department far removed from the actual site. This could greatly increase the efficacy of the water budget program.

Customer Communication Tools

There are many ways that customers may be contacted regarding landscape water budgets, surveys or other essential water agency communications. Letters, an interactive website with address on all water use efficiency communications, e-mails for a select group, and phone calls are all useful tools for educating customers. Marketing information is available in on page [37](#); more information on this topic may be found in the [Public Information Guidebook](#), and communication examples are available in the [Residential Guidebook](#).

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Figure 2: Example of Water Use versus Water Budget

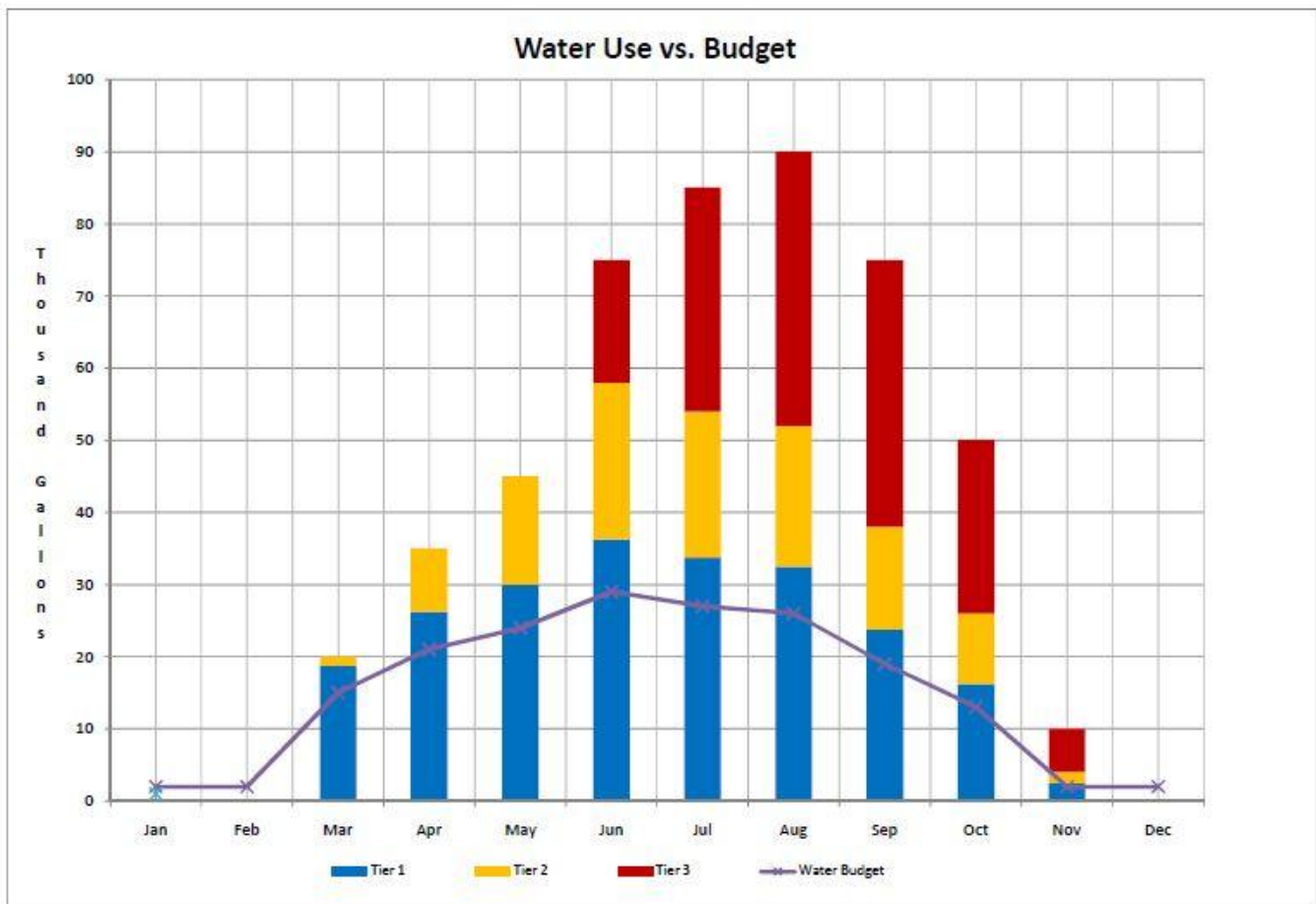
2011 Irrigation Account Water Use Analyzer

Hw =	0
Other =	11,133

Tier 1	\$ 5.53
Tier 2	\$ 6.18
Tier 3	\$ 9.27



Month	ET for billing period	Use	Irrg Bud	Over/Under Budget	Tier 1	Tier 2	Tier 3	Current Cost
Jan	0.25		2	0%	0	0	0	\$ -
Feb	0.25		2	0%	0	0	0	\$ -
Mar	3.46	20	15	133%	18.75	1.25	0	\$ 111.41
Apr	4.95	35	21	167%	26.25	8.75	0	\$ 199.24
May	5.64	45	24	188%	30	15	0	\$ 258.60
Jun	6.74	75	29	259%	36.25	21.75	17	\$ 492.47
Jul	6.42	85	27	315%	33.75	20.25	31	\$ 599.15
Aug	6.04	90	26	346%	32.5	19.5	38	\$ 652.50
Sep	4.50	75	19	395%	23.75	14.25	37	\$ 562.39
Oct	2.98	50	13	385%	16.25	9.75	24	\$ 372.60
Nov	0.25	10	2	500%	2.5	1.5	6	\$ 78.72
Dec	0.25	0	2	0%	0	0	0	\$ -



LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Figure 3: Example of the potential financial savings if a customer adhered to the water budget

2011 Irrigation Account Water Use Analyzer

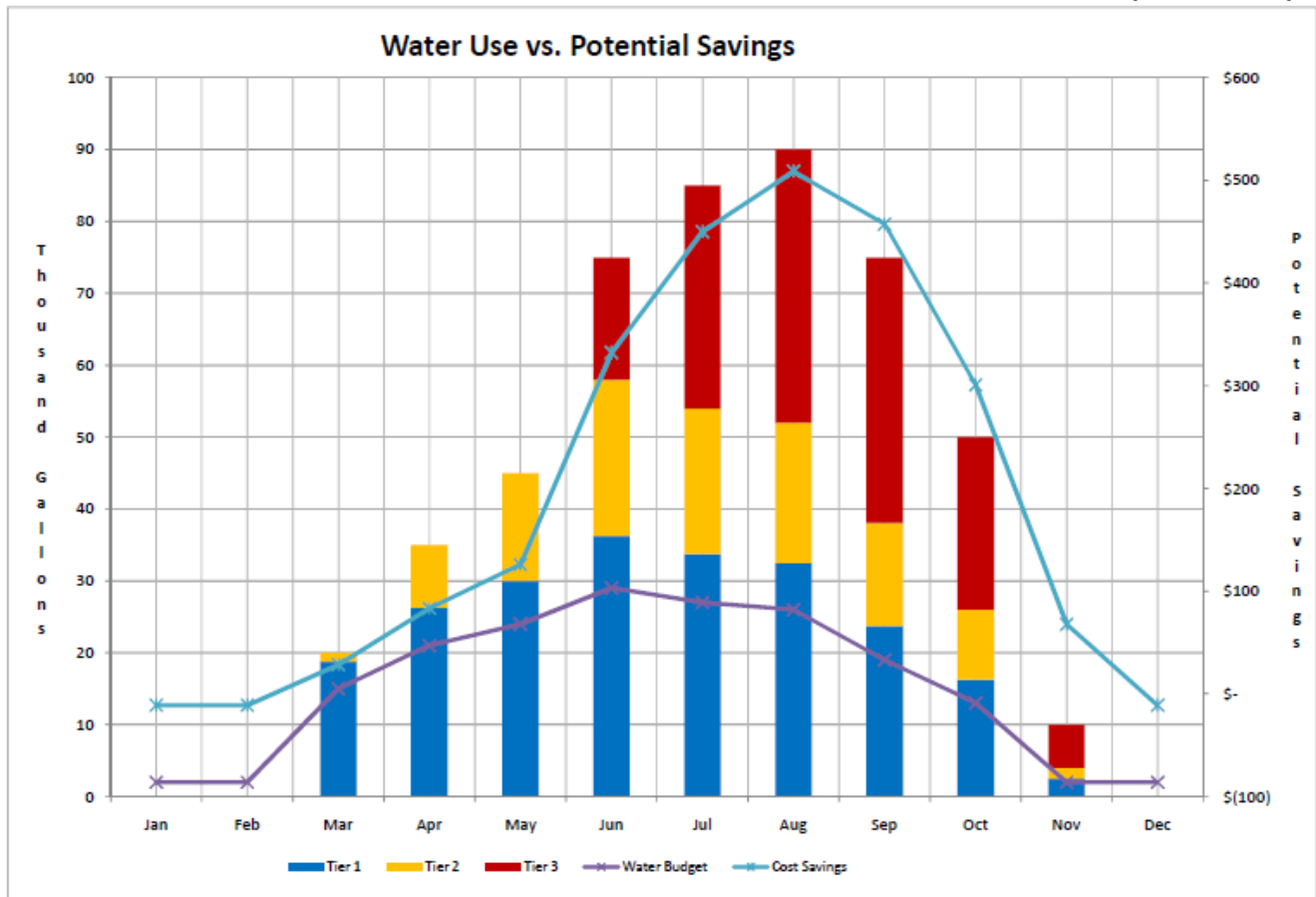
Hw =	0
Other =	11,133

Tier 1	\$ 5.53
Tier 2	\$ 6.18
Tier 3	\$ 9.27



Month	ET for billing period	Use	Irrg Bud	Over/Under Budget	Tier 1	Tier 2	Tier 3	Current Cost	Efficient Cost	Cost Savings
Jan	0.25		2	0%	0	0	0	\$ -	\$ 11.06	\$ (11.06)
Feb	0.25		2	0%	0	0	0	\$ -	\$ 11.06	\$ (11.06)
Mar	3.46	20	15	133%	18.75	1.25	0	\$ 111.41	\$ 82.95	\$ 28.46
Apr	4.95	35	21	167%	26.25	8.75	0	\$ 199.24	\$ 116.13	\$ 83.11
May	5.64	45	24	188%	30	15	0	\$ 258.60	\$ 132.72	\$ 125.88
Jun	6.74	75	29	259%	36.25	21.75	17	\$ 492.47	\$ 160.37	\$ 332.10
Jul	6.42	85	27	315%	33.75	20.25	31	\$ 599.15	\$ 149.31	\$ 449.84
Aug	6.04	90	26	346%	32.5	19.5	38	\$ 652.50	\$ 143.78	\$ 508.72
Sep	4.50	75	19	395%	23.75	14.25	37	\$ 562.39	\$ 105.07	\$ 457.32
Oct	2.98	50	13	385%	16.25	9.75	24	\$ 372.60	\$ 71.89	\$ 300.71
Nov	0.25	10	2	500%	2.5	1.5	6	\$ 78.72	\$ 11.06	\$ 67.66
Dec	0.25	0	2	0%	0	0	0	\$ -	\$ 11.06	\$ (11.06)

Total = \$ 2,320.61



Monitoring and Tracking Data

The Landscape BMP requires submission of basic summary data regarding the water budget program each reporting period. The summary data include number of ***dedicated irrigation meters***, number of dedicated irrigation meters with water budgets, aggregate water use over all dedicated irrigation meters, and aggregate budgeted water use over all dedicated irrigation meters.

In addition, agencies may find it prudent to conduct other evaluation and tracking tasks to fine-tune the water budget program over time:

- Denoting sites by CII and/or SIC code classifications (e.g., commercial building, park, street meridian, homeowners' association).
- Denoting sites by landscape measurement technique if multiple methods are employed.
- Validating accuracy of landscape measurements at a random sample of sites using field measurement techniques.
- Conducting market research on a sample of sites (e.g., focus groups, mail surveys, telephone interviews) to find ways to improve the water budget program and its complementary programs.

It is also important to track all outreach and conservation efforts done with mixed-use meter accounts. Tracking what types of outreach are used, the way savings are estimated, and the most successful recruitment activities will help agencies to have more successful programs in the future.

Integrating Water Budgets with Water Pricing

Water budgets can be tied to water pricing strategies. The basic concept is to have a higher water price for water consumption that exceeds a water budget allocation. This creates an additional financial incentive for over-budget customers to improve irrigation efficiency. Several California water agencies have implemented such pricing approaches, including the Capistrano Valley Water District (now part of the City of San Juan Capistrano), [Irvine Ranch Water District block rates](#), [Helix Water District water budgets and rates](#), the [City of Santa Rosa landscape water budgets](#), and Eastern Municipal Water District. Analysis of the Capistrano Valley Water District case showed water budgets tied with pricing lead to a 22 percent drop in landscape water use after controlling for customer growth and weather (A&N, 1997b).⁵

⁵ A&N Technical Services reported the simple pre- and post-program water use drop for Capistrano, IRWD,

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

One complication of tying water budgets to pricing is the fact that some sites may have multiple irrigation meters. Some agencies may be restricted by billing system constraints to conduct pricing at the individual meter level. In this case, efforts should be made to measure landscape areas associated with each meter. This can be problematic (see the Climate Data section on page 16). In particular, delineating individual meter landscape areas at multiple meter sites is not possible using tax assessor, aerial photography, or multispectral images. Use of these techniques needs to be supplemented with site inspections to make direct area associations with individual meters.

Integrating pricing into the process also complicates obtaining self-reported assessments of landscape area. Careful policy considerations are required to maximize consistency and fairness if this route is taken. Self-reporting is less of a concern if water budgets are being developed solely as information sources to help sites better understand their water use.

Finally, the conservation coordinator should fully recognize that pricing policies tend to be political and will affect multiple stakeholders.

Program Costs

The costs of developing water budgets can vary greatly, depending on the specifics of the water budget program and existing circumstances. In this section information is presented to assist conservation coordinators in constructing financial budgets for the water budget program.

The approximate cost of a typical water budget program is estimated at about \$150 per site when all direct and indirect factors are considered. Table 2-1 shows an example budget by task. The labor rates include all overhead and indirect costs (e.g., equipment and transportation). In this example, the cost of running a water budget program includes a fixed cost of \$3,000 plus \$142 per site.

Table 2: Example Water Budget Program

Task	Fixed Costs	Cost per Site	Notes
Inventory of dedicated irrigation meters	\$1,8000		30 hours x \$60/hour = \$1,800
Landscape measurement		\$100	Assumes field measurement method used
Budget calculation	\$1,200		20 hours x \$60/hour
Budget distribution		\$12	\$1 per site per monthly billing period
Monitoring and tracking		\$30	0.5 hours x \$60/hour
Total	\$3,000	\$142	

and Otay, to be 35,37, and 20 percent respectively. However, these savings can be misleading when customer growth and weather are not considered. When growth and weather were controlled, for example, in Capistrano (only case), the water savings were reduced to 22 percent.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

This estimate, however, could easily vary between \$50 and \$300 per site. The largest and most variable cost factor concerns landscape measurement.

For small agencies or for agencies with few dedicated irrigation meter accounts (e.g., less than 100 to 200), field measurement, landscape plans, customer reported, or some combination of these measurement methods will most likely be the most prudent course. However, if adequate aerial photos with associated parcel databases exist and can be accessed for minimal cost, this method may prove attractive. For larger agencies, the possibility of using multispectral images becomes more promising as the fixed cost associated with obtaining an image can be spread over more accounts. Multispectral images can also be valuable to agencies for other purposes. This can include creating water budgets for mixed-use metered accounts and/or residential accounts. Multispectral images can also be valuable in other utility functions such as serving storm water programs. Identifying other potential benefits and beneficiaries of multispectral images may lead to cost share arrangements.

Because of the significance of landscape measurement, the conservation coordinator should investigate the landscape measurement options carefully, noting the tradeoffs between costs and other objectives such as accuracy, consistency, and timeliness. Table 2-2 shows an estimated range of costs associated with each method. The pros and cons of various methods are discussed in [Landscape Area](#) section on page 14.

Table 3: Estimate Costs of Alternative Landscape Measurement Methods⁶

Method	Cost	Notes
Field measurement	\$75 to \$150 per site	Assumes average time varies between 3 and 6 hours @ \$25/hour. Time includes travel and administration tasks.
Landscape plans	\$75	Walker (1998) and AquaMetrics LLC (in press).
Customer reported	\$5 per site	Estimate considering cost of mailing plus database management.
Tax assessor	\$2 per site	Assumes tax assessor information needs to be purchased for \$1 per site. Assumes cost of data analysis and administration equals \$1 per site.
Aerial photography	\$40 to \$80 per site	Assumes that aerial photos and parcel database do not need to be purchased (IRTC, 1998; Psomas, 1998).
Multispectral images	\$30 to \$60 per site	Assumes a fixed cost between \$20,000 and \$30,000 to obtain multispectral image and orthophoto/base map (Kah, 1999). Assumes parcel database does not need to be purchased, and assumes 500 dedicated irrigation meters. If agency needs measurements for all dedicated irrigation meters plus CII mixed-use meters, the per site cost will drop to approximately \$10.

⁶ These numbers are averages as of January 2011. They will be updated as needed.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

While the principal purpose of this chapter is to address how water utilities can implement a water budget system that meets the intent of the Landscape BMP, it should be noted that a utility's investment in the development of a water budget program capability can also enable it to support a broader range of performance-based landscape programs. For example:

- Technical Support: DWR encourages water utilities to support local jurisdictions in their implementation of the updated Model Water Efficient Landscape Ordinance;
- New Construction: Programs targeting new construction, such as California Friendly Landscapes & California Friendly Model Homes by the Metropolitan Water District of Southern California, have successfully utilized MAWA and ETWU as performance metrics for participating projects;
- Landscape Audits: Significant cost-savings can be realized in the management of landscape programs by switching from costly field area measurements to digital measurements based on aerial imagery;
- Targeted Retrofits: More meaningful technical assistance can be provided to certain customers when ETWU calculations are completed based on as-built conditions – this can lead to strategic recommendations for changes to the plant palette and irrigation system retrofits.

The cost and complexity of developing local water budget systems can be substantial. One strategy for containing costs, reducing complexity, and accelerating implementation is to collaborate with an agency that has already developed a working program.

Irvine Ranch Water District has an excellent program in place:

<http://www.cuwcc.org/Portals/0/BMPResources/Landscape/IRWD%20block%20rates.doc>.

Chapter 3 Technical Assistance

BMP Requirement

The Landscape BMP requires agencies to offer site-specific technical assistance to customers with dedicated irrigation meters that are 20 percent over their water budget. As described in Chapter 2, agencies are required to provide notices to accounts with water budgets showing the water budget and actual consumption. Even with this water use information, customers may not know how to remedy the cause for excess water use. Some customers will need additional technical assistance to make effective improvements in water management and/or the irrigation system in order to comply with their water budget.

Types of Assistance

The type of technical assistance provided can vary widely depending on a customer's knowledge and expertise. It can range from consultations with the site landscape manager to surveys and full irrigation audits (see page 36 on [Water Use Analysis](#)). Agencies can provide data to increase the value of this assistance, such as aerial images of the site, detailed water use information, etc.

When determining what type of assistance to provide, agencies need to consider staff expertise, cost, and effectiveness. For example, some agencies have the resources to provide a full range of services while others are more limited. Some agencies routinely provide site surveys; others have found that surveys are not effective in their service area and therefore they provide irrigation audits when requested.

Approaches to Providing Assistance

Agencies use a variety of approaches, either alone or in combination, to provide technical assistance to their customers:

- **In-house staff:** Agencies can use in-house staff with landscape knowledge and expertise. Some agencies have Certified Landscape Irrigation Auditors on staff for this purpose. The benefit of this approach is that the agency can provide direct assistance without having to coordinate with a consultant or partnering agency.
- **Consultants/Contractors:** Agencies can contract for services with landscape consultants or contractors that specialize in landscape irrigation management and are able to evaluate irrigation systems. This could include utilizing a select list of certified contractors, such as WaterSense Landscape Irrigation Professionals, Certified Landscape Irrigation Auditors, and California Landscape Contractors Association Certified Water Managers. The California Landscape Contractor Association's list of certified water managers may be found at: <http://www.clca.us/water/index.html>. Some customers need a higher level of assistance while others may only need help troubleshooting a

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

specific irrigation problem. The benefits of this approach for an agency are that the cost to provide this service would only be incurred when provided and the consultants could be selected based on customer needs.

- Partnering with Other Agencies:** Agencies can partner with other agencies in the region to share resources or contract to provide the service. Water Conservation Districts and Resource Conservation Districts (RCD) have missions that complement those of retail water agencies; partnering with a local district that has the appropriate landscape irrigation expertise may be very cost effective. In southern California, the Mission RCD and Riverside-Corona RCD provide irrigation technical assistance with funding provided by local water agencies and the federal Bureau of Reclamation. In the Chino Basin, water agencies collaborated with the Chino Basin Water Conservation District to build the technical expertise of District staff. The District now provides assistance to the agencies' customers throughout the Basin.

Other potential partnerships include local community colleges and universities that have landscape management programs.

The following table provides examples of the services and approaches water agencies are currently using to provide technical assistance to their customers with dedicated irrigation meters:

Table 4: Technical Services Provided to Customers with Dedicated Irrigation Meters

Agency	Who implements the program?	Surveys	Audits	Other Programs
Otay Water District	District staff implement these programs	X	X	Otay's Turf Replacement Program and WaterSmart Irrigation Upgrade Program
Inland Empire Utilities Agency	Partner with other agency (Chino Basin Water Conservation District)	X	X	Development of water budgets for all dedicated irrigation meters in 2011
Marin Municipal Water District	District staff implement these programs	X	X	Plan Review, Weekly Watering Schedule, Qualified Water Efficient Landscape certification
Contra Costa Water District	District staff implement these programs	X	X	Site specific water budgets Irrigation equipment rebates

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

City of Santa Rosa	District staff implement these programs	X	X	Real time ET ₀ -based budget rates, turf replacement rebate, irrigation hardware rebate, rainwater harvesting rebate, graywater rebate, weekly watering schedule
Modoc	District has a collaborative agreement with the local Resource Conservation District to implement surveys and audits	X	X	Irrigation system evaluation, place repair flags, evaluate and make recommendations on irrigation schedules, provide distribution uniformity checks, and use surveys and audits as an opportunity to inspect smart controllers and sprinkler nozzles
East Bay Municipal Utility District	District staff implement these programs	X	X	Site specific water budgets Irrigation equipment rebates

Monitoring and Evaluation

Regardless of the approach used to provide technical assistance, it is essential to monitor and evaluate the effectiveness of the activities. Results will vary due to the customer’s expertise, financial resources, and willingness to improve irrigation management. It is important to collect data on cost, water savings, and the extent to which customers use the services offered so that the program can be refined going forward.

Chapter 4 Water Use Surveys

BMP Requirement

The Landscape BMP requires agencies to provide non-residential customers with support and incentives to improve their landscape water use efficiency. This support includes developing and implementing a strategy targeting and marketing large landscape water use surveys to commercial/industrial/institutional (CII) accounts with mixed-use meters. In un-metered service areas, support includes actively marketing landscape surveys to existing accounts with large landscapes or accounts with landscapes which have been determined by the purveyor not to be water efficient.

A landscape water use survey consists of sending trained staff or consultants to landscape sites to measure and recommend ways to improve both the technical performance and the management of irrigation systems. Water surveys are sometimes referred to as water audits, irrigation performance tests, and landscape water use analyses, among other terms.

This chapter addresses seven steps that water conservation coordinators need to undertake in developing and administering a landscape water survey program as shown in Figure 4.

The Helix Water District presents an excellent case study regarding the development of their water budget program that may be helpful to agencies looking to implement a similar program:

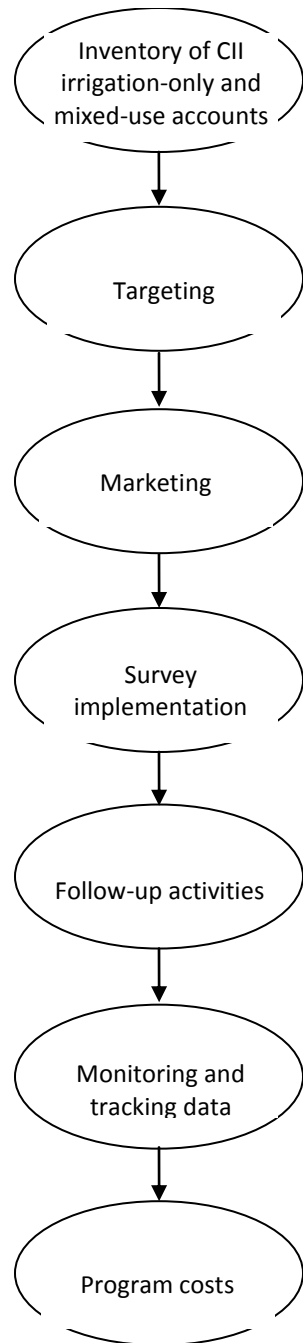
<http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Helix%20Water%20District%20water%20budgets%20and%20rates.doc>.

Inventory of CII Mixed-Use Accounts

The first step is to identify the number of CII mixed-use meters and CII unmetered accounts served by the agency. This is one of the data elements included in the Landscape BMP reporting requirements shown in Table 1 on page 12.

To start, first identify the total number of CII accounts. Most water agencies have billing systems that contain a customer code field from which CII accounts can be flagged. Next, subtract out CII accounts with dedicated irrigation meters. **Code fields related to sewer or wastewater charges can be a useful source of information for identifying customers with dedicated irrigation meters.** Remember

Figure 4: Steps in Developing a Water Use Survey Program



LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

that neither single family nor multifamily residential accounts are to be included.⁷

After identifying these CII accounts, the next task is to identify which of them are associated with some level of outdoor landscape irrigation. **With the exception of small specialized business sites, most CII mixed use meter sites and unmetered accounts will irrigate landscape.** In most cases, there will be no direct way of identifying indoor and outdoor water uses served by mixed-use meters. Water agencies will have to use one or more of the following approaches:

1. Identify likely irrigation customers by examining historical water use billing records.
2. Conduct a census asking customers to specify their end water uses (e.g., mail survey).
3. Conduct a comprehensive landscape measurement program linking all water use accounts to estimates of landscape area (see Section 2.2).

The first approach, examining water use records, may prove to be the best course for many agencies. Evaluating the magnitude and seasonal pattern of water consumption provides not only evidence of irrigation end uses, but also information that may be useful in targeting and marketing surveys to customers. Customers with high summer water use relative to winter water use are likely to have irrigation end uses, as illustrated in Figure 4-2. Based upon the site, multiple mixed use meters could serve the site requiring an extensive list. Accurate water agency customer data fields with account addresses and bill payer of record contact information will facilitate the process.

The second approach, conducting a census, may lead to an incomplete assessment. For a portion of the CII sites, the customer contact listed on water agency accounts may be able to provide confirmation that landscape is irrigated. However, many CII accounts have bill payer of record contact information that is sent to a corporate office located outside the service area of the water agency. In those situations, specific knowledge of irrigation practices correlated to specific mixed use meter accounts is unknown. A specific site contact person familiar with the irrigation system must be solicited from the corporate bill payer of record.

The third approach is the preferred method if the background databases exist with the water agency able to calculate the interior usage and subtract that interior amount from the total water consumption for the site. The difference is the exterior or landscape water usage for the site that can then be correlated to landscape area measurements to create a water budget. The water budget for CII mixed use meters will be less accurate than dedicated irrigation meter water budgets since the interior water usage is a variable that cannot always be accurately calculated. See Figure 3 on page 25.

⁷ Strictly speaking, a multifamily residential site is not in the CII sector and hence is not subject to the Landscape BMP water surveys; multifamily sites are covered under water surveys in the Residential BMP. However, there are likely to be multifamily sites with mixed-use meters with large landscapes (e.g., homeowners' associations) that are best served by a Landscape BMP type of landscape survey.

Targeting

The Landscape BMP stipulates that agencies offer water surveys to CII mixed-use accounts and unmetered accounts and complete water surveys of not less than 15 percent of those accounts over a ten year period. To maximize the cost-effectiveness of the water survey program, agencies should target sites likely to provide the greatest water use savings. This section considers four factors that agencies can use to target prospective sites: water use analysis, site size, site management, and preliminary surveys. Otay Water District provides a different level of water survey to mixed-use meters, as opposed to landscape meter sites only: http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Otay_CII_landscape_program.doc

Water Use Analysis

Although estimates of the amount of water used for irrigation at mixed-use sites are often inexact, having an approximate assessment of the magnitude of irrigation can be useful in targeting. In general, it is more cost-effective to conduct surveys at larger landscape sites because surveys have many fixed costs and the conservation potential tends to be greater at larger sites. Hence, water agencies can develop targeting strategies that rank water customers by estimated irrigation use, giving higher priority to higher water using sites. Water agency consumption data for CII sites can be retrieved based upon customer category and top percentile.

However, cost-effectiveness does not always improve with site size. In fact, it may be that water surveys of midsized landscape sites (0.5 to 3 acres) offer the best returns. Because the largest sites (over 3 acres) are more likely to be run by concerned and motivated site managers, irrigation performance tends to be good.⁸ It is in the midrange where irrigation use is still significant and site managers tend to be less attentive to irrigation performance that water surveys may provide the most "bang for the buck."

Given that most large landscape areas have dedicated irrigation meters,⁹ most mixed-use metered sites will generally have 3 acres of landscaping or less. Hence ranking sites in descending order of estimated landscape water use would be prudent. In addition, many water agencies have numerous CII mixed use metered sites with little or no irrigated landscaping, and a water consumption ranking will minimize the chance of conducting landscape surveys at these sites.

⁸ In addition, large sites tend to have on-site personnel and larger landscape subareas, employ rotor sprinklers of higher sprinkler uniformity, and lose less water through spray drift and runoff. Parks and golf courses are excellent examples of large sites with generally little savings potential. (schools typically have little savings potential too however it's our experience that it's due more to lack of resources and staffing)

⁹ Large landscapes often are on dedicated irrigation meters to avoid wastewater charges on these high water use accounts.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

If a water agency has universally measured landscape areas (see [Inventory of CII Accounts with Dedicated Irrigation Meters](#) page 13) and linked these measurements with water accounts, this information can be used to rank potential mixed-use sites based on the rationale of the previous section.

Site Management

A water survey can be a valuable tool in providing useful data to both management and landscape staff. The type of landscape management can be an indicator of irrigation performance. At some sites, landscape managers pay prompt attention to irrigation system performance, leaks, and irrigation scheduling. If the site manager encourages maintenance staff to achieve water savings to reduce costs, a survey can be a useful communication tool for the landscape manager and site manager. At other sites, decision makers are far removed from field operations and irrigation performance lags. It is at these less actively managed sites that water surveys might be most beneficial. Hence, surveys should be targeted toward those types of sites when possible.

Performing water surveys for landscape contractors can be an effective way to increase the benefits of a survey program. Contractors often manage many sites within an agency's service area. Improving water efficiency at one site can be expanded to include other sites managed by the contractor. Landscape contractors can also be a powerful marketing tool if they are able to increase the value of their services by recommending water surveys to their clients.

Preliminary Surveys

For some well-maintained or small sites, it may not be cost-effective to conduct a full water use survey. One option is to allow surveyors to conduct preliminary surveys (or pre-surveys) to quickly gauge the need for a full survey. A preliminary survey consists of obtaining a reasonable estimate of irrigated area and combining this with local weather data to generate an expected water budget. This budget is then compared to historical water consumption to gauge the potential water savings rewards from conducting the full survey. If a site has a small or negative cost/benefit result, then the survey would not be conducted. The benefit of this screening technique is that a preliminary survey typically costs about 25% of a full survey cost.

Marketing

Marketing to CII customers most likely to benefit from a water use survey maximizes the efficiency and return of a survey program. Targeting the appropriate customers reduces marketing costs because the program contacts customers with high potential savings; decreases the chances for wasted water survey efforts due to low customer enthusiasm and lack of savings potential; and limits the number of customers who become frustrated by program participation when they discover limited or no savings potential.

All of the following marketing mechanisms have been used to promote surveys to mixed use meter or unmetered sites:

- targeted direct mail;

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

- coordinating with landscape contractors;
- education programs (i.e. workshops);
- bill stuffers and/or bill messages; and
- broadcast media.

Direct mail, coordinating with landscape contractors, education programs, and the promotion of CIMIS-based scheduling information tend to be the most effective mechanisms because they direct their efforts to customers who are likely to have an interest in irrigation water conservation. Water budgets can generate interest in surveys by allowing the customer to compare their nominal consumption with a calculated budget. Bill stuffers and broadcast media are not targeted and therefore are less likely to attract the customer who would benefit most from an irrigation system survey.

Mailing Approaches

Mailings with a well designed water conservation and cost savings message have been successful in generating a response from customers who need help. Since customers expect a survey within a reasonable time period when contacted, staggered calendar mailings are suggested. Targeting mailings by political boundaries or zip codes within the service area would ensure a balanced, representative sampling of high water users.

Landscape Contractor Coordination

Landscape contractors can be a cornerstone of a marketing campaign for two reasons. First, they often serve many sites within a service area. Second, they may transfer new water efficiency practices to additional sites. Connecting with contractors can reduce the costs of marketing because they will bring more sites to the agency's attention. Contractor personnel increase their landscape water management knowledge with each succeeding site survey. The landscape industry has recognized its role in water conservation and water agencies have considerable opportunity to use this resource. The San Diego County Water Authority has used contractors to administer its large landscape program since 1992 (http://www.cuwcc.org/Portals/0/BMPResources/Landscape/SDCWA_large_turf_audit_program.doc) Information regarding other activities that water agencies implement in coordination with contractors and local landscape organizations (such as holding seminars/trainings, creating advisory groups, and involving outside groups in rebate programs) is available in Chapter 5 Flex Track Program on page 48.

Overcoming some contractors' apprehension regarding an irrigation survey is a challenge. Some interpret the water survey as a "fishing operation" or "report card," looking for defects in their maintenance and operations. Portraying the survey as an opportunity to correct longstanding defects in the irrigation system is a good way of overcoming this problem. Often, a contractor has brought recurring irrigation problems to management's attention to no avail for years. A survey serves to confirm that previously identified defects do indeed require attention to conserve water and reduce costs.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Landscape construction or repair work in excess of \$500 (counting labor *and* material costs!) must be performed by a state-licensed contractor--by law. Conservation coordinators can obtain information on local, licensed contractors from the California Landscape Contractors Association internet site at www.clca.org.

Other Approaches

Irrigation repair, retrofit, and irrigation scheduling workshops are excellent venues for marketing a survey program. See [Chapter 5](#) Flex Track Program for more information regarding training programs. Marin Municipal Water District offers a suite of educational and enforcement programs to encourage customer conservation. See the following link for more information:

http://www.cuwcc.org/Portals/0/BMPResources/Landscape/MMWD_water_audit_program.doc

Survey Implementation

Water use surveys are a means of providing assistance to CII accounts with mixed-use meters or no meters. The surveys can also be used to assist accounts with dedicated irrigation meters that are 20 percent over budget (see Chapter 3). Field activities performed for a standard water survey typically include these five basic elements:

1. Measuring irrigated landscape area, preferably by plant type;
2. Performing irrigation system check and noting any issues such as broken/leaking heads, high-pressure, overspray, etcetera;
3. Performing distribution uniformity analysis of sprinkler system (if performing a more in-depth evaluation typically referred to as an “audit”);
4. Calculating irrigation schedules; and
5. Providing a survey report and information packet to customers.

One very important component of implementing a water survey program resulting in water budgets is fine tuning. Calculating a water budget includes a complex array of multiple variables. In the end, sometimes the most straight forward method of setting irrigation schedules is to inspect each irrigation zone and ask the question: “is this zone too wet, too dry or just right?” Based on this simple observation, the surveyor can make very small adjustments up or down until each zone is receiving the correct application rate for the correct period of time.

The biggest cost component of a survey program is the labor involved in its day-to-day administration (e.g., scheduling surveys with customers) and actual field work. Hence, staffing strategy is a key decision in survey implementation.

Contractors versus In-house Staffing

Water survey programs can be staffed with agency employees, outside contractors, or both. If water agency staff have the skills, expertise and time to provide the survey, this can be more cost-effective overall. Both can provide a timely, high level of customer service. For

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

water agencies with limited staff resources, agency staff can administer the survey program and outside contractors can be used as the in-field surveyors.

The approach that will work best for each agency will depend on many factors. Major factors to consider include cost, quality of service, reliability, flexibility, and the ability to synchronize and use in-house staff on other projects. It may be that several water purveyors in the same region get together to hire an outside organization for the entire region. Conservation coordinators should recognize that there could be significant seasonal fluctuations in customer interest in surveys (high in the summer; low in winter). Scheduling surveys so in-field surveyors have a constant work load can also be challenging, especially because each landscape site has unique characteristics requiring different time commitments from the surveyor. In general, conservation coordinators may find using contractors offers more flexibility in matching labor supply with survey demand. Conservation coordinators may also find, however, that using inhouse staff may be more cost-effective under certain conditions, such as when a consistent survey workload can be established or in-house staff can be used effectively on other projects during slow survey times or during the “off” season. Contractors may also have more appeal to smaller water agencies where the small number of surveys expected does not warrant an in-house survey specialist.

Table 4-1 lists the current water survey staffing arrangements of some large California water agencies.

Table 4-1. Examples of Water Survey Staffing

<u>Agency</u>	<u>Staffing Size</u>	<u>Staffing Strategy</u>	<u>Service Connections</u>
El Dorado Irrigation District	0.5	In-house	33,000
East Bay Municipal Utility District	1	In-house	400,000
Otay Water District	4	Contractor and in-house	48,074
City of Santa Rosa	1.5	In-house	50,000

Technical How-to

Surveys typically include inspections of the following landscape and irrigation components:

1. Review the meter with customer, landscape maintenance contractor, or both. Check for leaks. For a dedicated irrigation meter, watch for movement at the meter when the irrigation system is turned off. Mixed meters should have all indoor water turned off prior to checking the meter. Locate and repair any leaks if movement is seen.
 - a. Review consumption history.
 - b. Identify irrigated area of each irrigation only meter (s) for the purpose of creating water budgets for the customer

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

2. Take a water pressure reading. If it is too high, suggest the installation of a pressure regulator or adjustment to their existing pressure regulating device. If the pressure is too low, it can be corrected by adding a booster pump or redesign the irrigation system.
3. Check for over watering by reviewing the program on the irrigation controller. Ask what the Peak Summer irrigation schedule was? How many days, cycles for each plant type. Document the settings for runtimes per station per program, document the times of day and days per week the controller is set. Add the total minute's runtime for the week for each station and compare to the ET_0 based runtimes for that week.

a) For overhead spray or rotor systems use the following formula:

$$\text{Minutes per Week} = \left(\frac{ET_0 \times PF - Re}{DU \times PR} \right) \times 60$$

Where:

ET_0 is the weekly reference ET (inches for the week);

PF is the zone plant factor

0.80 for cool season grass

0.60 for warm season grass

0.70 for high water shrubs

0.50 for mixed water use shrubs

0.30 for low water use shrubs);

Re is the weekly effective rainfall (inches for the week)

If total rainfall is less than 0.25 inches, then

$$Re = 0$$

If total rainfall is 0.25 inches or greater,

$$\text{then } Re = \text{Total Rainfall} \times 0.33;$$

DU is the irrigation system distribution uniformity;

PR is the irrigation system precipitation rate (inches per hour);

60 is a conversion factor.

b) For drip irrigation systems use the following formula:

$$\text{Minutes per Week} = \left(\frac{ET_0 \times PF - Re}{DU \times ER} \right) \times D^2 \times 29$$

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Where:

ET_o is the weekly reference ET (inches for the week);

PF is the plant factor (see above);

Re is the weekly effective rainfall (inches for the week) (see above),

DU is the irrigation system distribution uniformity;

ER is the drip emitter flow rate (gallons per hour);

D² is the plant canopy diameter (feet);

29 is a conversion factor.

4. With assistance (preferably with the landscape professional on site), run each station and visually assess the condition of the system. Note if there are leaks, breaks or misaligned heads. Visually check for head to head coverage for uniform distribution on spray systems. Observe the type of irrigation system and note if the system has matched manufacturer heads and nozzles or if the station mixed irrigation uses; i.e. sprays with drip and/or rotors.
 - a. Different water agencies do this task in different ways. For example, EBMUD doesn't find it cost effective to run each station of the irrigation system. On average, EBMUD large-landscape auditors' field time with the onsite irrigation contractor is generally about 1.5 hours. During this time, they review irrigation systems that make up a "snap shot" of the irrigation systems used on the site. For example, they inspect one lawn spray system, a lawn rotor system (if applicable), a shrub spray system, a shrub rotor system, a drip system, and a bubbler system.
5. While the irrigation is running, see if the spray from the heads are blocked by vegetation, or sunk into the ground with turf blocking the spray pattern or no longer at a 90 degree angle to the ground. Recommend the vegetation is cleared from the spray, or realign the head.
6. See if water is running off the planted area and suggest adjustment of runtimes by reprogramming for multi runtimes. Recommend check valves to correct low head drainage.
7. Take core sample of soil to check for organic material level and recommend sheet mulching where appropriate to improve the pore space for irrigation.
8. Check that all irrigation is watering the root zone of the plants. Eliminate irrigation systems that are no longer watering vegetation.
9. Check that vegetation is requiring the same water needs, the plants are receiving the same sun exposure and equal microclimates on each station. Suggest adding stations to correct for the design flaw.

10. Drip systems require close investigation for missing emitters, splits in tubing, clogged emitters, missing end caps. Listen for escaped water emitting at a faster rate than the balance of the system. Recommend flushing the drip system, clearing clogged emitters, cleaning the filter and replacing all broken and missing parts.
11. Conduct a sprinkler uniformity test to educate the landscape/irrigation customer/contractor on how evenly water is being applied in a tested area. Sprinkler uniformity and the precipitation rate of the tested area will be used to estimate run times and days for the different planted sections within the landscaped area.

Follow-Up Activities

Good landscape water management requires a continuing commitment year after year. This contrasts with device-based water conservation programs that focus on replacing water fixtures and equipment (e.g., ultra-low flush toilets). After a customer has entered a survey program, maintaining their interest on an ongoing basis is a challenge. Providing financial incentives, additional training opportunities, follow-up help, and regular feedback can help.

Follow-up surveys are intended to help customers implement and reinforce efficient irrigation practices. They tend to be much shorter than full water surveys. Follow-up surveys are most appropriate when technical repairs and retrofits have been carried out, but irrigation scheduling usually remains a longstanding problem. Since the initial survey often includes schedules for only a representative sample of stations, extending schedules to more stations and controllers is likely to help the customer. Additional testing can document improvements from retrofits and repairs. The key is to flexibly address site problems with the customer's irrigation needs in mind

At sites with equipment upgrades tied to agency financial incentives, the follow-up survey provides a means to protect the agency's investment. Equipment upgrades often include more sophisticated controllers, placing increased strains on a customer's scheduling skills. This suggests that testing and scheduling are essential to effective follow-up surveys.

Follow-up surveys can also be useful when there is a change in property or landscape manager at a site. This may include having to provide a new copy of the information provided from the original survey.

Seasonal Notices

Another way to help irrigation customers is to provide seasonal notices to adjust irrigation runtimes or frequency. If budgets have been generated, combining the two is even more helpful. Irrigation schedules require adjustments to keep pace with changes in ETo. Informational seasonal communications can be cost-effective.

Monitoring and Tracking Data

Under the Landscape BMP, survey summary data must be submitted each reporting period (Table 1-2). The summary data include number of CII mixed-use accounts, number of incentives offered and received, number of surveys offered, number of surveys accepted, and the estimated annual water savings resulting from surveys.

Agencies will find it prudent to record other data for evaluation and tracking. Periodic evaluation can help guide and refine a program over time to improve results. This includes improving targeting/marketing activities and obtaining estimates of water savings and cost-effectiveness.

Data collection needs and associated protocols are best identified at the beginning of a program. After the fact, data collection is often more expensive, less reliable, and often not possible. Data collection should, at a minimum, include the following:

- date of survey;
- site and contact information
- type of site (e.g., commercial building, park, street meridian, homeowners' association);
- landscape area measurements (by plant type));
- brief description of irrigation system, including controller make and model;
- type of site management (e.g. maintenance contractor);
- if audit performed, measurement of technical irrigation performance (e.g., distribution uniformity);
- dates and descriptions of follow-up activities, including financial incentives; and
- how and why customer participated in water survey program.

Program Costs

Program costs can vary greatly. This section presents information to assist conservation coordinators in constructing water survey program budgets.

The approximate cost of a typical water survey is about \$1,000 per site when all direct and indirect factors are considered. This estimate could easily vary between \$500 and \$1,500 depending on circumstances. Because water surveys are labor intensive, by far the greatest cost component is the labor cost for the surveyors. So, the primary cost drivers are the surveyor's labor rate and the average hours spent per site.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Table 4-2 illustrates an example budget broken out by water survey task. The labor rates include all overhead and indirect costs (e.g., equipment and transportation). In this example, the water survey program costs are \$13,200 plus \$755 per survey.

Table 5: Water Survey Program Budget Example for a 1-acre Site.¹⁰

Task	Fixed Cost	Cost per Site	Notes
Inventory of CII Mixed Use Accounts Targeting	\$2,400		40 hours x \$60/hour
Marketing	\$2,400	\$25	40 hours x \$60/hour plus direct costs
Survey Implementation		\$720	12 hours x \$60/hour
Follow-Up Activities			Not Included
Monitoring and Tracking	\$6,000	\$10	100 hours x \$60 which includes 1 basic analysis
Total	\$13,200	\$755	

Conservation coordinators should factor into their budgets that it is difficult to schedule surveys so that their surveyors are constantly working on surveys. Workloads can fluctuate because of the random nature of customers requesting surveys. In addition, during the winter months there is generally less interest in water surveys, causing seasonal work differences.¹¹ Agencies that can use surveyors productively on other work or contract with outside consultants on an as-needed basis can minimize this exposure. The City of Santa Rosa was able to gather information from aerial photos, but has an on-going program of ground-truthing the estimates (See [City of Santa Rosa landscape water budgets](#), and see Figure 5 on page 47). This method could save agencies money when compared with doing total ground-truthing initially. Another way to save money is to partner with an educational institution that offers class credits for on-the-ground training. Helix Water District did this in the development of its water budget program in 2009: [Helix Water District water budgets and rates](#).

¹⁰ Information is current as of January 2011.

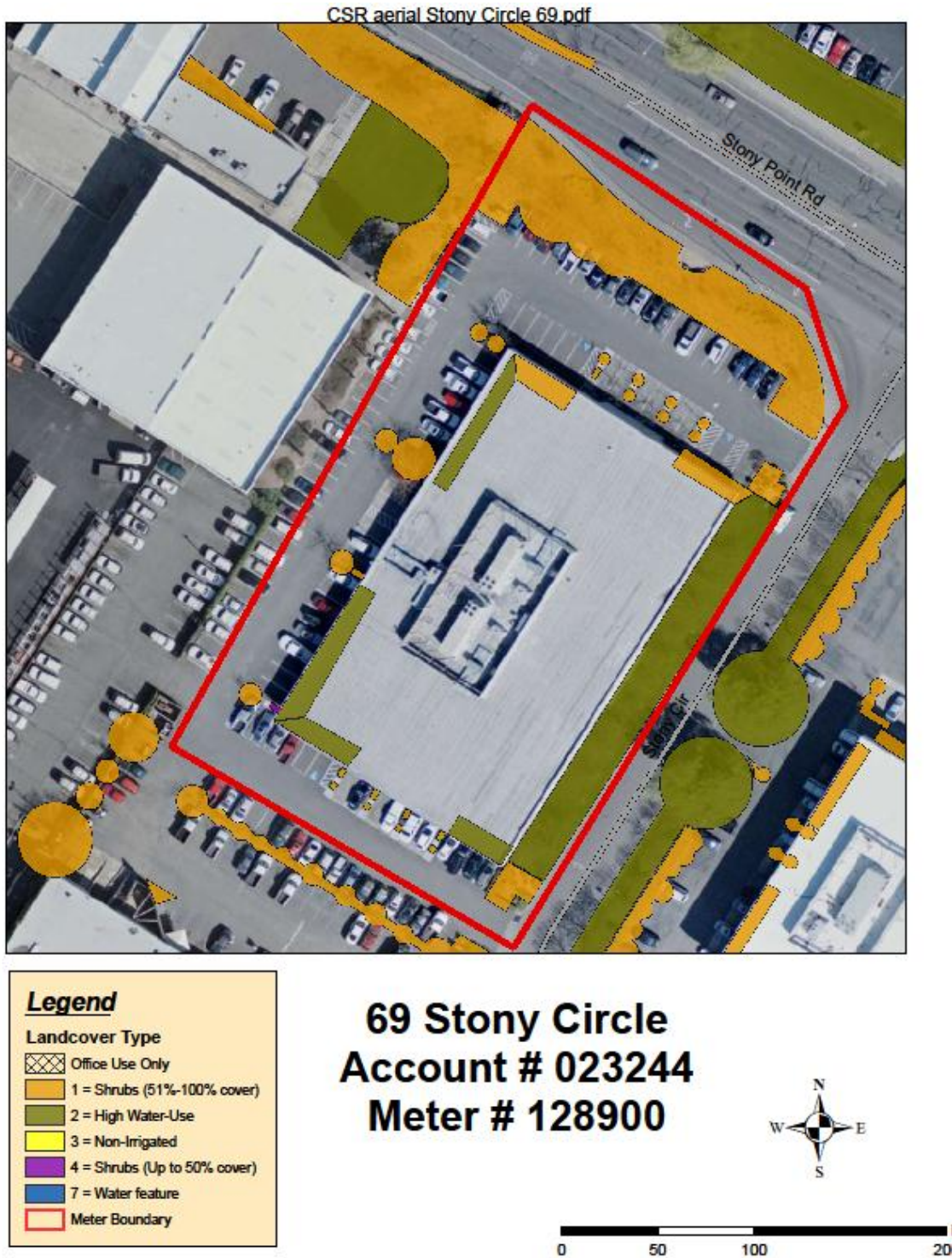
¹¹ Seasonal differences are probably more pertinent in northern California, where greater rainfall and lower ET₀ general occur in winter.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Another factor to consider is the size and complexity of CII mixed-use landscape sites in the local service area. The cost per site shown in Table 5 is for conducting a survey at a typical one acre site. If the sites surveyed tend to be smaller, the surveyor will need less time for landscape measurement and station inspections. In addition, if a database exists with comprehensive landscape measurements (see page 22: Distributing Water Budgets), the surveyor will need significantly less time for landscape measurements (just time spent in validation).

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

Figure 5: This is a marked-up aerial photograph from the City of Santa Rosa. Markings indicate the meter boundary and irrigated and non-irrigated areas in the landscape broken out by water use level.



Chapter 5 Flex Track Program

BMP Requirements

The Flex Track program provides an alternative approach for compliance with the landscape BMP. Agencies choosing this (Flex Track) option in lieu of standard implementation of the BMP list are required to implement any combination of items on the Flex Track Menu at a rate that will achieve equal or greater water savings to the Standard Compliance method (see page 7: [Landscape BMP Summary](#)). All savings claims must be measured and supported by documentation. Please see the Flex Track Menu on the Council's website: <http://cuwcc.org/Resources/Memorandum-of-Understanding/Exhibit-1-BMP-Definitions-Schedules-and-Requirements/Flex-Track-Option>.

Technical Landscape Resources and Training

One of the components of the Landscape Flex Track Menu includes providing technical resources and training for non-residential customers. This ranges from providing information on landscape design and irrigation management to performing irrigation audits and supporting technical education events. The intent is to achieve water savings by expanding the knowledge and technical expertise of those responsible for managing irrigated landscapes.

Provide information and resources

Water providers are an important source of technical information for customers seeking assistance in how to improve landscape water use efficiency. Effective water conservation messaging results in a greater awareness of irrigation water use and may encourage customers to request information; in many cases, an increased water bill will trigger a response. These customers are likely to make water saving changes to the landscape design or irrigation system, so water providers should be prepared to offer this assistance directly or by making customers aware of resources available online and through professional organizations. Primary concepts that customers should consider are outlined below. For each of these areas, customers should be made aware of any applicable requirements in the local water efficient landscape ordinance.

a) Water Budget

A landscape water budget is the fundamental concept that guides landscape design and irrigation management (see Chapter 2 for information on how to develop a water budget). It sets the target water use for a site, whether it is an existing or new landscape. If a landscape water budget has not been established, this is an excellent

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

opportunity to work with the landscape manager to determine the Maximum Applied Water Allowance (MAWA). The MAWA will provide the water use goal that supports any necessary design modifications as well as changes in irrigation system equipment or its operation. The MAWA will also provide the basis for estimating water savings for Flex Track reporting as it can be compared to water use prior to and after assistance.

b) Water efficient landscape design

Elements of water efficient landscape design include:

- Hydrozones based on microclimates and plant water requirements;
- Appropriate plant selection;
- Planted areas that are of a size, shape and slope that can be efficiently irrigated without runoff, and;
- Areas designed to collect runoff and storm water onsite so that it can percolate into the soil.

Customers should review design requirements in the local landscape ordinance. Online design resources include Smart from the Start Landscapes (www.h2ouse.org/tour/smart-from-the-start.cfm).

Perform landscape and irrigation audits

Information regarding this topic is available in Chapter 4 Water Use Surveys.

Sponsor or support landscape workshops and trainings

In-person Workshops: Landscape workshops and on-site trainings can be uniquely helpful to a water agency's outreach and education efforts. This is largely because a training event like this brings landscape professionals from many different sectors of the industry all into a room together. Land use planners will talk with irrigation professionals who will talk with landscape designers who will talk with water agency staff – the shared knowledge will generate more questions and a more in-depth education in the classroom, as well as greater communication and a more cohesive planning process in the “real world.”

A landscape workshop should include topics such as:

- Basic principles of plant water use;
- California's Model Water Efficient Landscape Ordinance and local ordinances as applicable;
- How landscape conservation is implemented by different local organizations;

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

- An example irrigation audit; and
- If possible, guest speakers providing insight into irrigation system design and maintenance, landscape design and maintenance, or other related topics.

Trainings: Trainings can easily and inexpensively be done in an online format. For example, the Metropolitan Water District of Southern California provides online training for professionals and homeowners at <http://bewaterwise.com/training01.html>. The Indian Wells Valley Water District also implements a xeriscape training workshop for residential customers and landscape managers alike throughout their community: <http://www.cuwcc.org/Portals/0/BMPResources/Landscape/case-study-IWVWD-xeriscape-wkshop.doc>.

Trainings can also be focused on a particular sector of the industry. For example, training can be provided on the local agency's particular Water Efficient Landscape ordinance with topics relevant specifically to landscape designers. Other training might focus on maintenance practices for water efficient landscapes for contractors and gardeners.

A number of agencies offer training that complements the extensive classes offered by California Polytechnic University at San Luis Obispo's Irrigation and Training Research Center (ITRC) and Fresno State University's Center for Irrigation Technology (CIT). Cal Poly's ITRC and Fresno State's CIT have been responsible for advancing state-wide knowledge of irrigation problems and scheduling. As a result, an increasing number of personnel in the landscape maintenance industry understand the basics behind improving irrigation efficiency. Examples of ongoing agency education programs include the Metropolitan Water District of Southern California's "California Friendly Landscape Training:" <http://www.bewaterwise.com/training01.html>. Irrigation training and certification is also available at a number of venues; see Cal Poly's Irrigation Training and Research Center: www.itrc.org and the Qualified Water Efficient Landscaper program: <http://www.qweltraining.com/>. The California Landscape Contractors Association and the Irrigation Association both offer classes and certification regarding irrigation equipment installation. The U.C. Cooperative Extension Service, Master Gardeners and many junior colleges also offer horticultural/irrigation classes and events.

Financial Incentives

Landscape budget-based rates

Allocation-based rate structures (water budgets) promote the efficient use of water by providing customers with economic signals as their use increases. It can also provide a stable foundation for water conservation programs: revenue from higher tier water use can be "reinvested" to promote long-term improvements in water use efficiency

programs. More information on rate structures can be found in the [Utility Operations Guidebook](#).

Examples of agencies that are successfully using budget-based rate structures include:

- Irvine Ranch Water District: <http://www.irwd.com/services/rates-alternate-test-page>
- Helix Water District: <http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Helix%20Water%20District%20water%20budgets%20and%20rates.doc>

Conversion of mixed use meters to dedicated landscape meters

While this can be an expensive fix, it will often be worthwhile for a utility to do. A basic cost-benefit analysis is an essential component of a meter conversion project. The City of Santa Rosa offers their customers an informative brochure, available on their website, to help them in making the decision: <http://ci.santa-rosa.ca.us/doclib/Documents/servicesplit.pdf>.

Sub-meters to separate landscape water use

In lieu of a dedicated landscape meter, sub-metering is an effective tool for water agencies to track landscape use more accurately. Several agencies in California have obtained State and/or federal funding for projects like these, based on the belief that most of the indoor water conservation has been completed in most areas of the state, and landscape savings are the next frontier in urban water use efficiency.

El Dorado Irrigation District received a grant from the State of California (Proposition 50 funds) to do sub-metering on CII landscapes. The project is described at: <http://www.eid.org/customers/water-efficiency/landscape>.

Additional Links include an online eligibility questionnaire:

<http://www.eid.org/doc lib/08 wat eff/2010/EligibilityQuestionnaire.pdf>

and a customer application form:

<http://www.eid.org/doc lib/08 wat eff/2010/CustomerAgreement-Application.pdf>.

Irrigation efficiency improvements

There are many irrigation system products on the market today that will improve the efficiency of the existing irrigation system and can result in immediate savings for customers. These include but are not limited to; drip irrigation, high efficiency sprinkler nozzles and heads, and irrigation management devices that adjust scheduling based on sensor input (rain, soil moisture, weather conditions). Some examples are available below.

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

- East Bay Municipal Utility District provides specific commercial irrigation upgrade incentives: <http://www.ebmud.com/sites/default/files/pdfs/WS-Commerical-Irrigation-Upgrade.pdf>
- Metropolitan Water District of Orange County's (MWDOC) rotating nozzles program: <http://www.cuwcc.org/Portals/0/BMPResources/Landscape/MWDOC Rotating Nozzles Program.doc>
- MWDOC's smart controller rebate program: <http://www.cuwcc.org/Portals/0/BMPResources/Landscape/MWDOC Smart Timer Program.doc>
- San Diego County Water Authority's smart controller rebate program: <http://www.cuwcc.org/Portals/0/BMPResources/Landscape/SDCWA Smart Controller Rebate Application.pdf>
- Marina Coast Water District's landscape renovation incentive: <http://www.cuwcc.org/Portals/0/BMPResources/Landscape/mc wd water-wise 2010-winter.pdf>

High water use plant replacement

A water agency with a successful turf replacement program is Otay Water District, located in San Diego County. The Otay WD program provides \$1.00 per square foot with a maximum of \$3,000.00 for residential sites and \$7,500.00 for commercial sites. An extensive list of qualifying standards must be met to participate in the turf removal program including the following requirements: design plan; plant list; 50 percent plant coverage of project area at maturity; and addition of mulch (see the [Otay Residential Water Survey](#) document). Post-project area landscape must be watered and established with a low volume irrigation system. Otay WD conservation staff provide pre- and post-project inspections to ensure qualifying standards are interpreted and completed for reimbursement purposes. Find more information on their website:

[http://www.otaywater.gov/conservation/water-conservation-resources/.](http://www.otaywater.gov/conservation/water-conservation-resources/)

The City of Santa Rosa also has a landscape-focused "Green Exchange" program. To reduce landscape water use, the City of Santa Rosa's Water-Use Efficiency Program focuses on three ways to reduce landscape water use: 1) improving irrigation scheduling (behavioral), 2) Improving the efficiency of the irrigation system (upgrade hardware), 3) reducing the sites watering requirements (change plants). More information on this program is available in the Green Exchange Program case study:

<http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Green Exchange Program description.doc>

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

The Market Transformation section in the [Residential Guidebook](#) may provide good background for this topic, as communities are sometimes reticent in adopting xeriscape styles. It may take several years of advertisement, collaboration with local garden and home-improvement stores, and perhaps community events, such as competitions for garden makeovers. The San Diego County Water Authority overcame this hurdle through a marketing campaign development (LINK to “SDCWA Better Beautiful” document).

There have been questions regarding the environmental effects of synthetic turf. Several studies and articles are available on this topic, listed below:

- The City of Santa Rosa wrote a short article to their customers, available on their water use efficiency rebate web page, on why artificial turf is not rebated:
<http://ci.santa-rosa.ca.us/doclib/Documents/Why%20Artificial%20Turf%20is%20not%20rebated.pdf>
- [http://www.cuwcc.org/Portals/0/BMPResources/Landscape/CDC advisory on synthetic turf.pdf](http://www.cuwcc.org/Portals/0/BMPResources/Landscape/CDC%20advisory%20on%20synthetic%20turf.pdf)
- [http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Just How Green Is Faux Grass - WSJ.pdf](http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Just%20How%20Green%20Is%20Faux%20Grass%20-%20WSJ.pdf)
- [http://www.cuwcc.org/Portals/0/BMPResources/Landscape/No Marin WD-Synthetic Turf.pdf](http://www.cuwcc.org/Portals/0/BMPResources/Landscape/No%20Marin%20WD-%20Synthetic%20Turf.pdf)
- [http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Synthetic Turf-Park Surfaces Top 171 Degrees.pdf](http://www.cuwcc.org/Portals/0/BMPResources/Landscape/Synthetic%20Turf-Park%20Surfaces%20Top%20171%20Degrees.pdf)
- [http://www.cuwcc.org/Portals/0/BMPResources/Landscape/water quality impacts of artificial turf.pdf](http://www.cuwcc.org/Portals/0/BMPResources/Landscape/water%20quality%20impacts%20of%20artificial%20turf.pdf)

Potable to recycled water

Using recycled water to meet potable demand is an important way for agencies to lower per capita potable water use. If recycled water is currently available, communities should encourage recycled water connections, particularly for large landscape irrigation. If recycled water will be a future resource, communities should encourage pipe installation for recycled water delivery. This resource is becoming increasingly important for water supply reliability and is an essential element of the land use/water supply connection. The Water Education Foundation (<http://www.watereducation.org/>) offers an informative introduction to recycled water in California in its “Layperson’s Guide to Water Recycling.”

Alternative sources of landscape irrigation water

The alternative, non-potable resources shown below are becoming more widely used. Graywater use in California is now written into the building code as a legal use of used water from the clothes washer, bathtub, and bathroom sinks. Gray water use is becoming more common. Alternative resources are often used when green building certification is being pursued, such as the US Green Building Council's LEED certification.

- a. Gray water: the reuse of water for landscape irrigation. Guidelines for gray water use in California are quite strict; it's important to read through them before implementing a program:
http://www.hcd.ca.gov/codes/shl/graywater_emergency.html
- b. Rainwater/cisterns: the collection and use of rainwater through any variety of systems for landscape irrigation. This equipment is gaining in popularity, and the key for this practice is rainfall.
- c. City of Santa Rosa offers rebates for both gray water and rainwater harvesting: www.srcity.org/WUE. Click on 'Rebates'.

Local and Regional Planning and Regulatory Activities

Stakeholder Advisory Committee

Stakeholder committees can play a critical role in mobilizing industries and maximizing water savings to help water agencies meet short and long term water savings goals. The use of stakeholder committees to achieve water savings is not new; many water agencies in California and throughout the nation have relied on stakeholder committees to meet water savings targets during critical shortage periods times in the past. These public/private partnerships are successful due to their interdependent relationship – public agencies institute policy while stakeholders implement policy. The advisory committee provides a forum for all involved to raise problems, identify solutions to complex problems, increase awareness, highlight success stories, and mobilize the community. The most successful models thrive on principles of mutual respect, openness, and collaboration.

Identifying the right mix of participants is important to the success of stakeholder committees. It must include: decision makers, end-users and influencers. Below is a cross-section of industry associations, public entities, commercial and non- profit interests that are important to consider.

In California, stakeholder associations include:

American Water Works Association: California-Nevada Section

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

American Society of Landscape Architects (ASLA)
Building Industry Association (BIA)
California Association of Community Managers (CACM)
California Landscape Contractor's Association (CLCA)
Irrigation Association
Qualified Water Efficient Landscaper
Regional Apartment Association

Additional commercial, non-profit, and public sector interests include:

Biotech
Commercial, Industrial and Institutional (CII) Firms
Community Associations
County Planning and Enforcement Agencies
Environmental Interests
Landscape Professionals
Local Water Agencies
Manufacturers
Municipalities
Nurseries and Propagators
Product Distributors
Regional Gardens and Museums
Regional Utility Sector
Service Providers
Watershed collaboratives

Entities that fail to adopt stakeholder committees may languish in their efforts to obtain acceptance of their policies thus minimizing the success of their water conservation efforts.

[http://www.cuwcc.org/Portals/0/BMPResources/Landscape/San Diego Region Conservation Action Committee.doc](http://www.cuwcc.org/Portals/0/BMPResources/Landscape/San_Diego_Region_Conservation_Action_Committee.doc)

Regional Efforts

There are many formal stakeholder groups around the State that are managing water resources together.

- a. **Integrated Regional Water Management Planning:** These groups were begun largely with the release of the Proposition 50 grant funds in 2006 for IRWMP regions. Integrated Regional Water Management (IRWM) is a collaborative effort to manage all aspects of water resources in a region. IRWM crosses jurisdictional, watershed, and political boundaries; involves multiple agencies, stakeholders, Individuals, and groups; and attempts to address the issues and differing perspectives of all the entities involved through mutually beneficial solutions. Information on DWR's IRWM program and the regions defined around the state is available on the DWR website: <http://www.water.ca.gov/irwm/index.cfm>.
- b. **Watershed Groups:** Watershed groups are often formed to address a problem in the watershed, such a source water contamination or the development of a potentially polluting industry. The California Watershed Network is a good place to learn about groups around the state: <http://www.watershednetwork.org/>, and the California Department of Conservation (www.consrv.ca.gov) provides grants for watershed coordinators around the state.

5.1.1 State and Federal Requirements

- a. **Model Water Efficient Landscape Ordinance:** See Chapter 2 Water Use Budgets, for more information on this topic.
- b. **Development, review, implementation, and enforcement of requirements for new developments:** The California Department of Housing and Community Development has recently developed a new building code for California that has optional implementation for landscape/outdoor design. It's titled the CALGreen Code, and is available here: <http://www.bsc.ca.gov/Home/CALGreen.aspx>.
- c. **Senate Bill 7x-7 – 2009 Water Conservation Legislation:** This legislation has newly defined conservation in California with State-mandated conservation for most, if not all, urban water agencies. While this legislation doesn't mandate particular practices, it does demand demonstrable conservation, as measured in an agency's gallons per capita per day (gpcd). Information on the bill, the stakeholder process, and how it will be implemented is available on the DWR website: <http://www.water.ca.gov/wateruseefficiency/sb7/>.

Holistic Approach

It is tempting to attempt to replicate indoor conservation measures outdoors, but agencies throughout California have learned that outdoor conservation is a different animal. Indoor practices rely on the replacement of mutually exclusive appliances/technologies while outdoor conservation is “systems” based – actions cannot solely be performed on one component because each piece is interdependent and complicated by ever changing conditions such as the weather. Outdoor conservation is also not just device-based; it involves different specialties: horticulture, irrigation, and soils. The difficulty faced by agencies with outdoor conservation in particular has led to an evolution of thinking in the conservation arena – one geared to a holistic approach.

A holistic approach to landscaping is one that works in harmony with the natural conditions of a watershed. Holistic practices foster soil health and conserve water and other valuable resources while reducing waste and preventing pollution. Holistic landscaping is not a particular style, but is an approach to landscaping and gardening that takes in the condition and needs of the ecosystem.

An example with further information is the Bay-Friendly Landscaping & Gardening Coalition: <http://bayfriendlycoalition.org>. Their Menu of Best Practices integrates landscaping design, construction and maintenance practices around the following 7 principles, which are applicable throughout California:

- Landscape Locally
- Landscape for Less to the Landfill
- Nurture the Soil
- Conserve Water
- Conserve Energy
- Protect Water and Air Quality
- Create and Protect Wildlife Habitat

A holistic model also requires integration of efforts to realize water savings. It involves market segmentation, market specific outcome identification, water savings assessments, and outlining of “how-to” steps. Under the holistic model, incentive programs are not offered in isolation, rather they are part of a larger portfolio of offerings such as: technical assistance programs; certifications; irrigation evaluations; downloadable landscape templates and water-use evaluation tools. Incentives are often offered through a collaboration with other regional

LANDSCAPE BMP IMPLEMENTATION GUIDEBOOK

organizations, such as ocean protection councils, watershed groups, urban forestry interests, and energy providers. By staging efforts and offering multiple types of assistance, conservation will be less defined by a device, and more defined as an ethic.

Figure 6: Illustration Depicting the 7 Principles of Bay Friendly Landscaping and Gardening.

