

**City of Petaluma, CA**

Department of water Resources and Conservation

# Water Conservation Plan

*An evaluation and recommendation of the most cost effective water conservation based on an 80 year present cost worth, comprised of water conservation measures that are feasible, cost effective, and implementable by the city.*



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## LIST OF ABBREVIATIONS

### Organizations

SCWA	Sonoma County Water Agency
CUWCC	California Urban Water Conservation Council
DHS	California Department of Health Services
NPDES	National Pollutant Discharge Elimination System
BMP	Best Management Practices
DSS Model	Least Cost Planning Decision Support System Model

### Water Usage

MG	Million Gallons
mgd	Millions Gallons per Year
gpd	Gallons per Day
ADMM	Average Day Maximum Month
AF	Acre-Feet
DU	Dwelling Unit

### Customer Class

SF/ SFR/ RSF	Single-Family (Residential)
MF/ MFR/ RMF	Multi-Family (Residential)
CIO	Commercial/Industrial/Office
INST	Institution
TURF	Parks/Open Space/Other Irrigated Land
PUB	Public Land

Customer Class abbreviations vary by agency, organization, and departments. Care was taken to relate these abbreviations and make them consistent for this report.

# **SECTION ONE**

## **EXECUTIVE SUMMARY**

# SECTION ONE

## EXECUTIVE SUMMARY

### Introduction

The City of Petaluma's City Council approved funding to develop a Water Conservation Plan. The intent of the study was to evaluate and recommend the most cost effective water conservation plan based on an 80 year present worth, comprised of water conservation measures that are feasible, cost effective, and implementable by the City. The goal of the plan was to further implement water conservation beyond that recommended under the City's Water Demand and Supply Analysis conducted in June 2006.

The City of Petaluma's current water conservation program provides a steady amount of water savings, but future additional savings provided by the program will start to diminish as the program reaches saturation. The Petaluma City Council wishes to continue the efforts of water conservation within the City of Petaluma to achieve further water conservation savings by implementing the next level of water conservation measures. All water conservation efforts to date have been factored into the work.

Water conservation is a key element for the City of Petaluma to meet future potable water demands. During the potable water supply analysis conducted under the City's Water Demand and Supply Analysis, additional water supply needs for the City of Petaluma to meet the potable water demand projections were quantified and a least-cost, phased program to meet those needs was developed. Water supply sources included both potable water supply and offset sources. These sources included SCWA water, recycled water, water conservation, and groundwater.

To develop the Water Conservation Plan, the project team was hand selected based on their unique skills and expertise in the area of water conservation. The project team consisted of City staff from the Department of Water Resources and Conservation, Department of Community Development, and Department of Parks and Recreation; landscape and irrigation experts, water conservation experts, the Department of Water Resources and Conservation's funding consultant, and consultants with extensive knowledge of the City's water system and demand and supply needs. The project team is shown in Figure 1-1.

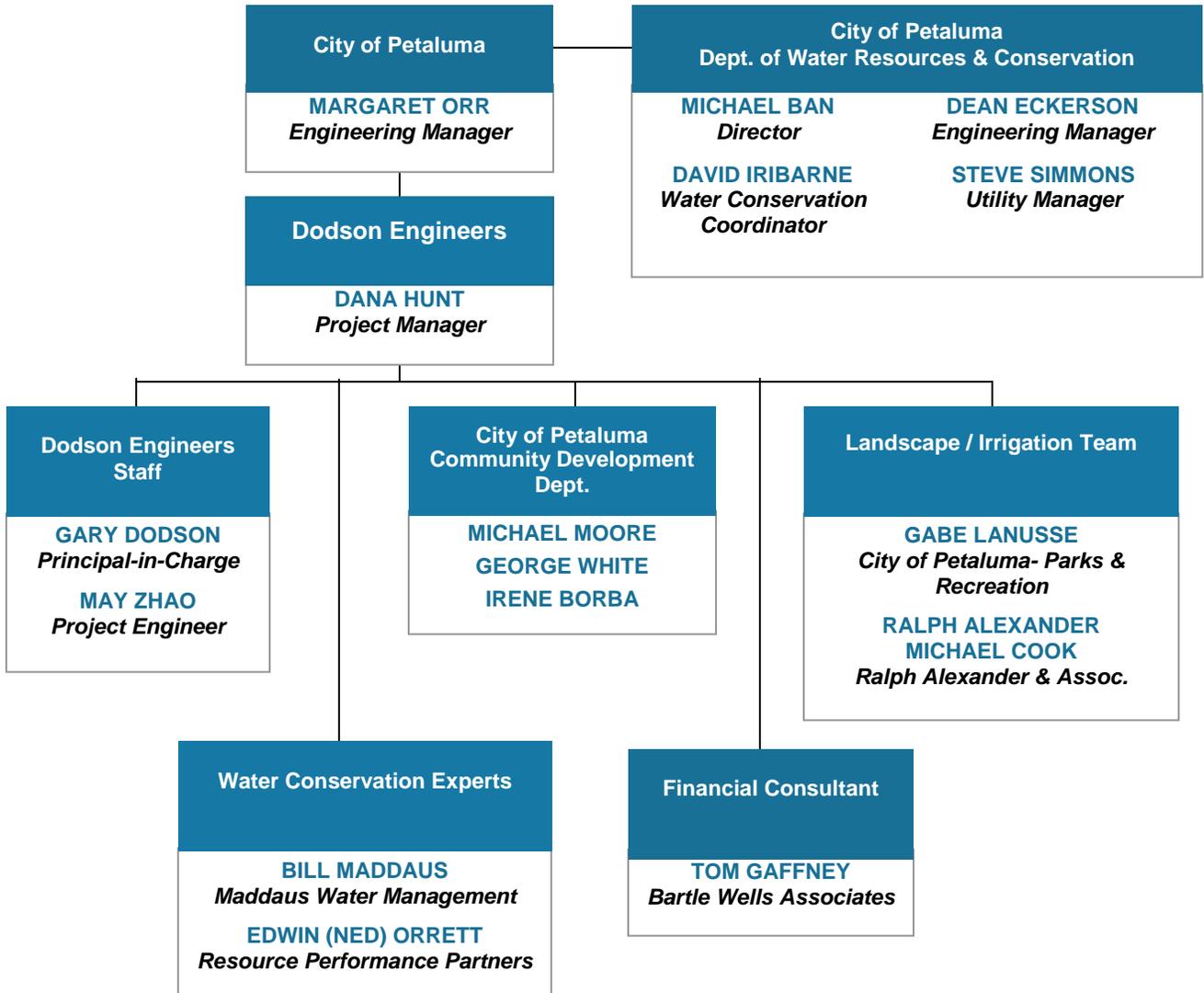
### Water Conservation Plan Development

#### Review of Pertinent Information

Upon commencement of the Water Conservation Plan study, pertinent background materials were gathered and reviewed by the project team. These items included materials directly related to the City of Petaluma and independent materials related to water conservation.

In addition to reviewing pertinent background materials on water conservation, ten water providers were surveyed about their water conservation programs and efforts. The project team developed the list of agencies to be surveyed based on similar climate, water supply challenges, and their innovative water conservation programs.

**FIGURE 1-1  
WATER CONSERVATION TEAM  
ORGANIZATIONAL CHART**



**City of Petaluma Water Use Characteristics**

Prior to development of potential water conservation measures for inclusion into the City of Petaluma’s Water Conservation Plan, it was essential that the project team members have an understanding of the City’s existing and future potable water demands and water use characteristics. The distribution of potable water demands to existing and future customer sectors and the final buildout water distribution among customer sectors were developed. In addition, existing and future potable water demands were categorized into indoor and outdoor uses.

**Water Conservation Plan Goal**

The establishment of a water savings goal for the Water Conservation Plan was based on the amount of additional potable water required to meet Buildout (Year 2025) demands, the confidence that the

recommended supply sources outlined in the Water Supply and Demand Analysis can meet the projected buildout demand, and the ability of a water conservation program to achieve the goal established.

The offset goal established for the Water Conservation Plan was 495 MG/Year by 2025 (Buildout). Although the annual amount of potable water that was established for offset via water conservation at Buildout (2025) under the Water Demand and Supply Analysis Project was 254.5 MG/Year, the goal established under the Water Conservation Plan by the project team exceeded this value. The goal was established to eliminate the need to use City-owned groundwater wells for potable water supply (the Water Demand and Supply Analysis Report determined groundwater would be needed during the 4 summer months starting in 2024 at a rate of 60.75 million gallons per year and to satisfy 0.5 mgd of average day maximum day demand) and maintain groundwater as a reserve for emergency/backup use, and to allow for a 25 percent safety factor on the water conservation and recycled water offset requirements established under the Water Demand and Supply Analysis Report. Although the recommended water conservation program outlined in the Water Demand and Supply Analysis Report met the requirements of water offset and was cost effective, the water conservation measures were basically a continuation of the California Urban Water Conservation Council's (CUWCC) Best Management Practices (BMPs). For the Water Conservation Plan, the City considered the entire breadth of water conservation measures, not strictly those recognized by the CUWCC, with the caveat that any measure selected must be feasible, cost effective, and attainable.

## **Development of Potential Water Conservation Measures**

The project team developed 202 potential water conservation measures for inclusion into the City's final Water Conservation Plan. The potential water conservation measures developed were divided into two distinct categories; namely, measures that could be implemented "on-site" at future new development sites and measures that could be implemented "off-site" at existing sites. The measures were then organized by indoor versus outdoor water savings and placed into applicable customer sectors. The potential measures included programs, ordinances and controls, public outreach and billing items.

## **Development of Evaluation Criteria**

Once the preliminary list of potential on-site and off-site water conservation measures was developed, the project team chose evaluation criteria which would be used to screen the potential conservation measures, determined the importance of each criterion, and identified any potential fatal flaws that would eliminate potential water conservation measures from further consideration to ensure a feasible and manageable program. Upon discussion and analysis of the proposed criteria by the project team, the team grouped related evaluation criteria and determined weights for the criteria and corresponding fatal flaws that would be used to select the most feasible and suitable measures.

## **Evaluation of Potential Water Conservation Measures**

Once evaluation criteria were identified, potential water conservation measures were evaluated and a shortlist of 112 measures was compiled for further evaluation. The initial screening process used the fatal flaws to eliminate potential measures.

The next step of the Water Conservation Plan process was to further reduce the number of potential water conservation measures and place the remaining measures into a water conservation program for further evaluation. Since many water conservation measures reduce the same water use (i.e. turf

limits, proper landscape materials, and ET controllers all reduce irrigation use), each group of potential measures must be evaluated together in order to determine the net water reduction and the program’s overall cost-effectiveness. A highly sophisticated computer model known as the Least Cost Planning Decision Support System (DSS) was used to complete this task. The model coordinates water savings between measures and does not “double count” water savings thus allowing the user to accurately calculate water savings for the overall program. The model is licensed through Maddaus Water Management and the California Urban Water Conservation Council (CUWCC) and has been used by more than one hundred and fifty (150) communities throughout the world, including the City of Petaluma and SCWA, to analyze the cost effectiveness and water savings of water conservation programs. One hundred and twelve (112) water conservation measures, after the fatal flaw analysis, were compiled into comprehensive tables for future evaluation by the project team to determine which measures would be included in a water conservation program for further analysis using the DSS Model.

The selected measures were then prioritized based on the evaluation criteria for inclusion into three water conservation programs each with a varying number of water conservation measures for further evaluation. For each of the water conservation measures remaining, the project team determined the customer sectors and implementation rate to be evaluated within the program. When the screening process was complete, twenty-eight water conservation measures remained for inclusion into one or more of the three water conservation programs to be modeled utilizing the DSS Model. In addition, twenty-four other measures were identified as measures that would not be modeled, but rather included into the City of Petaluma’s Water Conservation Plan. Such items reduce water use with little cost to implement, such as increasing publicity for water efficient products and requiring training of water conserving practices for landscape maintenance workers.

Table 1-1 shows the twenty-eight water conservation measures selected for inclusion into one or more of the three water conservation programs for further evaluation utilizing the DSS Model. (D) denotes a requirement for developers for implementing “on-site” measures. All measures were included in Program 3 with fewer measures included in Programs 1 and 2.

**TABLE 1-1  
WATER CONSERVATION MEASURES INCLUDED IN WATER CONSERVATION PROGRAMS 1, 2, AND 3**

Description of Conservation Activity	Water Conservation Program 1 (WCP1)	Water Conservation Program 2 (WCP2)	Water Conservation Program 3 (WCP3)
Residential Water Surveys - Indoor	X	X	X
Residential Water Surveys - Outdoor	X	X	X
Plumbing Retrofit Kits (Giveaways)	X	X	X
Water Budgets for Large Irrigators (Separate Meters)	X	X	X
Commercial Water Audits	X	X	X
High Efficiency (HE) Washing Machine Rebate	X	X	X
High Efficiency Washing Machine Requirement (D)	X	X	X
New Efficiency Dishwasher Requirement (D)	X	X	X
High Efficiency Faucets and Showerheads Requirement (D)	X	X	X
Hot Water System	X	X	X
High Efficiency Toilet (HET) Requirement (D)	X	X	X
Direct Installation of HETs for toilets >3 gallons per flush (gpf) ((w/ low income assistance)	X	X	X

Description of Conservation Activity	Water Conservation Program 1 (WCP1)	Water Conservation Program 2 (WCP2)	Water Conservation Program 3 (WCP3)
Mandate Retrofit on Resale (Urinals >1.6 gpf, Toilets >3.5 gpf)			X
Require 0.5 gpf or Waterless Urinals in New Buildings (D)	X	X	X
Waterless Urinal Rebate			X
Public Information Program	X	X	X
Smart Irrigation Controller Rebates- SF		X	X
Smart Irrigation Controller Rebates- Non SF	X	X	X
Smart Controller with Rain-sensor Shutoff Device Requirement (D)	X	X	X
Landscape and Irrigation Requirements (D)	X	X	X
Financial Incentives/ Rebates for Irrigation Upgrades	X	X	X
Plan Check for Renovation and for New Development (over 1000 sf) (D)	X	X	X
Increase Enforcement of Landscape Requirements	X	X	X
Residential Landscape Training Classes			X
New Accounts Reduced Connection Fees - for installing HE process equipment for selected businesses (restaurants, laundry mat, food/groceries and hospital) (D)			X
Hotel Retrofit (w/financial assistance)			X
CIO Rebates - replace inefficient water using equipment			X
Submetering, meter each unit (by City)		X	X
<b>TOTAL NUMBER OF MEASURES</b>	<b>20</b>	<b>22</b>	<b>28</b>

(D) denotes a requirement for developers for implementing “on-site” measures.

## Evaluation of Potential Water Conservation Program

The three programs outlined in Table 1-1 were analyzed for cost effectiveness and water savings using the Least Cost Planning Decision Support System (DSS) Model. The model developed a water demand baseline profile for the City of Petaluma. Wastewater savings and energy savings costs are also estimated and included in the cost benefit analysis. Projected water demands developed under the Water Demand and Supply Analysis Project were used to calibrate the model forecasts.

Output data for the DSS Model for each program included the following information:

- ◆ Program water savings for each year of the program.
- ◆ Program cost for each year of the program.
- ◆ Benefit-cost ratios for each measure included in the program. Utility benefit-cost ratios include only the impact on the utility or City. Utility-developer benefit-cost ratios include the impact on the utility as well as the developer who may have to pay increased connection fees or pay for more water conserving devices as a baseline cost to the development. Community benefit-cost ratios include the impact to the utility (City), developer, and customer.
- ◆ Amount of water saved for each measure included in the program.

The DSS Model output data for the three water conservation programs evaluated indicated total program water savings at Buildout (2025). The good news was that each program’s water savings exceeded the established goal of 495 MG/Year. The water savings are shown in Table 1-2.

**TABLE 1-2  
PROGRAM 1, 2, AND 3 YEAR 2025 WATER SAVINGS**

Program	Water Saved in 2025 (MG/Year)	ADMM Reduction in 2025 (mgd)
1	504	2.58
2	537	2.68
3	562	2.81

Water conservation measures are implemented over many years and it takes time for water savings to develop. Program costs were calculated within the DSS Model. Costs were developed based on cost to the utility (City) only and cost to the utility (City) plus development community. Table 1-3 summarizes these costs.

**TABLE 1-3  
PROGRAMS 1, 2, AND 3 COST INFORMATION**

Water Conservation Program	1		2		3	
	Utility	Utility+ Developer	Utility	Utility+ Developer	Utility	Utility+ Developer
<b>80 Year Present Worth Analysis</b>						
80 Year Present Worth	\$9,414,663	\$29,827,881	\$9,887,042	\$30,427,168	\$10,780,853	\$31,888,882
Annualized 80 Year Present Worth	\$311,736	\$987,653	\$327,377	\$1,007,497	\$356,973	\$1,055,897
<b>Annualized 80 Year Present Worth/Unit of Water Saved</b>						
(\$/MG)	\$717	\$2,270	\$704	\$2,165	\$723	\$2,138
(\$/Acre-Foot)	\$234	\$740	\$229	\$706	\$236	\$697

Note: All costs are in 2006 dollars

On an 80 year present worth cost basis all three programs evaluated are more cost effective than creating more potable water supply. The annualized 80 year present worth cost per unit of water saved for Programs 1, 2, and 3 is less than the current cost to purchase and distribute SCWA water to the City of Petaluma’s potable water customers. The current cost of purchasing potable water from SCWA and distributing the water to the City of Petaluma customers is \$2,661/MG or \$870/acre-foot. Since the three water conservation programs’ water savings in Year 2025 exceed the City’s needs and the Water Conservation Program goal of 495 MG/Year, the three programs were further evaluated by the project team. Water conservation measures that were more costly than others, saved only small quantities of water, or could be difficult to implement were removed. Feedback gathered from the community and City Council on September 10, 2007 was incorporated into the final program. Through this process, the water conservation project team was able to develop a recommended program that met the water conservation plan goal for water savings of approximately 495 MG/Year at buildout, but also reduced the cost of the overall program and achieved a lower cost per unit of water saved. The recommended water conservation program includes nineteen of the original twenty-eight water conservation measures modeled. A list of the recommended water conservation program’s measures is shown in Table 1-4.

**TABLE 1-4****SUMMARY OF MEASURES INCLUDED IN THE RECOMMENDED WATER CONSERVATION PROGRAM**

Corresponding Measure Number	Description of Conservation Measure
P1	Residential Water Surveys – Indoor
P2	Residential Water Surveys – Outdoor
P3	Plumbing Retrofit Kits (Giveaways)
P4	Water Budgets for Large Irrigators (Separate Meters)
P5	Commercial Water Audits
P6	High Efficiency (HE) Washing Machine Rebate
P7	HE Washing Machine Offer (D)
P8	HE Faucets and Showerheads Requirement (D)
P9	HE Toilet (HET) Requirement (D)
P10	City Purchase and Install HET's (urinals >1.6 gpf, toilets >3.5 gpf)
P11	Public Information Program
P12	Smart Irrigation Controller Rebates- Non SF
P13	Smart Controller with Rain-sensor Shutoff Device Requirement (D)
P14	Landscape and Irrigation Requirements (D)
P15	Application process for Landscape Renovation (>1000 sf and < 500 sf) (D)
P16	Increase Enforcement of Landscape Requirements
P17	Residential Landscape Training Classes
P18	Hotel retrofit (w/financial assistance)
P19	Submetering, meter each unit (by City)

(D) denotes a requirement for developers for implementing “on-site” measures.

## Recommended Water Conservation Program

Since the development of the water conservation programs 1, 2, and 3 and measures described in Section 5, three changes were made to the recommended program. First, California passed AB 715 which requires that on or after January 1, 2014, all toilets and urinals sold and installed in California be high efficiency models; therefore, measures P-9 and P-10 were revised to start implementation in 2008 and stop implementation at the end of 2013. Second, measure P-10 was modified from a mandated retrofit at resale program with City rebate to a program where the City will purchase and install high efficiency toilets for customers with high flow toilets. Third, highly efficient washing machines will be offered as part of the purchase package to buyers of new homes and not required to be installed by developers. This change was implemented following discussions with the community and City Council on September 10, 2007, November 20, 2007, and January 15, 2008. The model for the recommended water conservation program was updated and rerun to reflect the restructuring of measure P-10 and P-7 and for incorporation of AB 715 into measures P-9, P-10, and future water demand projections. Modifications to the program are anticipated as laws change, technology advances, and participation levels fluctuate. Thus, the City has obtained the DSS Model and can track and enhance the program as necessary in the coming years to meet the annual water savings.

The recommended water conservation program contains nineteen (19) measures. These measures are outlined in Table 1-5. Table 1-5 provides the measure number, name of measure, customer sector(s) affected, and a description of the measure.

**TABLE 1-5  
RECOMMENDED WATER CONSERVATION PROGRAM MEASURES**

Measure No.	Name of Measure	Customer Sector	Description
P1	Residential Water Surveys - Indoor	Existing Customers: SF, MF	This is the indoor component of water surveys for existing single-family and multi-family residential customers. Normally those with high water use are targeted. Water use evaluations that are marketed by realtors during the time of resale and customer call-ins are also included in this program.
P2	Residential Water Surveys - Outdoor	Existing Customers: SF, MF	This is the outdoor component of water surveys for existing single-family and multi-family residential customers. Normally those with high water use are targeted. Water use evaluations that are marketed by realtors during the time of resale and customer call-ins are also included in this program.
P3	Plumbing Retrofit Kits (Giveaways)	Existing Customers: SF, MF	Provide owners of pre-1992 homes with retrofit kits that contain easy-to-install low flow showerheads, faucet aerators, hose end nozzles, and toilet tank leak detection devices. These are also provided during surveys.
P4	Water Budgets for Large Irrigators (Separate Meter)	Existing and New Customers: Large Irrigators in CIO, TURF	Provide all irrigators of landscapes with separate irrigation accounts with a monthly irrigation water use budget on the water bill.
P5	Commercial Water Audits	Existing Customers: CIO	Offer high water use accounts a free water audit that would evaluate ways for the business to save water and money.
P6	High Efficiency (HE) Washing Machine Rebate	Existing Customers: SF, MF, CIO	Offer homeowners a rebate on a new water efficient clothes washer. Rebates will be offered to businesses if requested, but water savings for businesses was not included in the model.
P7	HE Washing Machine Offer (D)	New Customers: SF, MF, CIO	Require developers to offer to install an efficient washer before new home, commercial, or public building occupancy.
P8	HE Faucets and Showerheads Requirement (D)	New Customers: SF, MF, CIO, INST	Require developers to install Lavatory faucets that flow at no more than 1.5 gpm, kitchen faucets at 2.2 gpm, and showerheads at 2.0 gpm.
P9	High Efficiency Toilet (HET) Requirement (D)	New Customers: SF, MF, CIO, INST	Require developers to install high efficiency toilets (HETs) for new development from 2008 to 2013. The plumbing code requirement begins in 2013.
P10	City Purchase and Install HETs	Existing Customers: SF, MF, INST	City to purchase and install HETs (1.3 gpf) for customers with high flow toilets from 2008 through 2013. City may work through a contractor and will target public facilities and then high water users.

Measure No.	Name of Measure	Customer Sector	Description
P11	Public Information Program	Existing and New Customers: SF	Raise awareness for water conservation with public education programs such as seminars, video, speakers to community groups, radio and television time, and printed educational material such as bill inserts.
P12	Smart Irrigation Controller Rebates	Existing Customers: MF, CIO, INST	Provide a rebate for the purchase of a SMART irrigation controller and associated signal fees. Assume one controller per site. Minimum participant requirements: at least 500 sf of well maintained turf.
P13	Smart Controller with Rain-sensor Shutoff Device Requirement (D)	New Customers: SF, MF, CIO, INST	Require installation of smart controllers with rain sensor shut off for all new irrigation systems.
P14	Landscape and Irrigation Requirements (D)	New Customers: SF, MF, CIO, INST	Enforce a regulation that specifies that landscapes be designed and installed according to water efficient principals, with appropriate irrigation systems. (Combines with Smart Controller listed above). Goal is an overall 25% reduction of irrigation water use. Includes plan review as part of project approval process.
P15	Application Process for Landscape Renovations >1000 sf and < 5000 sf	Existing Customers (>1000 sf and < 5000 sf): MF, CIO, INST	Developer or contractor to submit application to the City for approval of renovations greater than 1000 sf and less than 5000 sf.
P16	Increase Enforcement of Landscape Requirements	Existing Customers: CIO, INST, MF	Enforce landscape requirements on renovated and new development landscaping including use of low water use plants and efficient irrigation.
P17	Residential Landscape Training Classes	Existing and New: SF	Combination of three types of training classes: (1) Low Water Use Landscaping (2) Homeowner Irrigation, and (3) Promotion of Water Efficient Plants.
P18	Hotel Retrofit (w/financial assistance)	Existing Customers: CIO	Following a free water audit, offer the hotel a rebate for equipment identified that would save water. Provide a rebate schedule for certain efficient equipment such as air-cooled ice machines, steamers, washers, cooling towers, and spray rinse valves.
P19	Submetering, meter each unit	New Customers: MF, CIO, INST	City to require submetering of each commercial unit, such as strip malls, and all multi-family accounts. Sub-meters may be provided by the City or the owner depending upon congestion issues for efficient installation.

(D) denotes a requirement for developers for implementing "on-site" measures.

Model output data for the recommended water supply program is included in Table 1-6.

**TABLE 1-6  
WATER CONSERVATION MEASURES INCLUDED IN THE PETALUMA RECOMMENDED WATER CONSERVATION PROGRAM**

Measure Number	Water Conservation Measures <sup>1</sup>	Customer		Benefit Cost Ratio <sup>2</sup>			Water Savings in 2025 (MG/Year)	Degree of Implementation	
		New/Existing	Sector	Utility	Utility + Developer	Community (Utility + Developer+ Customer)		Market Penetration (%)	Program Length
P1	Residential Water Surveys - Indoor	E	SF, MF	1.60	N/A	3.33	26.7	100%	30
P2	Residential Water Surveys - Outdoor	E	SF, MF	1.61	N/A	1.45	26.5	100%	30
P3	Residential Retrofit Kit (Giveaways)	E	SF, MF	6.59	N/A	11.33	6.4	75%	6
P4	Water Budgets for Large Irrigators (Separate Meters)	E,N	CIO, TURF	4.56	N/A	4.56	33.3	90%	5
P5	Commercial Water Audits	E	CIO	1.73	N/A	1.29	35.3	10%	3
P6	Clothes Washer Rebate/ Incentive	E	SF,MF,CIO	2.72	N/A	0.89	11.3	10%	3
P7	High Efficiency (HE) Washing Machine Offer (D)	N	SF,MF,CIO	36.41	0.89	0.97	34.2	100%	Indefinite
P8	HE Faucets and Showerheads Requirement (D)	N	SF,MF,CIO, INST	20.21	4.01	13.14	19.7	100%	Indefinite
P9	High Efficiency Toilet (HET) Requirement (D)	N	SF,MF,CIO, INST	17.09	0.68	0.75	15.7	100%	Indefinite
P10	City Purchase and Install HET's	E	SF,MF,INST	0.25	N/A	0.25	3.8	SFR 1386, MF 444, CII 25	5
P11	Public Information Program	E,N	SF	1.96	N/A	3.67	22.4	Varies	30
P12	Smart Irrigation Controller Rebates (start 2010)	E	MF,CIO,INST	1.02	N/A	0.94	14.7	20%	15
P13	Smart Irrigation Controller w/ Rain Sensor Requirement (D)	N	SF,MF,CIO, INST	47.32	1.15	1.27	46.9	100%	Indefinite
P14	Landscape and Irrigation Requirements (D)	N	SF,MF,CIO, INST	31.55	0.13	0.14	31.3	100%	Indefinite
P15	Application Process for Landscape Renovations (>1000 sf and < 5000 sf ) (D)	E,N	SF,MF,CIO,INST	3.56	0.33	0.41	55.8	CDD Permit application/100%	10
P16	Increase Enforcement of Landscape Requirement for renovated landscaping as permitted in P15	E	MF, CIO, INST	3.29	N/A	1.13	32.4	Audit upon work completion	Indefinite
P17	Landscape Education Training Program	E,N	SF	8.33	N/A	0.53	15.6	180 people/yr	Indefinite
P18	Hotel Retrofit (w/financial assistance)	E	CIO	2.30	N/A	0.89	2.6	20%	15
P19	Submetering, Meter Each Unit	N	MF, CIO, INST	11.15	3.72	4.29	22.1	100%	Indefinite

<sup>1</sup> (D) denotes a requirement for developers for implementing "on-site" measures.

<sup>2</sup> Benefit-cost ratio is a ratio of benefits, estimated from cost savings due to purchasing less water from SCWA, and the costs, estimated from the indicated party's cost to fund rebate programs, check that requirements have been made, install devices, etc. The higher the benefit-cost ratio, the more cost effective the water conservation measure is to the party indicated compared to the other measures considered.

Benefit-cost ratios and water savings for individual measures do not add up to total benefit-cost ratio and water savings for the program.

Results include passage of AB715 in October 2007 which requires that all toilets and urinals sold and installed be high efficient models by January 1, 2014.

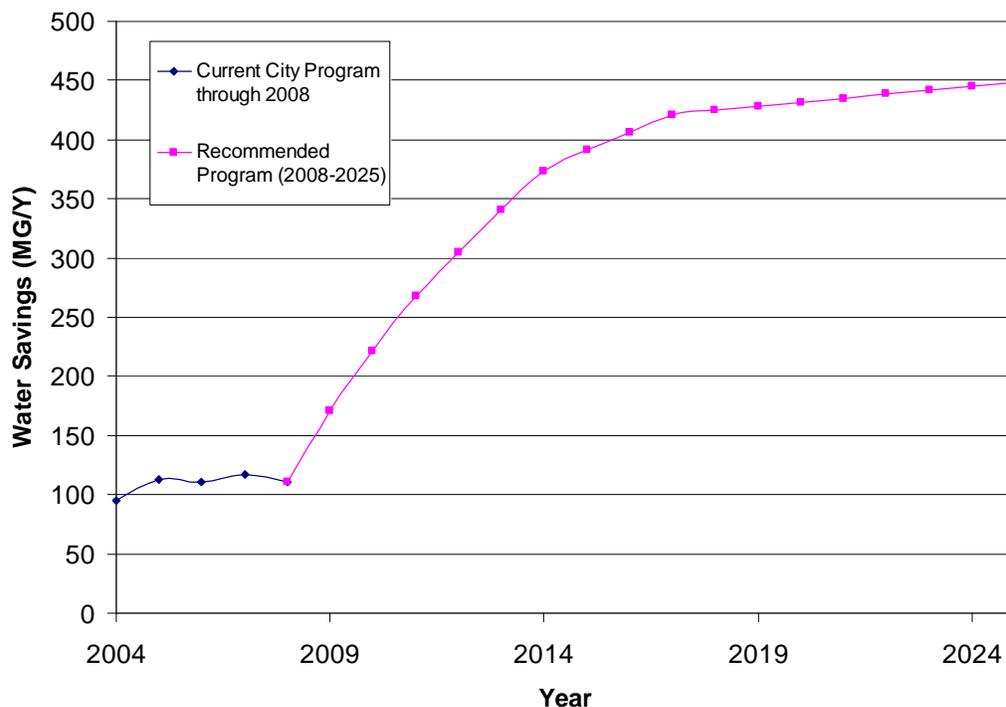
The DSS model output data for the recommended program indicates a total annual water savings of 448 MG/Year in Year 2025 and an Average Day Maximum Month (ADMM) reduction of 2.39 mgd in Year 2025. The information is presented in Table 1-7 and can be seen graphically in Figure 1-2.

**TABLE 1-7  
RECOMMENDED PROGRAM WATER SAVINGS**

Year	Annual Water Savings (MG/Year)			ADMM Reduction (mgd)
	Total	Indoor	Outdoor	
2008	111	45	66	0.57
2009	171	72	99	0.88
2010	222	93	129	1.14
2011	268	109	158	1.39
2012	304	121	184	1.59
2013	341	132	209	1.79
2014	374	140	234	1.98
2015	391	148	244	2.07
2016	406	150	256	2.16
2017	421	152	269	2.26
2018	425	153	272	2.28
2019	429	155	274	2.30
2020	432	157	275	2.31
2021	435	158	277	2.33
2022	438	160	278	2.34
2023	442	161	280	2.36
2024	445	163	282	2.38
2025 (Buildout)	448	164	284	2.39

As a result of incorporating AB 715, the amount of indoor water savings within the recommended water conservation program has decreased. The overall combined water savings from the effect of the updated plumbing code which incorporates AB715 and the recommended water conservation program results in a potable water offset that exceeds the established goal for this project of 495 MG/Year. The recommended water conservation program results in a water savings of 448 MG/Year. The increase in water savings from the building code is estimated to be 55.6 MG/Year. Therefore the total net water savings is 503.6 MG/Year.

**FIGURE 1-2  
WATER SAVINGS EACH YEAR FOR THE RECOMMENDED WATER CONSERVATION PROGRAM**



The recommended program’s costs were calculated using the DSS Model. Annual program costs as well as annualized 80 year present worth cost and annualized 80 year present worth cost per unit of water saved are included in Tables 1-8 and 1-9. These costs were calculated based on the cost to the City of Petaluma (Utility) only and cost to the utility plus development community. Recommended Water Conservation Program 80 Year Present Worth values are summarized in Table 1-8. Table 1-9 describes annual capital and operations costs for implementation of the nineteen water conservation measures under the recommended program for Years 2008 through Year 2025. All measures start in Year 2008 except measure P12 which starts in Year 2010. On an 80 year annualized present worth basis, the recommended water conservation program is more cost effective than any of the three preliminary programs evaluated (Table 1-3), more cost-effective than obtaining additional water for the City through City-owned groundwater wells (\$3,416/MG or \$1,113/acre-foot), and even more cost-effective than the current cost to purchase potable water from SCWA and distribute it to the City’s potable water customers (\$2,662/MG or \$870/acre-foot). Hence, water conservation is the most economical new water supply/offset source currently available to the City of Petaluma and the Development Community.

**TABLE 1-8  
RECOMMENDED WATER CONSERVATION PROGRAM 80 YEAR PRESENT WORTH COSTS**

Cost	Utility Cost	Utility + Development
80 Year Present Worth	\$7,126,129	\$24,895,880
Annualized 80 Year Present Worth	\$235,959	\$824,346
Annualized 80 Year Present Worth/Unit of Water Saved	\$612 / MG	\$2,137 / MG
	\$199 / acre-foot	\$696 / acre-foot

**TABLE 1-9  
RECOMMENDED WATER CONSERVATION PROGRAM ANNUAL COST**

Year	Utility Cost			Developer Cost	Utility + Developer Cost		
	Capital Cost	Operations Cost	Total Cost	Total Cost	Capital Cost	Operations Cost	Total Cost
2008	\$465,100	\$126,156	\$591,256	\$2,407,112	\$2,872,368	\$126,156	\$2,998,368
2009	\$461,291	\$126,924	\$588,216	\$2,203,652	\$2,664,943	\$126,924	\$2,791,868
2010	\$505,921	\$140,678	\$646,599	\$2,204,543	\$2,710,464	\$140,678	\$2,851,142
2011	\$460,500	\$127,895	\$588,395	\$2,031,253	\$2,491,753	\$127,895	\$2,619,648
2012	\$409,232	\$117,566	\$526,798	\$2,032,233	\$2,441,465	\$117,566	\$2,559,031
2013	\$463,499	\$131,780	\$595,280	\$2,033,214	\$2,496,714	\$131,780	\$2,628,494
2014	\$364,685	\$98,589	\$463,274	\$1,900,389	\$2,265,075	\$98,589	\$2,363,663
2015	\$368,722	\$100,130	\$468,853	\$1,901,373	\$2,270,096	\$100,130	\$2,370,226
2016	\$258,308	\$56,300	\$314,608	\$981,944	\$1,240,301	\$56,300	\$1,296,602
2017	\$259,071	\$56,504	\$315,575	\$982,365	\$1,241,436	\$56,504	\$1,297,940
2018	\$168,769	\$42,693	\$211,462	\$378,197	\$546,966	\$42,693	\$589,659
2019	\$119,468	\$30,393	\$149,862	\$378,197	\$497,665	\$30,393	\$528,059
2020	\$120,157	\$28,093	\$148,250	\$378,197	\$498,354	\$28,093	\$526,447
2021	\$123,596	\$28,634	\$152,230	\$412,025	\$535,621	\$28,634	\$564,255
2022	\$123,756	\$28,674	\$152,430	\$411,825	\$535,780	\$28,674	\$564,455
2023	\$121,193	\$28,034	\$149,227	\$412,023	\$533,216	\$28,034	\$561,250
2024	\$121,319	\$28,066	\$149,385	\$412,022	\$533,341	\$28,066	\$561,407
2025 (Buildout)	\$121,446	\$28,097	\$149,543	\$412,021	\$533,467	\$28,097	\$561,564

## Funding Mechanism

The recommended water conservation plan modifies the overall recommended water supply project outlined in the Water Demand and Supply Analysis Report dated June 2006. The modifications include increased water conservation, elimination of City-owned groundwater well supply, and incorporation of a contingency factor to ensure that potable water demands will be met. To meet the annual buildout shortfall amount of 772.72 MG/Year and the ADMM shortfall amount of 5.0 mgd as outlined in the Water Demand and Supply Analysis Report, both the recommended water conservation plan detailed herein, and the recycled water system developed within the Water Demand and Supply Analysis report, will need to be implemented. Combined, they are referred to as the recommended water supply project.

An update to the City's water utility capacity charge for new development was prepared based on the recommended water supply project. The charge incorporates the cost for additional potable water supply through recycled water and water conservation offset. The Water Capacity Charge Update was prepared by Bartle Wells Associates. The capacity charge defrays the capital costs of facilities to serve growth. The capacity charge includes a buy-in for the value of the City's existing facilities, a proportion of planned water capital improvements cost, and the cost for new water supply as described herein.

Bartle Wells Associates is currently developing an updated water capacity fee study that will address the improvements and projects outlined in this report as well as review current water, storm water, and wastewater charges. This report is scheduled to be submitted in February of 2008. This section will be updated after approval of the revised study.

## Implementation

The water conservation program developed is projected to save 448 MG/Year by Year 2025. This program is very aggressive and will require considerable effort by City staff to implement. Since the program must start in Year 2008 to achieve the water savings goal in Year 2025, the City should begin work immediately to get the required ordinances, development standards, and programs in place. Of the nineteen measures identified for implementation, five of the measures are directly related to new development and will require developers to utilize water efficient practices and install certain water efficient devices. A detailed implementation plan for each of the water conservation measures between Year 2008 and Year 2025 (Buildout) has been developed to aid the City to implement the program.

The City has obtained a copy of the DSS Model for in-house use. This model is a powerful tool and will serve as a great asset to the City throughout implementation of the program. The model should be updated annually with the actual implementation data for each measure to determine if the City is on track to meet the water savings goal. In addition, the model can be modified to determine how implementation rate adjustments and changes such as additions or deletions of measures will affect the final water savings outcome. The program developed under this study is meant to be an evolving program allowing the City to adjust implementation rates and/or measures over the life of the program to meet changing conditions and technology over the life of the 18-year plan to achieve the overall water savings goal.

In addition to the standard and proven implementation practices developed for the Water Conservation Plan, the City will work with Ned Orrett during the initial startup of the water

conservation program to develop a pilot test for one or more of the recommended off-site water conservation measures to explore an alternative implementation program. The program will seek to remove common barriers found in traditional water conservation programs associated with purchasing and installing proven, cost effective equipment. Under such a program, the City would incur setup costs for the program, but the overall program may be more cost effective and yield higher water savings than traditional implementation.

# **SECTION TWO**

## **INTRODUCTION**

## SECTION TWO INTRODUCTION

### Introduction

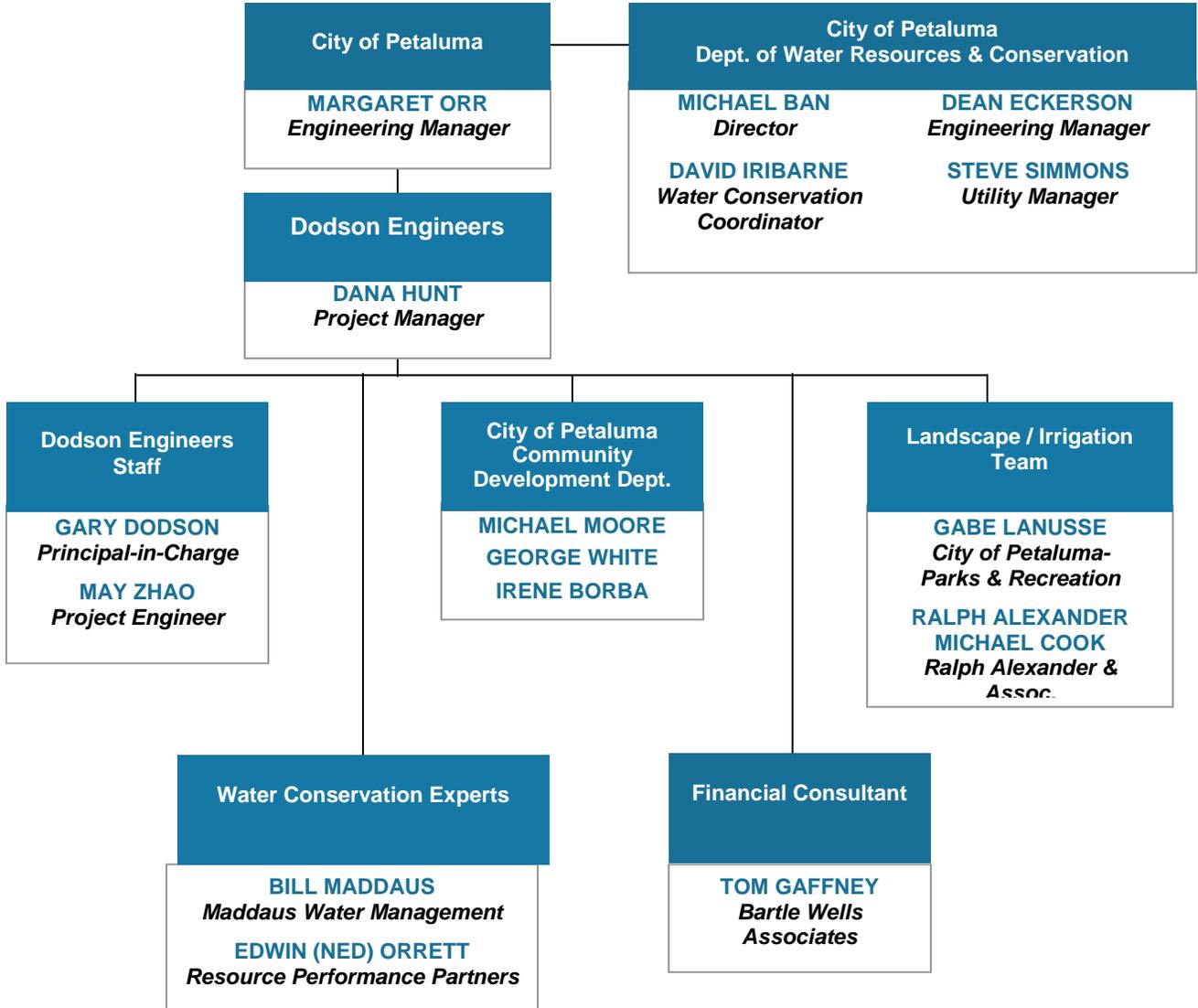
The City of Petaluma recently updated the City's General Plan through Buildout (Year 2025). As part of the General Plan 2025, a Water Resources Element was developed. Under the Water Resources Element, potable water demand projections for the City's new General Plan through buildout were required, as well as potable water supply requirements for each source to satisfy the projected demand. The Water Demand and Supply Analysis Project was undertaken by the City to determine the potable water demand and supply requirements to meet the new General Plan 2025.

Under the Water Resources Element of the General Plan, the City completed a Water System Master Plan, a Recycled Water Master Plan, and a Groundwater Master Plan. All of these documents were integrated along with water conservation efforts within the Water Demand and Supply Analysis to determine the least-cost, feasible program for the City of Petaluma to meet their potable water demands through buildout. The analysis explored potable water supply from the Sonoma County Water Agency (SCWA), groundwater from City wells, potable offset via recycled water, and water use reduction through conservation.

As a separate, but related study the City of Petaluma's City Council approved additional funding to develop a Water Conservation Plan. The intent of the study was to evaluate the most cost effective water conservation plan based on an 80 year present worth, comprised of water conservation measures that are feasible, cost effective, and implementable by the City.

To develop the Water Conservation Plan, the project team was hand selected based on their unique skills and expertise in the area of water conservation. The project team consists of City staff from the Department of Water Resources and Conservation, Department of Community Development, and Department of Parks and Lands; landscape and irrigation experts; water conservation experts; the Department of Water Resources and Conservation's financial consultant; and consultants with extensive knowledge of the City's water system and demand and supply needs. The project team is shown in Figure 2-1.

**FIGURE 2-1  
WATER CONSERVATION TEAM  
ORGANIZATIONAL CHART**



The methodology employed during the study included:

- ◆ Review of background documents available on water conservation as well as specific City documents and information.
- ◆ Review of other agencies' and cities' conservation programs and ordinances.
- ◆ Review City of Petaluma's potable water demand requirements through Buildout (2025), including existing and future water distribution among customer sectors.
- ◆ Brainstorming with project team to develop a list of potential "on-site" water conservation measures for various customer sectors to reduce indoor and outdoor potable water use for new development.
- ◆ Brainstorming with project team to develop a list of potential "off-site" water conservation measures for various customer sectors to reduce indoor and outdoor potable water use at existing customer sites.
- ◆ Brainstorming with project team to develop assumptions and evaluation criteria to be used in the evaluation of potential water conservation measures.
- ◆ Brainstorming with project team to determine the Water Conservation Plan goals.
- ◆ Brainstorming with project team to select on-site and off-site water conservation measures for further analysis based on evaluation criteria.
- ◆ Analysis of three water conservation programs of varying size which includes selected water conservation measures to determine water savings and cost for each program. Analysis to be performed utilizing the DSS Model by Maddaus Water Management.
- ◆ Brainstorming with project team to review the three water conservation programs evaluated and to select a water conservation program for implementation which meets the water conservation plan goals established.
- ◆ Analysis of selected Water Conservation Program utilizing the DSS Model by Maddaus Water Management to determine water savings and program costs.
- ◆ Establishment of the funding mechanism to recover City costs for water conservation efforts which reduce potable water demand and free up potable water supply for new development. A funding mechanism report will be prepared.
- ◆ Brainstorming with City and select project team members to discuss the implementation of the selected Water Conservation Program.

A summary of progress and project team discussion is found in **Appendix A: Meeting Agenda and Minutes**. Relevant handouts are also included to provide a background for each meeting.

## **Current Potable Water Supply**

The City of Petaluma currently receives its potable water supply from SCWA. The City of Petaluma is entitled to an average day max month (ADMM) rate of 21.8 mgd and 4,366.42 MG (13,400 acre-feet) per fiscal year as outlined under the 11<sup>th</sup> Amended Agreement for Water Supply. Commencing in September 2001, the Water Contractors and SCWA agreed to negotiate a new water supply agreement. This agreement is currently in the final phase of approval. The new water supply agreement entitled, "Restricted Agreement for Water Supply" will replace the existing 11<sup>th</sup> Amended Agreement. Under the Restricted Agreement, the City of Petaluma's delivery entitlement will not change.

Although the City of Petaluma's ADMM entitlement is 21.8 mgd, SCWA is currently unable to meet this entitlement. In December of 1999, SCWA declared the system temporarily impaired and in March 2001 the Memorandum of Understanding (MOU) Regarding Water Transmission System Capacity Allocation during Temporary Impairment was executed. This MOU allocated a lower ADMM limit to Petaluma. The original MOU expired on September 30, 2005. In February 2004, the preparation of the new MOU began. The new MOU allocates a total of 92 mgd of available supply to all contractors. The City of Petaluma's ADMM allotment is 17.1 mgd. The new temporary impairment MOU will expire on September 30, 2008.

For planning purposes for future potable water supply needs, the City assumed that the current annual entitlement from SCWA of 4,366.42 MG (13,400 acre-feet) per fiscal year, as outlined under the 11<sup>th</sup> Amended Agreement for Water Supply, will not change through buildout of the City's General Plan and that all potable water demand above this limit must be obtained from other sources. Similarly, the current SCWA ADMM allotment of 17.1 mgd as outlined in the MOU Regarding Water Transmission System Capacity Allocation during Temporary Impairment was assumed to remain constant through buildout of the City's General Plan 2025.

In addition to SCWA, the only potable water source currently available to the City is City-owned groundwater wells. Although these wells have been used in past years to supplement the SCWA supply during peak summer periods, the use of the wells for supply into the City's potable water system was discontinued due to customer complaints on the aesthetic quality of the water. The City wells are currently only used for irrigation of some City-owned parks and the airport. The City well capacity is reserved for emergency/backup supply.

The City assumed that the annual and ADMM allotments from SCWA will not increase during buildout of the General Plan, and that the difference between these allotments and the future potable water demand projections must be supplied by sources other than SCWA.

## **Water Conservation Program History**

In 1995, the SCWA commissioned a study of the cost-effectiveness of various water conservation measures that could be implemented by each water contractor. The study, entitled "Water and Wastewater Efficiency/Avoided Cost Study (September 1995)", determined the potential water savings, and economic costs and benefits of implementing Best Management Practices (BMPs) within the Agency's service area. This study led to the development of the "Water Conservation Plan" by the SCWA. The Water Conservation Plan designated, subject to annual budget appropriations, approximately \$1.5 million annually, for a ten-year period (commencing FY 1997-1998), to assist SCWA's water contractors in implementing cost-effective BMPs. The Water Conservation Plan is now funded through the 11<sup>th</sup> Amended Agreement for Water Supply.

The City of Petaluma's water conservation program began in 1999 and has focused primarily on implementation of the BMPs. The City's efforts currently have provided potable water savings of about 396 million gallons (1,216 acre-feet) from 1999 to the end of 2005. A portion of the funding for water conservation programs is provided in SCWA's operations and maintenance fund. The water conservation portion of this fund is approximately \$2 million annually (Petaluma's contribution to this fund is approximately \$330,000 annually). Of the \$2 million budgeted, approximately \$500,000 is expended for regional water conservation efforts by the Agency. The remaining \$1.5 million is designated to assist the water contractors in implementing their own water conservation programs. Petaluma's total entitlement to this fund, over a 10-year period, is \$2,780,083. This provides an

annual amount of \$278,000. These funds are identified in Petaluma's portion of the SCWA's Water Conservation Plan with the goal to reduce water demands on the transmission system.

Through SCWA, Petaluma's water conservation program has focused on improving the water use efficiency of the City's customers primarily through implementation of the California Urban Water Conservation Council's (CUWCC) Best Management Practices (BMPs). The City is a member of the CUWCC which was created to assist in increasing water conservation statewide under a Memorandum of Understanding (MOU). As signatory to the MOU, the City has pledged its good faith effort towards implementing BMPs identified in the CUWCC MOU. The City signed the CUWCC MOU on January 31, 2002, and submits annual BMP reports to the CUWCC in accordance with the MOU. The MOU requires that a water utility implement only the BMPs that are economically feasible. If a BMP is not economically feasible, the utility may request an economic exemption for the BMP. The Council's goal is to integrate urban water conservation Best Management Practices into the planning and management of California's water resources. The water conservation savings through June 2005 was estimated at 63 million gallons per year, which is equivalent to the amount of water used by approximately 544 single family households annually. The City's water conservation efforts under the CUWCC MOU are included in **Appendix B: City of Petaluma- CUWCC BMP Progress**.

In conjunction with the development of the Water Conservation Plan, the City will update the current landscape standards that are inconsistently enforced. Additionally the landscape standards will be updated to reflect current technology and practices that have successfully conserved water for similar water agencies and BMPs recommended by the CUWCC. The City's draft update to the landscaping standard, the existing landscape standard, and the Water Waste Ordinance is included in **Appendix C: Landscape Standards Update**.

Some of the programs' accomplishments within Petaluma through December 2005 included:

- ◆ Conducted 977 single-family residential water audits.
- ◆ Conducted 119 multi-family residential water audits.
- ◆ Developed 320 large landscape water budgets and communicated findings with owners. Offered follow-up survey and assistance.
- ◆ Replaced 1,208 high flow, non-residential toilets with ultra-low flush toilets (ULFT).
- ◆ Rebated 3519 ULFTs
- ◆ Rebated 119 High Efficiency Toilets (HET's)
- ◆ Installed 73 residential Smart irrigation controllers
- ◆ Installed 19 Smart controllers at select city facilities
- ◆ Implemented water waste ordinance.
- ◆ Replaced 2,544 high flow residential washing machines with water conserving models.
- ◆ Conducted waterless urinal pilot project and installed 22 waterless urinals at various public locations.
- ◆ Installed an additional 85 waterless urinals at Petaluma City schools.

- ◆ Conducted 9 audits in the commercial, institutional and industrial setting and obtained over 16 million gallons per year of potable water offset from implementation of various water saving devices and design changes.
- ◆ Completed large landscape water audits of various City parks.
- ◆ Designed and constructed a water efficient demonstration landscape for City Hall.
- ◆ Coordinated landscape water budget seminars for City staff and local landscape professionals, calculated landscape water budgets for 320 irrigation only users and communicated findings annually.
- ◆ Installed 105 prerinse spray valves in City restaurants.
- ◆ Coordinated restaurant water and energy savings seminars for City staff and local restaurant operators.
- ◆ Continued water conservation public outreach program, including water conservation messages on local buses, newspaper ads (including irrigation recommendations), presentations at various public events and community groups and information on City web page.

Petaluma's water conservation program provides a steady amount of water savings. Future additional savings provided by the program will start to diminish as the program reaches saturation (for example, nearly all of the restaurants in Petaluma have been retrofitted with new spray rinse nozzles). The Petaluma City Council wishes to continue the efforts of water conservation within the City of Petaluma to achieve further water conservation savings by implementing the next level of water conservation measures. All water conservation efforts to date have been factored into the work on water demand and supply.

## **Water Demand and Supply Analysis**

Under the Water Demand and Supply Analysis Project, potable water demands were projected in five year increments through buildout of the City's General Plan 2025. A water supply analysis was then conducted to determine the least-cost feasible program for the City to meet the forecasted demands. The Water Demand and Supply Analysis was conducted by Dodson Engineers, and the final report is dated June 2006.

### **Potable Water Demand Projection Analysis**

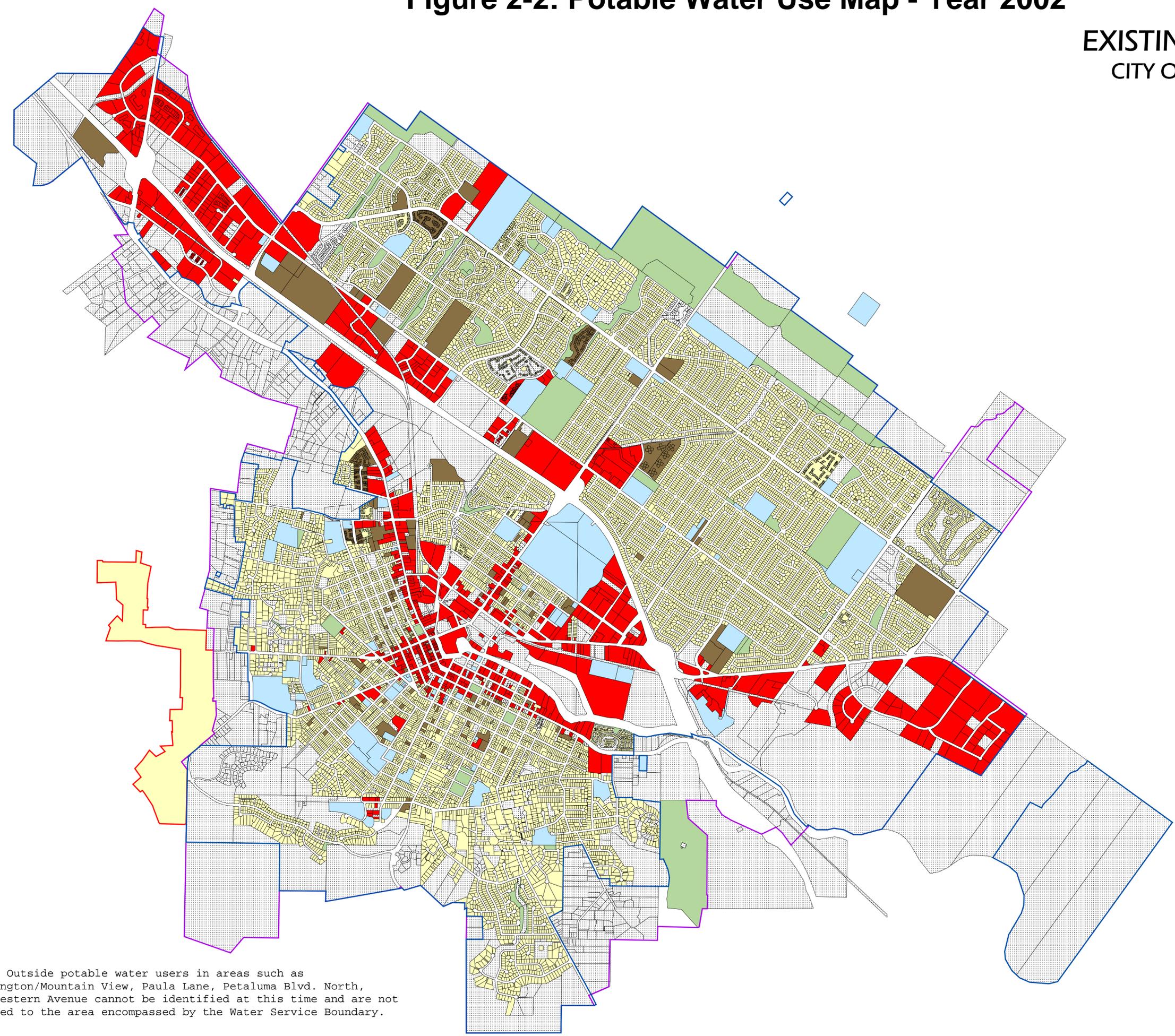
The City of Petaluma's potable water demand projections were developed based on buildout land uses developed for the General Plan update in conjunction with historic potable water use within the City. Since buildout potable water demand for the City of Petaluma was based on buildout land use conditions within the City, it was essential to determine how potable water is currently used within the City of Petaluma in relation to land use. A Base Year of 2002 was used for the analysis since both existing land uses within the City and potable water billing data by customer sector were available for that year.

A Year 2002 potable water use map was developed from the Year 2002 existing land use map. The Year 2002 potable water use map is shown in Figure 2-2. The land uses in Figure 2-2 are divided into the following categories to correspond with the General Plan land use designations.

- ◆ Single-Family (SF)
- ◆ Multi-Family (MF)

**Figure 2-2: Potable Water Use Map - Year 2002**

**EXISTING WATER USERS EXHIBIT  
CITY OF PETALUMA, BASE YEAR 2002**



**EXISTING WATER USERS**

- Single-Family Dwelling
- Multi-Family Dwelling
- Commercial/Industrial/Office
- Parks/Open Space/Other Irrigated Land
- Institution
- No Potable Water Service

**BOUNDARIES**

- City Limit
- Urban Growth Boundary
- Water Service Boundary

**DISCLAIMER**  
 These maps or plans were compiled and or digitized via electronic means utilizing many source documents. It is intended to be representative of certain physical, legal and geometric features within the City of Petaluma, CA and its environs. The existence or location of facilities must be field verified and does not constitute adequate capacity nor the availability of service. The City of Petaluma assumes no responsibility regarding the accuracy of the information presented herein for legal documentation, representations of actual construction or for any other purpose for which this map was not intended.



Department of General Plan Administration  
 27 Howard Street  
 Petaluma, CA 94952  
 (707) 778-4552  
 generalplan@ci.petaluma.ca.us

REVISION DATE: February 14, 2005

Note: Outside potable water users in areas such as Purrington/Mountain View, Paula Lane, Petaluma Blvd. North, and Western Avenue cannot be identified at this time and are not limited to the area encompassed by the Water Service Boundary.

- ◆ Commercial/Industrial/Office (CIO)
- ◆ Institution (INST)
- ◆ Parks/Open Space/Other Irrigated Land (TURF)

The Year 2002 land use data for potable water users was used in conjunction with the actual water demands from Year 2002 billing data to develop water use factors for each land use category. These factors were then applied to the land use changes which are expected to occur between Year 2002 and buildout based on the General Plan 2025.

As part of the General Plan 2025, a land use map for the City of Petaluma was developed to depict buildout land use in Year 2025. As with the land use map for Year 2002, this map was converted to a Year 2025 potable water use map indicating all potable water customers inside and outside the Urban Growth Boundary which will receive potable water. The Year 2025 (Buildout) Potable Water Use Map is shown in Figure 2-3. In addition to the Buildout (Year 2025) potable water land use map, the City of Petaluma’s Department of General Plan Administration, also developed maps that depict land use area changes in increments or tiers between the Base Year 2002 and Buildout (Year 2025) so water demands could be projected in five year time periods to reflect anticipated development rather than projecting linear water demand increases. Eight tier maps and their associated land use data were developed showing land use changes and new development in phases between Year 2002 and buildout. Each tier represents projects within different stages of development. The definition of each tier is listed below.

- ◆ Tier 1: Projects under construction or completed since base year (June 2002).
- ◆ Tier 2: Approved projects/subdivisions not yet under construction (as of June 2005).
- ◆ Tier 3: Projects currently in the formal review process (as of June 2005).
- ◆ Tier 4: Anticipated project, not active application (as of June 2005).
- ◆ Tier 5: Vacant lands, not including those contained in Tiers 1-4 above, potential based on 1987 General Plan.
- ◆ Tier 6: Underutilized land based on 1987 General Plan, additional potential based on Draft 2025 General Plan.
- ◆ Tier 7: Underutilized land based on Draft 2025 General Plan, additional potential based on Draft 2025 General Plan.
- ◆ Tier 8: Anticipated additional residential parcels mostly existing and in the County, expected to receive City water by 2025.

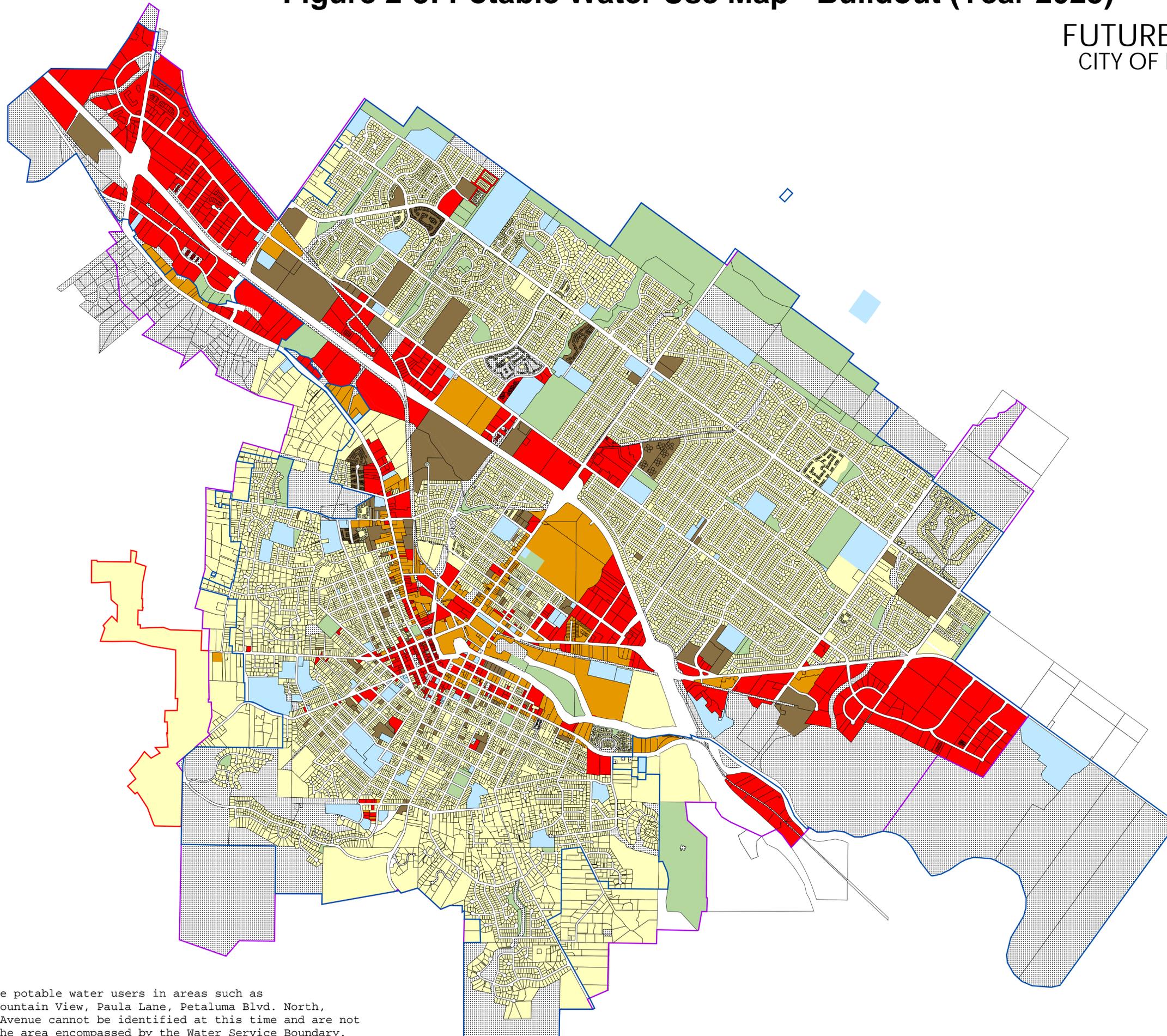
Development in each tier is expected to occur over a number of years. The City of Petaluma’s Department of General Plan Administration evaluated each tier and provided formulas to determine within which time period the development was expected to occur so water demand projections could be determined for each five year period between the Base Year 2002 and Buildout (Year 2025), as shown in Table 2-1.

**TABLE 2-1**  
**TIMELINE FOR TIER DEVELOPMENT**

Time Period	Associated Tier Development
2002-2005	= Tier 1
2005-2010	= Tier 2 + 50% of Tier 3 + 50% of Tier 4 + 25% of Tier 5

# Figure 2-3: Potable Water Use Map - Buildout (Year 2025)

## FUTURE WATER USERS EXHIBIT CITY OF PETALUMA, BUILDOUT 2025



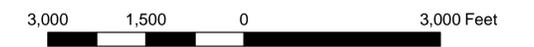
### FUTURE WATER USERS

- Single-Family Dwelling
- Multi-Family Dwelling
- Mixed Use
- Commercial/Industrial/Office
- Parks/Open Space/Other Irrigated Land
- Institution
- No Potable Water Service

### BOUNDARIES

- City Limit
- Urban Growth Boundary
- Water Service Boundary

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Note: Outside potable water users in areas such as Purrington/Mountain View, Paula Lane, Petaluma Blvd. North, and Western Avenue cannot be identified at this time and are not limited to the area encompassed by the Water Service Boundary.

2010-2015	= 50% of Tier 3 + 50% of Tier 4 + 50% of Tier 5 + 25% of Tier 6
2015-2020	= 25% of Tier 5 + 50% of Tier 6
2020-2025	= 25% of Tier 6 + Tier 7 + Tier 8

Water demand projections for future potable water land uses were calculated for each tier utilizing the data for each tier and the water use factors developed for each land use category.

Tiers 1 through 8 represent all development and land use changes per the General Plan's land use update adjusted for potable water customers through Buildout (Year 2025). Additional potable water demands were identified in addition to the development indicated on the potable water use map (Figure 2-3). These additional potable water demands include Tier 9 uses, additional water required for expansion of the Coast Guard facility located outside the Urban Growth Boundary (UGB), and additional potable water requirements for the City's new Ellis Creek Water Recycling Facility (WRF) scheduled to be operational in Year 2009. Tier 9 represents the potable water requirement to serve approximately 300 additional acres outside the UGB which has been indicated as a potential demand between 2018 and 2025 after the next General Plan Update. Table 2-2 outlines the total expected annual demand for additional potable water through buildout.

**TABLE 2-2  
TOTAL ADDITIONAL POTABLE WATER DEMAND BY SOURCE THROUGH BUILDOUT**

Water Demand Source	Buildout Annual Water Demand (MG/Year)
Tiers 1-8	1,259.94
Tier 9	161.54
Coast Guard Expansion (CG)	21.90
Water Recycling Facility (WRF)	63.60
<b>Total</b>	<b>1,506.98</b>

The total additional potable water demand expected within each five year period between 2002 and buildout is shown in Table 2-3.

**TABLE 2-3  
ADDITIONAL POTABLE WATER DEMAND AND TIMELINE**

Time Period	Additional Water Demand (MG/Year)	Time Period Formula
2002-2005	164.16	Tier 1
2005-2010	514.01	Tier 2 + ½ Tier 3 + ½ Tier 4 + ¼ Tier 5 + WRF + CG
2010-2015	373.21	½ Tier 3 + ½ Tier 4 + ½ Tier 5 + ¼ Tier 6
2015-2020	199.47	¼ Tier 5 + ½ Tier 6 + 28.6% Tier 9
2020-2025	256.14	¼ Tier 6 + Tier 7 + Tier 8 + 71.4% Tier 9
<b>Total</b>	<b>1506.98</b>	

The additional potable water demand outlined in Table 2-3 was adjusted to account for lost water and the effect of the plumbing code prior to calculating the total potable water demand projections. These adjustments are shown in Table 2-4 as well as the total annual potable water demand projections in five year periods. The lost water used in Table 2-4 of 223.47 MG/Year for Year 2002 is actual, and the 30 year historic average for lost water of 8 percent was used to adjust future water demands. The plumbing code will reduce overall future water demands. The water reduction

expected as a result of the plumbing code was obtained from the data used by SCWA to calculate demands for their 2005 Urban Water Management Plan.

**TABLE 2-4**  
**ANNUAL POTABLE WATER DEMAND PROJECTIONS**

Time Period	Additional Potable Water Demand (MG/Year)	Non-Adjusted Total Annual Water Demand (MG/Year)	Total Lost Water (MG/Year)	Total Plumbing Code Effect (MG/Year)	Total Annual Water Demand (MG/Year)
<b>Base Year (2002)</b>		3,399.72 (Actual)	223.47 (Actual)	N/A	<b>3,623.19 (Actual)</b>
<b>2002-2005</b>	164.16	3,563.88	285.11	-3.65	<b>3,845.34</b>
<b>2005-2010</b>	514.01	4,077.89	326.23	-40.15	<b>4,363.97</b>
<b>2010-2015</b>	373.21	4,451.10	356.09	-83.95	<b>4,723.23</b>
<b>2015-2020</b>	199.47	4,650.56	372.04	-124.10	<b>4,898.51</b>
<b>2020-2025</b>	256.14	4,906.70	392.54	-160.60	<b>5,138.64</b>

The total annual potable water demand projections shown in Table 2-4 are consistent with the projections made by SCWA for the City of Petaluma during preparation of their 2005 Urban Water Management Plan.

In addition to the total annual potable water demand projections, average day demand, maximum day demand, maximum month demand, and average day max month (ADMM) demand projections were calculated based on historic factors (Table 2-5). These are essential to the proper operation of the City’s potable water system.

**TABLE 2-5**  
**WATER DEMAND FACTORS**

Average Day Demand	= Annual Demand / 365 Days
Maximum Day Demand	= 1.84 * Average Day Demand
Maximum Month Demand	= 1.55 * Average Month Demand
ADMM Demand	= 1.57 * Average Day Demand

Potable water demand projections for total annual water demand, average day demand, maximum day demand, maximum month demand, and ADMM demand are outlined in Table 2-6. The actual demands for Year 2002 are presented in the table and demand for Years 2005, 2010, 2015, 2020 and Buildout (2025) have been calculated using the total annual water demand projections from Table 2-4 and demand factors outlined in Table 2-5.

**TABLE 2-6  
POTABLE WATER DEMAND PROJECTIONS**

Year	Total Annual Water Demand (MG/Year)	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Maximum Month Demand (MG/Month)	ADMM Demand (mgd)
2002 <sup>1</sup>	3,623.19	9.93	17.94	464.96	15.5
2005	3,845.34	10.54	19.38	496.69	16.54
2010	4,363.97	11.96	22.00	563.68	18.77
2015	4,723.23	12.94	23.81	610.08	20.32
2020	4,898.51	13.42	24.69	632.72	21.07
2025 (Buildout)	5,138.64	14.08	25.90	663.74	22.10

<sup>1</sup>Actual Demands from Billing Records  
 MG = Million Gallons  
 mgd = million gallons per day

### Potable Water Supply Analysis

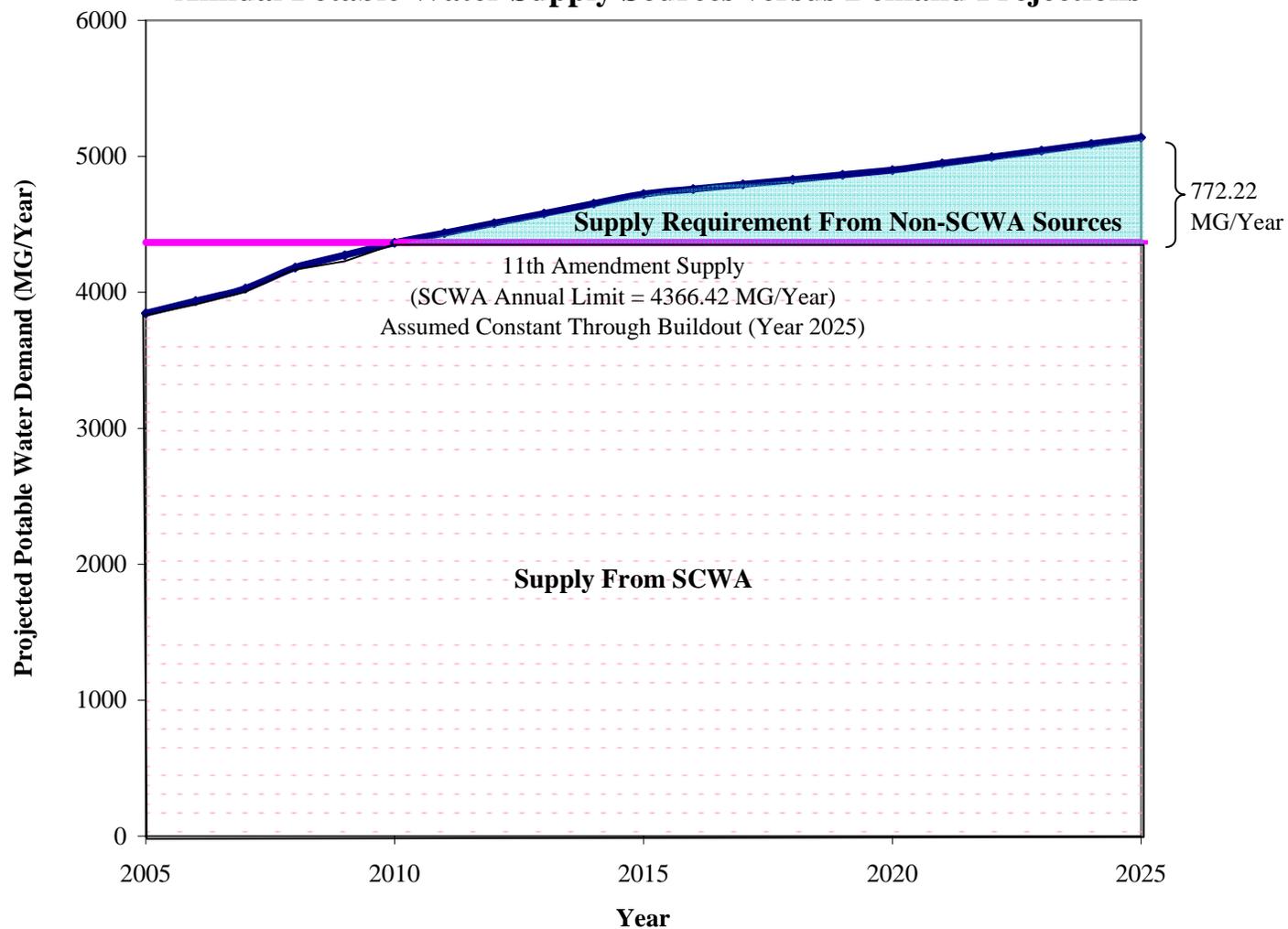
The potable water supply analysis within the Water Demand and Supply Analysis quantified the additional water supply needs for the City of Petaluma to meet the potable water demand projections and developed a least-cost, phased program to meet those needs. Water supply sources included both potable water supply and offset sources. These sources included SCWA water, recycled water, water conservation, and groundwater.

For planning purposes for future potable water supply needs, the City assumed that the current annual entitlement from SCWA of 4,366.42 MG (13,400 acre-feet) per fiscal year, as outlined under the 11<sup>th</sup> Amended Agreement for Water Supply, would not change through buildout of the City's General Plan and that all potable water demand above this limit would be obtained from other sources. Similarly, the current SCWA ADMM allotment of 17.1 mgd as outlined in the MOU Regarding Water Transmission System Capacity Allocation during Temporary Impairment was assumed to remain constant through buildout of the City's General Plan 2025.

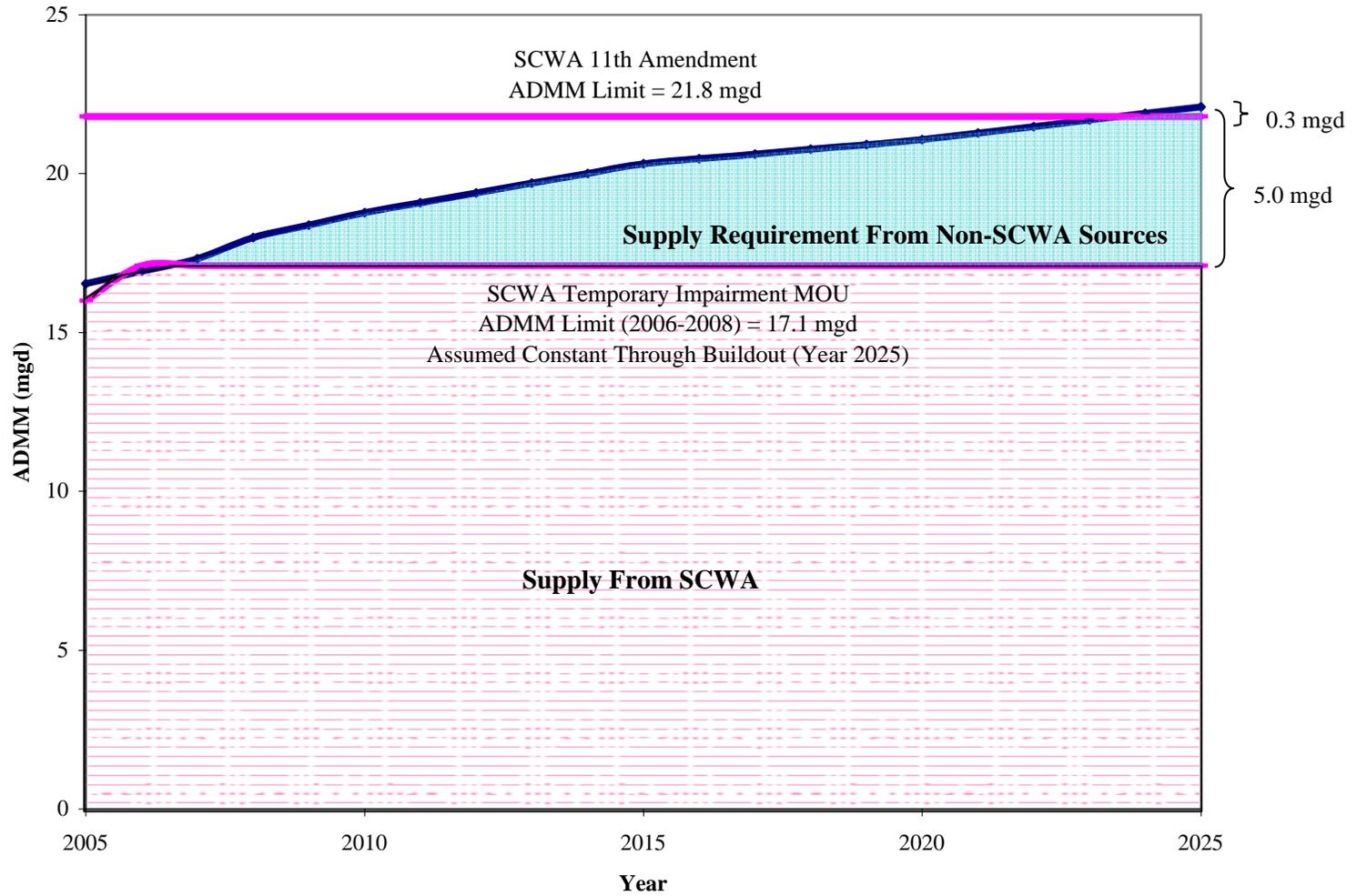
In addition to SCWA, the only potable water source currently available to the City is City-owned groundwater wells. Although these wells have been used in past years to supplement the SCWA supply during peak summer periods, the use of the wells for supply into the City's potable water system was discontinued due to customer complaints on the aesthetic quality of the water. The City wells are currently only used for irrigation of some City-owned parks and the airport. The City well capacity is reserved for emergency/backup supply.

Based on the assumption that the annual and ADMM allotments from SCWA will not increase during buildout of the General Plan, the difference between these allotments and the future potable water demand projections must be supplied by sources other than SCWA. The amount of water required from other sources is shown in Figures 2-4 and 2-5.

**Figure 2-4**  
**City of Petaluma**  
**Annual Potable Water Supply Sources versus Demand Projections**



**Figure 2-5**  
**City of Petaluma: Average Day Max Month (ADMM) Potable Water Supply Sources**  
**versus Demand Projections**



The total annual additional potable water supply required at Buildout (Year 2025) is 772.2 MG/Year. Although additional supply/offset source(s) are not required until Year 2011 to meet annual water demand projections, additional source(s) will be required in Year 2007 to meet expected ADMM demands. The total additional ADMM supply required at Buildout (Year 2025) is 5.0 mgd assuming that the current Temporary Impairment MOU limit of 17.1 mgd is not increased. If the limit is increased by SCWA to the 11<sup>th</sup> Amendment's ADMM allotment of 21.8 mgd a supply requirement of only 0.3 mgd would be required at buildout and the SCWA limit would not be exceeded until Year 2024. For purposes for City planning of future supply, the ADMM limit of 17.1 mgd was assumed to remain in place through buildout.

### Water Supply/Offset Sources

The Water Demand and Supply Analysis Project included evaluation of recycled water, water conservation, and groundwater sources to meet the additional potable water needs of the City of Petaluma through buildout.

#### Recycled Water

Recycled water was evaluated as a potential supply source to meet the demand requirements through buildout of the General Plan. Although technically an offset source, recycled water can be utilized at locations that currently utilize potable water or at future locations allocated to receive potable water to allow the potable water to be used at other locations.

#### *Background*

Currently the City of Petaluma operates a disinfected secondary recycled water system which serves agricultural customers, a vineyard customer, and a portion of the Adobe Creek Golf Course. None of these current customers are considered potable offset customers since they would not utilize potable water in the absence of recycled water. The City's current disinfected secondary recycled water has numerous restrictions on its use as dictated by the California Department of Health Services (DHS) and is not suitable for most urban uses such as irrigation of parks and schools.

The City is currently in the construction phase of the new Ellis Creek Water Recycling Facility (WRF) that will produce tertiary recycled water meeting the requirements of Title 22 for unrestricted use. The tertiary recycled water will be suitable for irrigation of urban turf areas and for some industrial uses.

The City's WRF is scheduled to become operational in Year 2009 and will have an initial tertiary recycled water capacity of 5.2 mgd (maximum day) with provisions for expansion to double the tertiary system capacity. During the design phase of the WRF, the City undertook a master planning project to identify a phased program to further implement the use of recycled water throughout the City of Petaluma and Southern Sonoma County through buildout. The goal of the master plan was to determine the least-costly, most reliable phased program to distribute all effluent from the City's new WRF during the period of restricted discharge into the Petaluma River.

The City is restricted from discharging wastewater effluent into the Petaluma River between May 1<sup>st</sup> and October 20<sup>th</sup> based on its NPDES permit with the San Francisco Bay Area Regional Water Quality Control Board. Although the focus of the master plan was for cost effective disposal of the WRF's effluent during this restricted discharge period, a goal for offset of potable water demand was included.

The recycled water master plan identified a recommended recycled water program consisting of both a secondary and tertiary recycled water system. The recommendation of the recycled water master plan was consistent with the goals of that project and provided for a potable offset of 204 MG/Year by tertiary recycled water. The majority of this offset, namely 138.34 MG/Year, was attributed to serving the 18-hole Rooster Run Golf Course with recycled water. The Phase I, 20-inch diameter ductile iron backbone pipeline serving the master plan's recommended tertiary system area was constructed in Year 2004. The pipeline runs between the Browns Lane/Ely Road intersection and Rooster Run Golf Course. The pipeline was connected to the existing secondary recycled water system so it could be used to irrigate the Rooster Run Golf Course with secondary recycled water prior to when tertiary water will become available in Year 2009. Rooster Run Golf Course began receiving secondary recycled water in Year 2006 for irrigation. Rooster Run Golf Course is the only potable offset customer identified that does not require tertiary quality recycled water. All other potential recycled water customers must wait until tertiary recycled water is available in Year 2009. Rooster Run Golf Course was included in the potable water demand projections since it was a potable water customer in Base Year 2002.

#### *Water Supply/Offset Analysis*

Under the Water Demand and Supply Analysis project, the focus of recycled water use was redefined from identification of the least-cost project to dispose of wastewater effluent during the period of restricted release into the Petaluma River to a concentrated effort to maximize potable offset through the use of recycled water. The same methodology used in the Recycled Water Master Plan was applied, but only existing recycled water customers and current or future potable water customers were included in the analysis. Only the tertiary recycled water system was analyzed under this work since none of the secondary recycled water system customers utilize potable water.

For analysis of the tertiary recycled water system, all customers were grouped together into areas based upon their physical location in the tertiary recycled water system. Each potential tertiary customer was grouped into one of six groups or model areas. Model areas identified for the tertiary recycled water system were combined to develop recycled water system scenarios for modeling and analysis. All tertiary scenarios included Model Area A, due to its inclusion of the existing Phase 1 recycled water pipeline project, which is essential for transporting tertiary recycled water from the WRF to the City limits. The basis of design for the WRF, currently under construction, was to initially design the facilities for a maximum day demand of 5.2 mgd (max day) with the provision for future expansion. This means that only a maximum day demand of 5.2 mgd of tertiary water can initially be produced. Based on scenarios developed, all scenarios except Scenario A exceeded a maximum day demand of 5.2 mgd and would require expansion of the WRF's tertiary facilities.

All scenarios developed for the tertiary recycled water system were modeled using MWH Soft Inc. H<sub>2</sub>OMAP Water software. A 24-hour simulation was run for each scenario using maximum day and average day demands. The model output results were confirmed for conformance with the general requirements, design requirements, and cost evaluation criteria that were developed during preparation of the Recycled Water Master Plan. Evaluation of the tertiary system scenarios included modeling and cost estimating for all scenarios.

The 80 year present worth cost and annualized present worth costs were developed for the five potable offset tertiary recycled water scenarios evaluated.

For comparison of recycled water as a potable offset source to other potable supply and offset sources, additional analysis was required due to the recommended project outlined in the Recycled

Water Master Plan for the least-cost wastewater effluent disposal project. Since a recycled water program consisting of both a tertiary and secondary recycled water system was recommended for the least-cost wastewater disposal project in the Recycled Water Master Plan, only the recycled water program costs that exceed the disposal program's cost were attributed to new water supply for comparison to other potable supply/offset sources. The results of this analysis are included in Table 2-7. These results were used for comparison to other potable supply/offset alternatives.

**TABLE 2-7**  
**COST OF POTABLE OFFSET VIA RECYCLED WATER**

Recycled Water Scenario	Total Annual Potable Offset (MG/Year)	ADMM Potable Offset (mgd)	\$/Acre-foot of Potable Offset	\$/MG of Potable Offset
A	218.74	1.517	\$13,216 <sup>1</sup>	\$40,548 <sup>1</sup>
A + C	339.74	2.577	\$801	\$2,458
A + E + G	343.24	2.509	\$1,864	\$5,717
A + C + E + G	464.24	3.569	\$1,125	\$3,462
ALL (A + C + D + E + F + G)	480.09	3.709	\$1,176	\$3,609

<sup>1</sup> The cost for Scenario A is artificially high due to the small incremental increase in potable water provided above the least cost project identified in the Recycled Water Master Plan. See Appendix L of the Water Demand and Supply Analysis Report for additional information.

### Water Conservation

Water conservation was evaluated as a potential supply source to meet the projected potable water demand for buildout of the General Plan. Although technically an offset source, water conservation measures reduce current and future potable water demands within the City to lower the potable water supply requirements. All prior water conservation work was accounted for within the analysis to ensure that all potable water reductions due to prior efforts were captured.

#### *Background*

The City of Petaluma's water conservation program began in 1999 and has focused primarily on implementation of the BMPs. The City's efforts currently provide potable water savings of about 77 million gallons (236 acre-feet) per year.

#### *Water Supply/Offset Analysis*

Under the Water Demand and Supply Analysis Project, a next tier of water conservation measures was developed for evaluation as an offset source for potable water use. The water conservation analysis work was performed by Bill Maddaus of Maddaus Water Management as a subconsultant to Dodson Engineers. Three distinct water conservation programs were developed, namely, Program A, B, and C. Each program included more water conservation measures than the previous program. A description of the conservation measures contained in each program is included in Table 2-8. For comparison of the water conservation programs to each other and to other water supply/offset sources, each program was developed in sufficient detail to determine its associated annual potable water savings, ADMM water savings, and 80 year present worth cost. Unlike other potable water supply and offset sources, water conservation programs are phased for implementation over numerous years and in many cases, water savings require time to develop. In addition to analyzing each program, each program consists of two differing levels of implementation of recycled water, since water conservation measures will not conserve potable water on sites that utilize recycled water. Water savings and program costs per unit of water conserved are shown in Table 2-9.

**TABLE 2-8**

**WATER CONSERVATION PROGRAMS AND ASSOCIATED CONSERVATION MEASURES**

Description of Conservation Activity	Corresponding Measure Number	Program A	Program B	Program C
Residential Water Surveys - Indoor	1	X	X	X
Residential Water Surveys - Outdoor	2	X	X	X
Residential Retrofit	3	X	X	X
Water Budgets	4	X	X	X
Large Landscape Conservation Audits	5	X	X	X
Clothes Washer Rebate	6	X	X	X
Public Information Program	7	X	X	X
Commercial Water Audits	8	X	X	X
Single Family Residential ULF Toilet Rebate	9	X	X	X
Multifamily Residential ULF Toilet Rebate	10	X	X	X
Hot Water Systems	11		X	X
Direct Install of HETs	12			X
Rain Sensor Giveaway	13		X	X
Landscape Training for RSF	14		X	X
ET Controller Rebate	15		X	X
Increase Enforcement of Landscape Requirements	16		X	X
Commercial Urinal Rebate	17			X
<b>TOTAL NUMBER OF MEASURES</b>		<b>10</b>	<b>15</b>	<b>17</b>

**TABLE 2-9**

**COST OF POTABLE OFFSET VIA WATER CONSERVATION**

Conservation Program	Long Term Sustainable Potable Water Offset (MG/Year)	Indoor Potable Water Offset (MG/Year) <sup>3</sup>	Outdoor Potable Water Offset (MG/Year) <sup>4</sup>	Long Term Sustainable ADMM Potable Water Offset (mgd)	80 Year Present Worth Cost (\$)	80 Year Present Worth Annualized Cost (\$/Year)	Cost Annualized 80 Year PW (\$/acre-ft per Year)	Cost Annualized 80 Year PW (\$/MG per Year)
A <sup>1</sup>	106.4	35.1	71.3	0.58	\$2,921,778	\$96,745	\$300	\$921
B <sup>1</sup>	240.3	64.5	175.8	1.38	\$4,698,728	\$155,583	\$226	\$695
C <sup>1</sup>	281.8	106.0	175.8	1.49	\$9,178,232	\$303,907	\$376	\$1,153
A <sup>2</sup>	97.8	33.9	63.9	0.53	\$2,921,778	\$96,745	\$326	\$1,002
B <sup>2</sup>	224.7	63.2	161.5	1.27	\$4,693,835	\$155,421	\$242	\$743
C <sup>2</sup>	266.3	104.8	161.5	1.39	\$9,173,339	\$303,745	\$397	\$1,220

<sup>1</sup> Assumes recycled water used in Areas A and C.

<sup>2</sup> Assumes recycled water used in Areas A, C, E, and G.

<sup>3</sup> 1 MG/Year annual indoor reduction = .002843 mgd ADMM reduction

<sup>4</sup> 1 MG/Year annual outdoor reduction = .00678 mgd ADMM reduction

**Groundwater**

Groundwater was evaluated during the Water Demand and Supply Analysis Project as a potential water supply source. The evaluation included potential use of the City’s existing groundwater wells as well as future additional City wells.

*Background*

During preparation of the City’s Water Resources Element for the General Plan 2025, West Yost & Associates was retained by the City of Petaluma to develop a Groundwater Master Plan. Dodson

Engineers utilized the work prepared by West Yost & Associates within their Technical Memorandum No. 5 as well as coordinating with them during work on the groundwater portion of the Water Demand and Supply Analysis project. The City of Petaluma currently has seventeen (17) groundwater wells. Twelve (12) of the wells are permitted by the California DHS while the other five are not permitted. The five non-permitted wells and one of the permitted wells are inactive. These wells have low yields and water quality issues. The wells are predominately on the east side of the City because the City has experienced better water quality in these areas. Well depths range from 229 to 680 feet, with most wells being around 500 feet deep.

The City’s policy has been to design wells with a short-term (2-3 days) maximum capacity independent of drawdown to enable their use for standby, emergency, peak hour, or maximum use day. Due to aesthetic issues such as bitter taste, discolored water, iron staining, low chlorine residuals, and odor when using the existing wells, the City has limited their use and utilized SCWA water for potable water demands. City wells have been used when required to meet peak summer demands to avoid exceeding SCWA’s ADMM limit in past years, but the preference is to reserve the City wells for emergency use only.

Based on findings by West Yost & Associates the annual groundwater limit for the City of Petaluma is estimated between 2,000 to 3,000 acre-ft/year (652 to 973.2 MG/Year). This is the maximum developable groundwater production rate given known potential risks associated with excessive drawdown. This figure is hard to determine due to limitations of data and lack of criteria for assessing the potential impacts of groundwater production. In the past, production has ranged from 400 to 1,000 acre-ft/year. The limit provided by West Yost & Associates was used for the analysis.

*Water Supply Analysis*

Dodson Engineers worked closely with West Yost & Associates to determine groundwater capacity utilizing existing and future City wells, treatment requirements to achieve water quality, and present worth costs for comparison of groundwater alternatives to other potable water supply/offset sources. Groundwater scenarios evaluated included use of the City’s existing wells, existing wells plus four additional wells, and existing wells plus twelve additional wells. Each new well was assumed to provide an average daily four month summer capacity of 0.25 mgd. Expected reliable four month summer capacity as well as annual capacity is summarized in Table 2-10.

**TABLE 2-10  
ANTICIPATED GROUNDWATER POTABLE SUPPLY CAPACITY**

Scenarios	4 Month Summer Capacity (mgd)	8 Month Non-Summer Average Capacity (mgd)	Annual Capacity (MG/Year)
<b>Existing Wells Only</b>			
4 month summer use	2.0	N/A	243
Year round use	2.0	2.0	730
<b>Existing Wells plus 4 Additional Wells</b>			
4 month summer use	3.0	N/A	365
Year round use	3.0	2.5	973
<b>Existing Wells plus 12 Additional Wells</b>			
4 month summer use	5.0	N/A	608
Year round use	5.0	1.5	973

For the analysis included in this report, existing wells are defined as all existing wells with the exception of Scott and Willow Brook wells. These wells were recommended for abandonment within Technical Memorandum No. 5. In addition, each scenario assumes that the existing wells and all new wells are provided with treatment to meet DHS drinking water standards, to meet DHS permit requirements, and to meet the aesthetic requirements of the water system customers. For cost comparison between the groundwater scenarios and to other potable water supply/offset sources to meet the City's buildout potable water demands, an 80 year present worth analysis was conducted. Groundwater 80 year present worth analysis and the results are summarized in Table 2-11. The cost analysis includes the total capital and annual costs for rehabilitation of existing wells, treatment, pumping, and distribution to customers utilizing the City's potable water distribution system. Costs included in Table 2-11 assume individual well head treatment.

**TABLE 2-11**  
**COST OF POTABLE SUPPLY VIA GROUNDWATER**

Scenario	Potable Supply		Cost 80 Year Present Worth	Cost Annualized 80 Year Present Worth	Cost Annualized 80 Year Present Worth per Unit of Potable Supply	
	Annual	ADMM			(\$/Acre- foot)	(\$/MG)
	(MG/Year)	(mgd)				
<b>Existing Wells Only</b>						
4 month summer use	243	2.0	\$25,091,884	\$830,836	\$1,113	\$3,416
Year round use	730	2.0	\$48,445,439	\$1,604,113	\$ 716	\$2,199
<b>Existing Wells plus 4 Additional Wells</b>						
4 month summer use	365	3.0	\$35,250,598	\$1,167,209	\$1,043	\$3,200
Year round use	973	3.0	\$64,412,123	\$2,132,798	\$ 714	\$2,192
<b>Existing Wells plus 12 Additional Wells</b>						
4 month summer use	608	5.0	\$57,875,174	\$1,916,348	\$1,027	\$3,152
Year round use	973	5.0	\$75,380,201	\$2,495,970	\$ 838	\$2,565

<sup>1</sup> All costs shown in 2006 \$s  
MG = Million Gallons

### Water Supply and Demand Analysis Recommended Project

Dodson Engineers and City of Petaluma staff worked together to determine assumptions and evaluation criteria for analysis of the water supply/offset program alternatives. Water supply program alternatives were developed for the Water Demand and Supply Analysis Project and consisted of one or more of the potable water supply/offset sources developed. The following basic assumptions were developed for the recommended water supply/offset program and were required to be met for success of the program.

- ◆ The recommended water supply/offset program must reliably meet both the annual and ADMM demand requirements of the City for buildout of the General Plan.
- ◆ The recommended water supply/offset program must be a phased program to allow water supply/offset sources to be expanded as demand occurs.

The following five evaluation criteria were identified:

- ◆ Cost
- ◆ Reliability
- ◆ Feasibility
- ◆ Flexibility
- ◆ Water Quality

Alternative development was based on combining individual water supply/offset sources scenarios to achieve programs meeting the annual water and ADMM demand requirements developed for buildout.

Eight programs were developed by combining two or more of the three potable water supply/offset sources evaluated. Of the eight programs, seven of the programs meet both the annual and ADMM minimum supply requirements. Since one of the objectives for the recommended program was for the program to be the least-cost program meeting the assumptions and criteria established within this document, the development of the program components concentrated on least-cost combinations of the identified water supply/offset sources.

Under the alternative evaluation phase an 80 year present worth program cost was developed for each the seven programs developed in the alternative development phase that met the project's basic supply requirements. The least-cost project consisted of the following supply/offset elements.

- ◆ Recycled water system serving recycled water areas A, C, E, and G
- ◆ Water conservation program C
- ◆ Groundwater wells utilizing 25% of existing well capacity with well head treatment during four summer months

Table 2-12 outlines the least-cost potable supply/offset program. The table includes annual and ADMM supply/offset quantities and the overall program cost per unit of potable supply/offset achieved.

**TABLE 2-12**  
**LEAST-COST POTABLE SUPPLY/OFFSET PROGRAM**

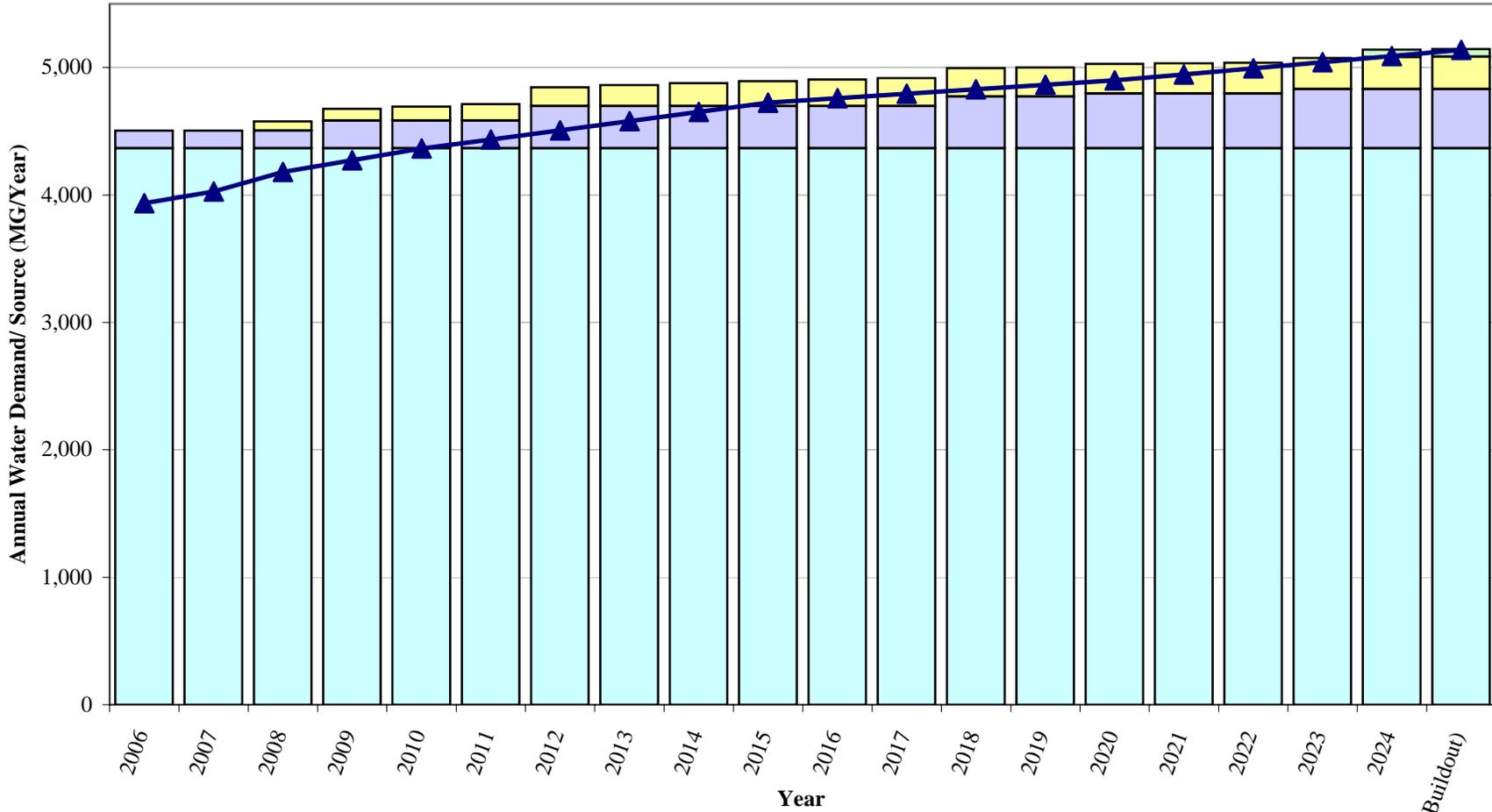
Potable Supply/Offset Source	Annual Supply/Offset (MG/Year)	ADMM Supply/Offset (mgd)
<b>Recycled Water</b> (To Areas A, C, E, and G)	464.24	3.569
<b>Water Conservation</b> (Program C)	266.30	1.39
<b>Groundwater Wells</b> (Summer use only of 25% of existing well capacity with treatment)	60.75	0.5
<b>TOTAL</b>	<b>791.29</b>	<b>5.459</b>
<b>Program Cost Annualized 80 Year Present Worth (\$/Acre-foot)</b>	\$ 585	
<b>Program Cost Annualized 80 Year Present Worth (\$/MG)</b>	\$1,796	

In addition to being the least-cost program, the program outlined above also meets all assumptions and evaluation criteria developed for the recommended program. A detailed description of each of the recommended program's components is outlined in detail within the Water Demand and Supply Analysis Report dated June 2006.

A phasing plan for the supply/offset program components was developed to ensure that sufficient potable water was available at all times to meet the City's potable water demands. Both annual water supply and ADMM supply needs were evaluated. Figures 2-6 and 2-7 outline implementation of the City of Petaluma's supply offset elements to ensure that annual and ADMM potable water demands are met each year through buildout.

The recommended project meets the criteria set by City staff and the demand projections based on the General Plan 2025. Water conservation efforts can be expanded and customized beyond the efforts outlined on the Water Demand and Supply Analysis to create a more sustainable and cost-effective water offset source for the City.

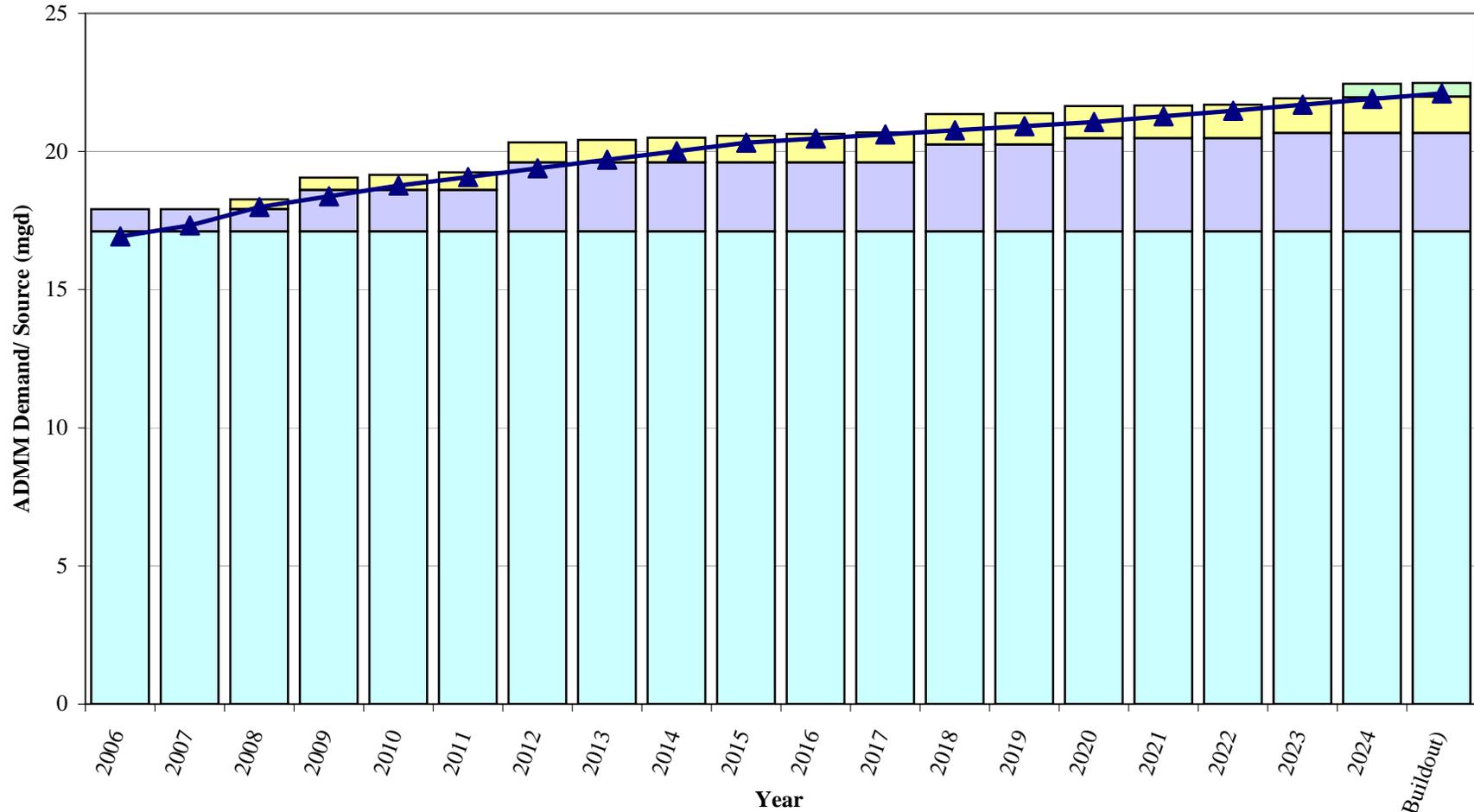
**Figure 2-6  
City of Petaluma: Annual Water Demand versus Supply by Source**



<p><b>SCWA</b> Assumed constant at current allotment</p>	<p><b>Recycled Water (Areas A,C,E, and G)</b> 2006 Rooster Run, 2009 Add Area A - future, 2012 Add Area C - future, 2018 Add Area E - future, 2020 Add Tier 5 users, 2023 Add Area G</p>	<p><b>Water Conservation- Program C</b> 2008- Start program</p>	<p><b>Groundwater</b> 1/4 of existing well capacity with wellhead treatment 2024- Start program</p>	<p><b>Water Demand</b></p>
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2025 (Buildout)

**Figure 2-7  
City of Petaluma: Average Day Max Month Demand (ADMM) versus Supply by Source**



SCWA (Assumed constant at current allotment)	Recycled Water (Areas A,C,E, and G) 2006 Rooster Run, 2009 Add Area A - future, 2012 Add Area C - future, 2018 Add Area E - future, 2020 Add Tier 5 users, 2023 Add Area G	Water Conservation- Program C 2008- Start program	Groundwater 1/4 of existing well capacity with wellhead treatment 2024- Start program	Water Demand
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2025 (Buildout)

# **SECTION THREE**

## **BACKGROUND INFORMATION AND AGENCY SURVEY**

## SECTION THREE

# BACKGROUND INFORMATION AND AGENCY SURVEY

### Background Information

Upon commencement of the Water Conservation Plan study, pertinent background materials were gathered and reviewed by the project team. These items included materials directly related to the City of Petaluma and independent materials related to water conservation. A list of the background materials reviewed is provided below.

- ◆ Projected Water Demands through Buildout (2025) – Baseline water use in 2002
- ◆ Water System Master Plan
- ◆ Recycled Water Master Plan
- ◆ Urban Water Management Plan
- ◆ City water conservation progress and water reduction accomplished
  - Water Billing Data (three years of historical monthly water billing data by customer class): Because the City has changed the utility billing system recently, only three years of billing data were retained.
- ◆ Central Petaluma Specific Plan
- ◆ CPSP Smart Code Appendix
- ◆ Petaluma Park and Recreation Detail Standards/Irrigation Equipment Standards
- ◆ Petaluma Street Tree Guidelines
- ◆ “Hold the Flow” by Ned Orrett
- ◆ MW Water Efficiency Study (1995)
- ◆ “The Potential for Urban Water Conservation in CA” by the Pacific Institute
- ◆ “Innovative Water Conservation Eliminates Water Supply Impacts Enabling Sustainable Housing Development” by William O. Maddaus, Michelle L. Maddaus, Marshall Torre, and Richard Harris
- ◆ “Creating Water Efficient Housing in Petaluma” by Maddaus Water Management
- ◆ “Indoor Water Efficiency for Homes along the East Shore of Tomales Bay” by Edwin Orrett
- ◆ “Water Efficiency Audit for CISCO Systems, Inc. – Petaluma Operations,” by Edwin Orrett
- ◆ Water Transmission System PPP related documents
- ◆ NOAA Fisheries Schedule from SCWA for Biological Opinion
- ◆ Temporary Impairment MOU
- ◆ Petaluma Landscape Efficiency Standard
- ◆ Petaluma’s current water conservation program related documents and ordinances
- ◆ “Zero Footprint Design for University District Specific Plan for City of Rohnert Park” by John Nelson

## Agency Survey

In addition to reviewing pertinent background materials on water conservation, ten water providers were surveyed about their water conservation programs and efforts. The project team developed a list of agencies with similar climate, water supply challenges, and innovative water conservation programs for potential inclusion in the survey. This initial list of agencies included:

- ◆ EBMUD
- ◆ Contra Costa Water District
- ◆ Marin Municipal Water District
- ◆ Santa Clara Valley Water District
- ◆ City of Burlingame
- ◆ City of Sacramento
- ◆ Alameda County Water District
- ◆ City of San Diego
- ◆ Metropolitan Water District of Southern California (MWD)
- ◆ Denver, CO
- ◆ Seattle, WA
- ◆ Austin, TX
- ◆ Phoenix, AZ
- ◆ Irvine Ranch (known to be innovative, but development is well controlled and uniform based on the Irvine Ranch design)
- ◆ Windsor (uses recycled water in the front yards)
- ◆ Roseville
- ◆ Santa Rosa (has a Green Homes Smart Building Program)
- ◆ Pacific Grove, Carmel, Monterey, and the Marina Coast Water District (facing limited water supplies)
- ◆ Oceanside (has a thorough landscape ordinance)
- ◆ Arizona Municipal Water Utilities Association

Upon further review of these agencies programs by Dodson Engineers a shortlist of ten (10) agencies was determined. These agencies included:

- ◆ Marin Municipal Water District, CA
- ◆ Monterey Peninsula Water Management District, CA
- ◆ Metropolitan Water District of Southern California
- ◆ City of Santa Monica, CA
- ◆ San Diego County Water Authority, CA
- ◆ City of Oceanside, CA
- ◆ Town of Gilbert, AZ

- ◆ City of Phoenix, AZ
- ◆ Southern Nevada Water Authority, NV
- ◆ City of El Paso, TX

The project team developed a fifteen (15) minute survey form that would be administered by phone by Dodson Engineers. The water conservation survey form is included in **Appendix D – Water Conservation Survey**. The survey form included six main categories including:

1. Facility Information
2. Water Conservation Programs
3. Resolutions and Ordinances
4. Water Conservation Funding
5. Recycled Water
6. Other

Appendix D includes completed survey forms for each of the ten participating agencies as well as pertinent information provided by the agencies and cities.

A summary of the results of the survey is shown in Table 3-1. Most agencies have turf limits and programs in addition to the BMPs, but none have a “Zero-Water-Footprint” Program which seeks to offset all of the water demand resulting from development through water conservation efforts.

**TABLE 3-1  
SUMMARY OF SURVEY RESULTS**

Agency	Programs in addition to BMPs <sup>1</sup>	Programs that target peak reduction	Smart / ET Controller or Clock	Turf Area Limits	Have Zero Water Footprint Program	Programs to reduce on-site water use <sup>2</sup>	Ordinances	Funding Mechanism <sup>3</sup>	Recycled water in CII sector (not turf)	Recycled water in residential landscapes
Marin Municipal Water District, CA	✓			✓			✓	1,2	✓	
Monterey Peninsula Water Management District (MPWMD), CA (manages Cal American System)	✓	✓		✓			✓	3,4		
Metropolitan Water District of Southern California (Met Water), CA (wholesaler)	✓	✓	✓					3		
City of Santa Monica, CA	✓	✓		✓		✓	✓	3	✓	
San Diego County Water Authority (SDCWA), CA (wholesaler)	✓	✓	✓					2		
City of Oceanside, CA		✓		✓		✓	✓	1,2		
Town of Gilbert, AZ		✓		✓			✓	3		
City of Phoenix, AZ		✓		✓		✓	✓	5	✓	✓
Southern Nevada Water Authority (SNWA), NV (group of agencies)	✓	✓	✓	✓		✓		6		
City of El Paso, TX	✓	✓		✓			✓	3	✓	✓

<sup>1</sup> BMP goals do not apply to agencies outside of California, so a checkmark denotes a program this is in addition to in the 14 BMPs developed by the CUWCC.

<sup>2</sup> Programs for onsite water use excludes ordinances for new development

<sup>3</sup> Funding Mechanisms vary. Numbers correspond with funding mechanisms listed below:

- 1) General Fund of City Budget
- 2) Grants from wholesale water provider or government
- 3) Fees and charges from water bill or connection charges
- 4) Water permit application fees
- 5) Fee from new development
- 6) Fines for water waste

Several highlights were identified from the survey results that deserve mention. These include agencies with innovative programs, innovative ordinances, and particular concerns.

Many of the agencies surveyed have innovative programs for water conservation. These programs include:

- ◆ Audits for water budget accuracy (MPWMD)
- ◆ Stormwater harvesting for landscape and toilet flushing (City of Santa Monica)
- ◆ Resort/ hotel water efficiency plan (SNWA)

- ◆ Regional vendor for all retrofit rebates (Met Water)
- ◆ Point of purchase vouchers rather than rebates (SDCWA)
- ◆ Joint rebates with the energy provider (City of El Paso, SDCWA)
- ◆ Incentives to fund capital improvements, mostly CII and MFR sectors (SNWA)
- ◆ Water fixture credit for reduced water use (MPWMD)
- ◆ Free waterless urinal installation (City of El Paso)
- ◆ Working with Home Owner Associations (SDCWA, Town of Gilbert)
- ◆ Plumbers for People-plumbing service for low income customers (City of Phoenix, City of El Paso to start program)
- ◆ Turf conversion incentives (SNWA, City of El Paso)
- ◆ Water conservation garden and promotion of water efficient landscaping for frequently visited public places such as the Wild Animal Park (SDCWA)
- ◆ Water efficient landscaping example for model homes (City of San Antonio<sup>1</sup>)
- ◆ Water efficient landscape samples, templates/sample designs, or price estimates provided (SNWA, City of Albuquerque<sup>1</sup>)
- ◆ Professional assistance with landscape design (City of Oceanside)
- ◆ Water Smart Certified contractors; classes in both English and Spanish (SNWA)

Many of the agencies surveyed have innovative water conservation ordinances worthy of mention. They include:

- ◆ Marin Municipal Water District's ordinance requires that new and modified landscapes meet the following requirements:
  - Turf limitations for areas < 1/2 acre of irrigated area. If irrigation controller used, rain shut off device and soil moisture sensors needed.
  - Landscape plan for areas > 1/2 acre have turf limitations, prohibit high water plants and decorative water features, and require an automatic irrigation system with shut off unit or soil moisture sensors, check valves, overhead irrigation restrictions, soil preparation, 2" of mulch, separate water meter for new landscapes using more than 81,463 gallons of water per year, and a water management plan.
  - Water management requirement includes a warranty maintenance period where controllers are tested and adjusted, irrigation valves are checked, and irrigation meters read to check for consistency with water demand projections, and a site log is made every two weeks.
  - District inspection after installation form completed, submitted, and certified.
- ◆ City of Oceanside's ordinance requires that new development have the following:
  - Landscape plan before issuance of permit which requires one hundred percent use of concepts of low water use planting and micro-irrigation systems.
  - Dual water lines for recycled water use.
  - Hot water circulation devices and insulated water piping.

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<sup>1</sup> Agency was contacted for participation for the survey, but could not be reached.

- ◆ City of Gilbert, AZ's ordinance requires that new residential development limit turf areas and submit landscape plans. CIO and institution customers to submit water use plans which include use of best available conservation technologies.
- ◆ Southern Nevada Water Authority's ordinance states no landscaping is allowed in front yards, and turf areas are limited in backyards for new development. Grass at apartments is prohibited.

In addition, many of the agencies surveyed listed concerns associated with their conservation programs. These include:

- ◆ Marin Municipal Utility District - People reverting back to non-water conserving behaviors or fixtures.
- ◆ Marin Municipal Utility District - Maintenance of irrigation system and proper operation needed in conjunction with the use of Smart Controllers or ET controllers.
- ◆ Monterey Peninsula Water Management District - Lack of landscaper education even when there are classes offered at California Polytechnical University and similar institutions.
- ◆ City of Santa Monica - Need to work with both property owners as well as renters/operators for CIO such as for medical buildings to use water conserving devices.
- ◆ San Diego County Water Authority - For low water using landscape, 3 components need to be in place: low water use plants, landscape and irrigation system design, and maintenance.
- ◆ City of El Paso - Need to work with local nurseries to ensure that plants on list are available.

The information obtained during the survey was used during the development of the Water Conservation Plan for the City of Petaluma.

# **SECTION FOUR**

## **WATER USE CHARACTERISTICS**

## SECTION FOUR

# WATER USE CHARACTERISTICS

Prior to development of potential water conservation measures that may be included in the City of Petaluma’s Water Conservation Plan, it was essential that the project team members have an understanding of the City’s existing and future potable water demands and water use characteristics. Table 4-1 outlines the City of Petaluma’s existing and projected future annual and average day maximum month (ADMM) potable water demands.

**TABLE 4-1  
EXISTING AND FUTURE POTABLE WATER DEMAND DATA**

Year	Total Annual Water Demand (MG/Year)	ADMM Demand (mgd)
2002 <sup>1</sup>	3,623.19	15.5
2005	3,845.34	16.54
2010	4,363.97	18.77
2015	4,723.23	20.32
2020	4,898.51	21.07
2025 (Buildout)	5,138.64	22.10

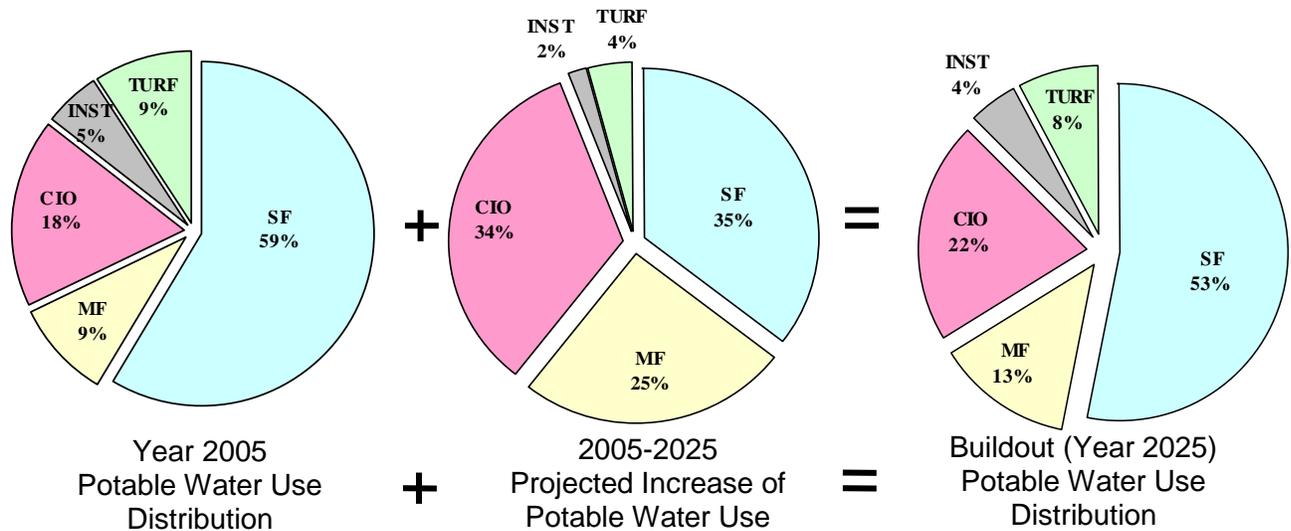
<sup>1</sup>Actual Demands from Billing Records  
MG = Million Gallons  
mgd = million gallons per day

This data was developed under the City’s Water Demand and Supply Analysis Project. The work performed under the Water Demand and Supply Analysis Project is summarized in Section Two – Introduction of this report.

Since SCWA’s potable water supply allocation to the City of Petaluma is based on an annual delivery and an ADMM delivery rate, both sets of demand data are essential for a clear understanding of the City’s future water supply needs.

Under the Water Demand and Supply Analysis Project, existing (Base Year 2002) and future potable water demands were determined. These demands can be predicated among six customer sectors which include: single-family residences, multi-family residences, commercial/industrial/office (CIO), institution, and turf. The distribution of potable water demands to existing customer sectors, future customer sectors, and final buildout water distribution among customer sectors is shown graphically in Figure 4-1 and by percentage in Table 4-2.

**FIGURE 4-1:  
CURRENT AND PROJECTED POTABLE WATER DISTRIBUTION BY CUSTOMER SECTOR**



**TABLE 4-2  
POTABLE WATER DISTRIBUTION BY CUSTOMER SECTOR**

Customer Sectors	Existing (2002)	Existing (Projected as of 2005)	2005-2025	Buildout (2025)
	% of Total	% of Total	% of Total	% of Total
Single-Family (SF)	59%	59%	35%	53%
Multi-Family (MF)	9%	9%	25%	13%
Commercial/Industrial/ Office (CIO)	18%	18%	34%	22%
Institutional (INST)	5%	5%	2%	4%
Turf	9%	9%	4%	8%
<b>TOTAL</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

Note: Data does not include WRF (2009), Coast Guard or anticipated growth beyond UGB.

Based on historic water use data for the City of Petaluma’s minimum month water use and work performed under the Water Demand and Supply Analysis Project, projections were made for distribution of water demands for indoor and outdoor uses.

Table 4-3 outlines existing and future water demand distribution for average day and ADMM conditions.

**TABLE 4-3  
INDOOR AND OUTDOOR WATER USE DISTRIBUTION**

Year	Total Water Demand (MG/Year)	Average Day			ADMM <sup>2</sup>		
		Indoor Only <sup>1</sup> (mgd)	Outdoor (mgd)	Total (mgd)	Indoor Only <sup>1</sup> (mgd)	Outdoor (mgd)	Total (mgd)
2002	3,623	6.5	3.4	9.9	6.5	9.0	15.5
2005	3,845	6.9	3.7	10.5	6.9	9.7	16.5
2010	4,364	7.8	4.2	12.0	7.8	11.0	18.8
2015	4,723	8.6	4.3	12.9	8.6	11.7	20.3
2020	4,899	9.0	4.4	13.4	9.0	12.1	21.1
2025	5,139	9.3	4.8	14.1	9.3	12.8	22.1

<sup>1</sup> Indoor Only = no outdoor use. Total outdoor use was approximately 34% of all use (2002)

<sup>2</sup> ADMM (Average day max month) water for 2002 is actual. ADMM = 1.57 times average day based on historic data.

Table 4-4 illustrates the projected indoor/outdoor water use distribution by customer sector at buildout of the City's General Plan.

**TABLE 4-4  
INDOOR/OUTDOOR WATER USE DISTRIBUTION AMONG CUSTOMER SECTOR AT BUILDOUT**

Customer Sector	% Indoor Use	% Outdoor Use
Single-Family	70	30
Multi-Family	77	23
CIO	68	32
Institution	75	25
Turf	0	100
<b>TOTAL</b>	<b>65</b>	<b>35</b>

New single-family homes constructed after 2002 are expected to have a higher potable water demand than existing single-family residences in the baseline year (2002). In the Water Demand and Supply Analysis Report dated June 2006, the existing single-family residence water use factor was calculated as 317.4 gpd/unit. An increase was noted in billing data records for new homes within Petaluma and all other surrounding communities served by SCWA during preparation of the 2005 Urban Water Management Plan by SCWA. An average water use factor of 418 gpd/unit was calculated for new single-family homes within Petaluma constructed after 2002 through analysis of billing records. This factor will be applied to all new single-family homes to develop potable water demands for the City. More detail on the development of the water use factor can be found in Appendix B of the Water Demand and Supply Analysis Report.

The data within this section will assist the water conservation project team in assessing the effectiveness of various water conservation measures with respect to water distribution among existing (off-site) and future (on-site) customer sectors. In addition, information of indoor/outdoor water use provides valuable information on how water is typically used within the City and within the different customer sectors. While both indoor and outdoor water use contribute to annual water use, outdoor water use directly contributes to ADMM water demand whereas indoor water use directly contributes to wastewater flows.

# **SECTION FIVE**

## **WATER CONSERVATION PLAN DEVELOPMENT**

## SECTION FIVE WATER CONSERVATION PLAN

### Water Conservation Plan Goal

The establishment of a water savings goal for the Water Conservation Plan was based on the amount of additional potable water required to meet buildout (Year 2025) demands, the confidence that the recommended supply sources outlined in the Water Supply and Demand Analysis Project can meet the projected buildout demand, and the ability of a water conservation program to achieve the goal established. The additional potable water required to meet the projected water demand at Buildout of the General Plan 2025 is 772.2 MG/Year above the City of Petaluma’s annual allotment of 4,366.42 MG/Year (13,400 acre-feet/year) as outlined in the 11<sup>th</sup> Amendment with SCWA. Furthermore, an additional ADMM potable water requirement of 5.0 mgd beyond the City’s agreement with SCWA under the Temporary Impairment MOU is also required. Under the Water Demand and Supply Analysis Project, the additional demand requirements were met utilizing alternative water supply and offset sources including recycled water, water conservation, and City-owned groundwater wells. Table 5-1 outlines the supply and offset quantities of each source to meet the buildout demand projections.

**TABLE 5-1  
ADDITIONAL POTABLE WATER SUPPLY/OFFSET SOURCES UNDER WATER DEMAND AND SUPPLY ANALYSIS PROJECT**

Supply/Offset Source	Annual Supply (MG/Year)	ADMM Supply (mgd)
Recycled Water	464.24	3.57
Water Conservation	254.50	1.31
City-Owned Groundwater Wells	60.75	0.50

Although the minimum annual amount of potable water that must be offset via water conservation at Buildout (2025) as defined by the Water Demand and Supply Analysis Project is 254.5 MG/Year, the goal established under the Water Conservation Plan is to exceed this value and eliminate the use of City-owned groundwater wells for potable water supply to reserve the groundwater supply for emergency/backup use and to allow for a 25 percent safety factor on the estimates in Table 5-1 for achievable water conservation and recycled water offset. The use of safety factors was crucial in developing the water savings goal. In addition, the program is only in its early stages of development, and numerous factors may affect the actual water savings achieved. If water conservation savings meets expectations and the contingency is not needed, the recycled water transmission system will not be fully constructed. This is a valid approach since potable offset via recycled water is more costly than potable water offset via water conservation. Table 5-2 outlines the components used to determine the annual water savings goal for the Water Conservation Plan. The Water Conservation Plan goal includes the water conservation program requirement outlined in the Water Demand and Supply Analysis plus a 25 percent safety factor on the recycled water and water conservation offset requirement in the Water Demand and Supply Analysis, as well as 100 percent of the City-owned groundwater well requirement.

**TABLE 5-2  
WATER CONSERVATION PLAN ANNUAL WATER SAVINGS GOAL AT BUILDOUT (2025)**

Goal Components	Annual Water Savings Goal (MG/Year)
Water Conservation Offset Requirement	254.50
Safety Factor of 25% of Water Conservation Offset Requirement	63.75
Safety Factor of 25% of Recycled Water Offset Requirement	116.00
100% of City-Owned Groundwater Well Requirement	60.75
<b>Total Water Conservation Plan Goal</b>	<b>495</b>

The intent of the Water Conservation Plan goal of 495 MG/Year for annual water supply offset is to develop a program that can be implemented in lieu of the water conservation program outlined in the Water Demand and Supply Analysis. Although the recommended water conservation program outlined in the Water Demand and Supply Analysis met the requirements of water offset and was cost effective in comparison to recycled water and groundwater, the water conservation measures included in the program required further scrutiny by a team of professionals to ensure that the Water Conservation Plan was not only cost-effective, but attainable. This program supersedes the Water Demand and Supply Analysis Water Conservation section because it is the most cost effective water conservation plan based on an 80-year present worth analysis, comprised of water conservation measures that are feasible, cost effective, and attainable by the City including an appropriate engineering safety factor. All measures included in the Water Demand and Supply Analysis Project’s water conservation program were evaluated along with a multitude of additional measures for potential inclusion into the final Water Conservation Plan recommended program. This ensures that the Water Conservation Plan is not only cost-effective but also attainable. The Water Conservation Plan goal of 495 MG/Year is an aggressive but achievable goal when compared to the water savings established for the Water Demand and Supply Analysis Project’s water conservation program and concurrent work by SCWA under their Urban Water Management Plan. Table 5-3 compares the annual water savings in Year 2025 for other potential water conservation programs to the goal of 495 MG/Year. The team set this goal to protect groundwater for use as an emergency supply and to implement customary engineering safety factors to ensure water supply always meets demand requirements.

**TABLE 5-3  
WATER CONSERVATION PLAN ANNUAL WATER COMPARISON**

Water Conservation Program	Annual Water Savings (Year 2025)
Petaluma Water Demand & Supply Analysis Recommended Water Conservation Program C	254.5 MG/Year
SCWA Tier 1 Program	106 MG/Year
SCWA Tier 2 Program	86 MG/Year
SCWA New Development Program	167 MG/Year
SCWA Tier 1 + Tier 2 Program	180 MG/Year
SCWA Tier 1 + New Development Program	255 MG/Year
SCWA Tier 1 + Tier 2 + New Development Program	343 MG/Year
<b>Petaluma Water Conservation Plan Goal</b>	<b>495 MG/Year</b>

Note: Water conservation programs are not additive due to non-additive water savings of independent measures.

## Development of Potential Water Conservation Measures

After reviewing prior water conservation efforts by other agencies, the Water Conservation Plan project team spent two four-hour brainstorming sessions developing potential water conservation measures for inclusion into the City’s final Water Conservation Plan. The 202 water conservation measures developed were divided into two distinct categories; namely, measures that can be implemented “on-site” at future new development sites and measures that can be implemented “off-site” at existing sites. The measures were then organized by indoor versus outdoor water savings and placed into applicable customer sectors. Tables 5-4 and 5-5 list the potential on-site and off-site water conservation measures identified during the brainstorming sessions. The measures are categorized by indoor versus outdoor water saving; categorized as programs, ordinances and controls, and public relations and billing; and denoted to indicate the impacted customer sectors.

**TABLE 5-4  
POTENTIAL “ON-SITE” WATER CONSERVATION MEASURES**

Water Conservation Measures	SFR	MFR	CIO	INST	TURF
<i>Indoor Water Conservation Measures</i>					
<b>Programs - Developer to Install</b>					
½ gal/flush urinals			•	•	
1 gal/flush toilets			•	•	
AMR (automated meter reading)	•	•	•	•	
Approved commercial dish washers			•	•	
Approved list of appliances	•	•	•	•	
Centralized water heater	•	•	•	•	
Common bath rooms		•	•	•	
Common laundry rooms, prohibit in-unit laundry rooms		•	•		
Composting toilets	•	•	•	•	
Digital x-ray machines			•		
Dual meters (indoor and outdoor)	•	•	•	•	
Dual plumbing indoors (recycle for toilets)	•	•	•	•	
Flow regulating nozzles	•	•	•	•	
Ground water for on-site, non-potable use			•		
High efficiency appliances (dish, clothes washers)	•	•	•	•	
High efficiency commercial washers			•		
High efficiency toilets	•	•	•	•	
High level/low level sink sprays	•	•	•	•	
Hot water on demand system	•	•	•	•	
Low flow shower heads	•	•	•	•	
Meters on cooling towers			•		
Onsite recycle (within indoor, cascading use)	•	•	•	•	
Rainfall recovery	•	•	•	•	
Recirculation showers	•	•	•	•	
Recycled water for non-potable uses			•		
Recycle indoor water			•		
Recycled water for cooling			•		
Roof catchments	•	•	•		
Roof-mounted solar heaters	•	•	•	•	
Self-cleaning surfaces (walls, windows)		•			
Self-closing faucets			•	•	
Sensing faucets	•	•	•	•	
Shower timers	•	•	•		
Small diameter pipes for hot water	•	•	•	•	
Submetering – equitable billing		•			

<b>Water Conservation Measures</b>	<b>SFR</b>	<b>MFR</b>	<b>CIO</b>	<b>INST</b>	<b>TURF</b>
Subsurface cooling			•		
Temperature limited shower head	•	•	•	•	
Urine separating toilets	•	•	•	•	
Vacuum toilets	•	•	•	•	
Water Miser for autoclaves			•		
Waterless urinals			•	•	
<b>Ordinances and Controls</b>					
Artificial indoor plants only	•	•	•	•	
Limit indoor fountains	•	•	•	•	
Limit number of toilets				•	
Limit service connection to 3/8 "	•				
Limit service pressure to 35 - 50 psi	•				
Limit service pressure to 35 psi	•				
Limit size of bath tubs	•	•			
Limit size of water heater	•	•			
No food waste disposals	•	•	•	•	
No in unit washing facilities / common laundry rooms		•	•		
Potable use indoor (only)	•	•	•	•	
Prohibit evaporative coolers	•	•	•	•	
Prohibit food waste disposals	•	•	•	•	
Prohibit in floor (radiant) heating	•	•	•	•	
Prohibit once-thru cooling			•		
Prohibit water-cooled ice machines			•		
Prohibiting shower panels	•	•	•		
Provide potable water delivery via truck w/no potable plumbing	•				
Recycle water for fire suppression			•		
Require approved appliances by developer	•	•			
Restaurants to serve water on request			•		
<b>Public Relations and Billing</b>					
Buyer agreement to maintain low use fixtures on resale	•	•	•		
City meters to each unit		•	•	•	
Educate school district				•	
Educate state				•	
Incentive for commercial laundry to reduce water			•		
Incentive for connectionless food steamers			•		
Incentive for digital x-ray machines			•		
Model homes to demonstrate water savings	•	•			
Provide water audit for new buyers	•	•			
Submit water management plan			•		
Utility bills to tenant		•	•		
Water budget				•	
Water efficiency guide for new businesses			•		
Water saving info at hardware stores	•	•			
Water saving info at model homes	•	•			
Work with hardware stores to promote water conservation	•	•			
<b>Outdoor Water Conservation Measures</b>					
<b>Programs - Developer to Install</b>					
Artificial turf		•	•	•	•
Automatic pool covers	•	•	•		
Backyard development by developer	•	•			
Common car wash facility		•	•		
Common recreation facilities		•	•		

Water Conservation Measures	SFR	MFR	CIO	INST	TURF
Community garden		•			
Developer to train buyer on irrigation system (landscape system)	•	•	•		
Drip irrigation	•	•	•	•	•
Drip irrigation of shrubs & trees	•	•	•	•	
Efficient spray irrigation of non-turf areas	•	•	•	•	
ET controllers	•	•	•	•	•
Hardscape recreation		•	•		
Low flow irrigation system	•	•	•	•	•
Low water use turf	•	•	•	•	•
Optional backyard landscaping by developer	•	•			
Professionally maintained gray water system	•	•	•	•	
Proper soil preparation by developer	•	•	•	•	•
Rain collector	•	•	•		
Reclaimed water in front yard	•	•			
Well water for irrigation			•		
<b>Ordinances and Controls</b>					
Approve planting & irrigation plans Developer (front) Buyer (back)	•				
Approved (list of plants)	•	•	•	•	•
Approved planting & irrigation plans for common area		•	•	•	
Approved water budget requirement	•	•	•	•	•
As-builts of irrigation system provided	•	•	•	•	
Controller audits	•	•	•	•	
Large lot landscape plan review	•		•	•	
Limit % of turf	•	•	•	•	
Limit lot size	•				
Limit size of: Fountains Swimming pools Hot tubs	•	•	•	•	•
Limit sq. ft. of turf	•	•			
Limit turf	•	•	•	•	•
No driveway washing	•				
No front yard hose bibs	•	•			
No front yard turf	•	•			
No hardscape wash down		•	•		
No irrigation runoff	•	•	•	•	•
No overhead irrigation in strips < 5'	•	•	•	•	•
No spray irrigation of non-turf areas	•	•	•	•	
No window planter boxes		•	•		
Overuse shut off valves	•	•	•	•	•
Permit for landscaping	•	•	•	•	
Prepaid audits	•	•	•	•	
Prohibit ponds, water fountains, and swimming pools		•	•	•	
Prohibit private car washing	•				
Prohibit timer controllers	•	•	•	•	
Prohibit turf			•		
Recycle water at car wash			•		
Require proper turf type					•
Require rain shutoff of controllers	•	•	•	•	
Turf guidelines					•
Vandal proof hose bibs	•	•			

Water Conservation Measures	SFR	MFR	CIO	INST	TURF
<b>Public Relations and Billing</b>					
Bilingual training materials		•	•	•	•
Certified landscape maintenance contractors	•	•	•	•	•
Certify landscape contractors	•	•	•	•	•
Discount for reduced water use	•				
Flyers & pamphlets at garden center		•	•	•	
Fourth tier water rate	•	•	•	•	•
Sliding scale connection fee	•	•	•	•	
Tiered rates	•	•	•	•	•
Training of landscape maintenance workers	•	•	•	•	•
Water budget					•
Water budget based billing	•	•	•	•	•
Water conservation information in billing	•	•			
Water management education					•

**TABLE 5-5  
POTENTIAL "OFFSITE" WATER CONSERVATION MEASURES**

Water Conservation Measures	SFR	MFR	CIO	INST	TURF
<i>Indoor Water Conservation Measures</i>					
<b>Programs - Retrofit</b>					
½ gal/flush urinals			•	•	
City submeters each unit such as strip malls		•	•		
Connectionless food steamers			•		
Cooling tower meters (can provide evaporation credit on the sewer bill)			•	•	
Flow regulating nozzles	•	•	•	•	
High efficiency appliances (dish & clothes washers, ice machines, etc.) Provide a "list" of what is water efficient.	•	•	•	•	
Hot water on demand	•	•	•	•	
Leak detection	•	•	•	•	
Low flow shower heads	•	•	•	•	
Process efficiency improvements			•		
Roof catchments/ rainfall harvesting		•	•		
Self closing faucets			•	•	
Sensing faucets	•	•	•	•	
Smart meter	•	•	•	•	
Sub metering – equitable billing		•	•		
Water Miser for autoclaves (lab/hospital)			•		
Waterless urinals			•	•	
<b>Ordinances and Controls</b>					
Buyer agreement to maintain low use fixtures on resale	•	•	•		
Mandate retrofit by certain date- paired with other items	•	•	•	•	
Prohibit water cooled ice machines upon replacement through a restaurant water conservation program with list of rebates for approved appliances upon replacement			•		
Low income retrofit program	•	•			
Retrofit on resale/ time of name change on water bill	•	•	•	•	
Water management plan requirement			•	•	
<b>Public Relations and Billing</b>					
Capacity buyback options			•	•	
Centralized website with high efficient appliances and rebates or where to buy	•	•	•	•	

<b>Water Conservation Measures</b>	<b>SFR</b>	<b>MFR</b>	<b>CIO</b>	<b>INST</b>	<b>TURF</b>
Commercial laundry water reduction incentives			•		
Direct installation program instead of rebates	•	•	•	•	
Direct installation program for high efficiency toilets/ 1 gal toilets	•	•	•	•	
Generic/ economic incentives for reduced water use-behavior rebates similar to energy ones. Can use reductions in peak or annual use.	•	•	•	•	
Restaurants to serve water on request			•		
Tiered water pricing- lower blocks and increase prices or by other method	•		•		
Water efficiency guide for businesses (see EBMUD)			•		
Work with hardware stores to promote and stock water conservation appliances and info	•	•			
<b>Outdoor Water Conservation Measures</b>					
<b>Programs - Retrofit</b>					
Artificial turf					•
Automatic pool cover rebates	•	•	•	•	•
Community garden		•			
Rebate for rain shutoff of controllers	•	•	•	•	•
Rebate on ET controllers	•	•	•	•	•
Rebate on low water use turf	•	•	•	•	•
Require proper soil preparation by developer upon renovation or rebate for mulch	•	•	•	•	•
Retrofit for efficient or low flow spray irrigation of non-turf areas or drip	•	•	•	•	•
<b>Ordinances and Controls</b>					
Approved planting & irrigation plans for common area upon renovation		•	•	•	
Approved water budget requirement allocation or for large lots for SFR	•	•	•	•	•
Approved/recommended list of plants	•	•	•	•	•
Prohibit overhead irrigation in strips < 5' or meandering sidewalks upon renovation	•	•	•	•	•
Turf guidelines/ limitations incl. choice of turf. Specify turf that is sold in Petaluma	•	•	•	•	•
<b>Public Relations and Billing</b>					
Bilingual training materials		•	•	•	•
Certify landscape contractors for renovation	•	•	•	•	•
Demonstration projects	•	•	•	•	
Flyers & pamphlets at garden center		•	•	•	
Fourth tier water rate/ Tiered water rates	•	•	•	•	•
Generic landscape plans	•	•			
Train/ certify of landscape maintenance workers for renovation	•	•	•	•	•
Turf conversion incentives	•	•	•	•	•
Water budget based billing		•	•	•	•
Water conservation information in billing- graphs of historical use and comparison with other customers	•	•	•	•	•
Water management education					•
Working with Home Owner Associations on hiring qualified landscapers	•	•	•	•	•

## Development of Evaluation Criteria

Once the preliminary list of potential on-site and off-site water conservation measures was developed, the water conservation plan team convened once again for a four-hour brainstorming session. This brainstorming session was dedicated to developing evaluation criteria which would be used to screen the potential conservation measures. The goal of the evaluation criteria brainstorming session was to develop evaluation criteria, determine the importance of each criterion, and identify any potential fatal flaws that would eliminate potential water conservation measures from further consideration to ensure a feasible and manageable program. An initial list of potential evaluation criteria was developed prior to the meeting which included the following components:

- ◆ Relative cost
- ◆ Responsibility of Cost Burden and Proposed Beneficiaries
- ◆ Performance Records
- ◆ Appropriate for Community
- ◆ Sustainability
- ◆ Environmental Impact
- ◆ Legality
- ◆ Annual Expected Water Savings
- ◆ Timing of Water Reduction/Seasonal Water Reduction
- ◆ Public Support
- ◆ Convenience of Use
- ◆ Longevity

Upon discussion and analysis of the proposed criteria outlined above by the project team, the team developed evaluation criteria, weighting criteria, and corresponding fatal flaws that would be used to screen for the most feasible and suitable measures. The evaluation criteria are included in Table 5-6.

**TABLE 5-6**  
**SUMMARY OF CRITERIA, WEIGHT, AND FATAL FLAWS FOR EVALUATION OF WATER CONSERVATION MEASURES**

Criteria	Weight	Fatal Flaw
Relative Cost	30%	Cost more than desalination of the Petaluma River (\$2,000/AF or \$6,000 /MG)
Public Support/ Responsibility of Cost Burden/ Environmental/ Convenience	30%	Excessive developer fees compared to nearby agencies, not meeting health standards, no relative advantage, and less attractive than present equipment
Performance Records/ Longevity	15%	Not having been previously tested/ no performance data
Annual Water Savings/ Appropriate for Community	15%	Not appropriate for community and customer types and not meeting 5% of total expected water savings goal
Seasonality of Water Savings (ADMM Reduction)	10%	None

The criteria outlined in Table 5-6 are defined below:

- ◆ Relative cost compares the cost of water supply to other sources such as SCWA supply, recycled water, and groundwater. The relative cost of each measure can also be compared to one another to determine which measures are more cost effective.
- ◆ Public Support/ Responsibility of Cost Burden/ Environmental/ Convenience incorporate the public's acceptance and response to the water conservation measure. It is more likely that a measure will be accepted if the costs and benefits are fairly distributed, if environmental benefits exist, if the water is used wisely, and if the measure is as convenient, if not more convenient than current equipment.
- ◆ Performance records and longevity describe the measures tested performance for water savings and if the water savings is sustainable over time.
- ◆ Annual water savings/ appropriate for community describe how effective the measure is with respect to annual water savings and if it will lead to water savings given the customer classes, end uses, climate, and economic level of the City.
- ◆ Seasonality of water savings favors measures that reduce the Average Day Max Month demand. These measures are outdoor landscaping measures.

## Evaluation of Potential Water Conservation Measures

Once evaluation criteria were identified, potential water conservation measures were evaluated and a shortlist of 112 measures was compiled for further evaluation. The evaluation criteria and fatal flaws identified in Table 5-6 were used to evaluate the potential on-site and off-site water conservation measures outlined in Tables 5-4 and 5-5. The initial screening process was to perform a fatal flaw analysis on each measure and eliminate potential measures with fatal flaws. Tables 5-7 and 5-8 illustrate water conservation measures identified by the project team which were eliminated due to the fatal flaw analysis.

**TABLE 5-7**

**FATAL FLAW ANALYSIS RESULTS FOR POTENTIAL "ON-SITE" WATER CONSERVATION MEASURES**

Water Conservation Measures	SFR	MFR	CIO	INST	TURF
<i>Indoor Water Conservation Measures</i>					
<b>Programs - Developer to Install</b>					
½ gal/flush urinals			•	•	
1 gal/flush toilets			•	•	
AMR (automated meter reading)	•	•	•	•	
Approved commercial dish washers			•	•	
Approved list of appliances	•	•	•	•	
Smart plumbing/ centralized water heater/ small hot water pipes	•	•	•	•	
Common bath rooms		•	•	•	
Common laundry rooms, prohibit in-unit laundry rooms		•	•		
Composting toilets	•	•	•	•	
Digital x-ray machines			•		
Dual meters (indoor and outdoor)	•	•	•	•	
Dual plumbing indoors (recycle for toilets)	•	•	•	•	
Flow regulating nozzles	•	•	•	•	

<b>Water Conservation Measures</b>	<b>SFR</b>	<b>MFR</b>	<b>CIO</b>	<b>INST</b>	<b>TURF</b>
Ground water for on-site, non-potable use			•		
High efficiency appliances (dish & clothes washers)	•	•	•	•	
High efficiency commercial washers			•		
High efficiency toilets	•	•	•	•	
High level/low level sink sprays	•	•	•	•	
Hot water on demand system	•	•	•	•	
Low flow shower heads	•	•	•	•	
Meters on cooling towers			•		
Onsite recycle (within indoor, cascading use)	•	•	•	•	
Rainfall recovery	•	•	•	•	
Recirculation showers	•	•	•	•	
Recycled water for non-potable uses			•		
Recycle indoor water			•		
Recycled water for cooling			•		
Roof catchments/ rainfall harvesting	•	•	•		
Roof mounted solar heaters	•	•	•	•	
Self-cleaning surfaces (walls, windows)		•			
Self-closing faucets			•	•	
Sensing faucets	•	•	•	•	
Shower timers	•	•	•		
Submetering – equitable billing		•			
Subsurface cooling			•		
Temperature limited shower head	•	•	•	•	
Urine separating toilets	•	•	•	•	
Vacuum toilets	•	•	•	•	
Water Miser for autoclaves			•		
Waterless urinals			•	•	
<b>Ordinances and Controls</b>					
Artificial indoor plants only	•	•	•	•	
Limit indoor fountains	•	•	•	•	
Limit number of toilets				•	
Limit service connection to 3/8 “	•				
Limit service pressure to 35 - 50 psi	•				
Limit service pressure to 35 psi	•				
Limit size of bath tubs	•	•			
Limit size of water heater	•	•			
No food waste disposals	•	•	•	•	
No in-unit washing facilities / common laundry rooms		•	•		
Potable use indoor only	•	•	•	•	
Prohibit evaporative coolers	•	•	•	•	
Prohibit food waste disposals	•	•	•	•	
Prohibit in floor (radiant) heating	•	•	•	•	
Prohibit once-thru cooling			•		
Prohibit water-cooled ice machines			•		
Prohibiting shower panels	•	•	•		
Provide potable water delivery via truck w/no potable plumbing	•				
Recycled water for fire suppression			•		
Require approved appliances by developer	•	•			
Restaurants to serve water on request			•		
<b>Public Relations and Billing</b>					
Buyer agreement to maintain low use fixtures on resale	•	•	•		
City meters to each unit		•	•	•	

<b>Water Conservation Measures</b>	<b>SFR</b>	<b>MFR</b>	<b>CIO</b>	<b>INST</b>	<b>TURF</b>
Educate school district				•	
Educate state				•	
Incentive for commercial laundry to reduce water			•		
Incentive for connectionless food steamers			•		
Incentive for digital x-ray machines			•		
Model homes to demonstrate water savings	•	•			
Provide water audit for new buyers	•	•			
Submit water management plan			•		
Utility bills to tenant		•	•		
Water budget				•	
Water efficiency guide for new businesses			•		
Water saving info at hardware stores	•	•			
Water saving info at model homes	•	•			
Work with hardware stores to promote water conservation	•	•			
<b>Outdoor Water Conservation Measures</b>					
<b>Programs - Developer to Install</b>					
Artificial turf		•	•	•	•
Automatic pool covers	•	•	•		
Backyard development by developer	•	•			
Common car wash facility		•	•		
Common recreation facilities		•	•		
Community garden		•			
Developer to train buyer on irrigation system (landscape system)	•	•	•		
Drip irrigation	•	•	•	•	•
Drip irrigation of shrubs & trees	•	•	•	•	
Efficient spray irrigation of non-turf areas	•	•	•	•	
ET controllers	•	•	•	•	•
Hardscape recreation		•	•		
Low flow irrigation system	•	•	•	•	•
Low water use turf	•	•	•	•	•
Optional backyard landscaping by developer	•	•			
Professionally maintained gray water system	•	•	•	•	
Proper soil preparation by developer	•	•	•	•	•
Rain collector	•	•	•		
Reclaimed water in front yard	•	•			
Well water for irrigation			•		
<b>Ordinances and Controls</b>					
Approve planting & irrigation plans Developer (front) Buyer (back)	•				
Approved (list of plants)	•	•	•	•	•
Approved planting & irrigation plans for common area		•	•	•	
Approved water budget requirement	•	•	•	•	•
As-builts of irrigation system provided	•	•	•	•	
Controller audits	•	•	•	•	
Large lot landscape plan review	•		•	•	
Limit % of turf	•	•	•	•	
Limit lot size	•				
Limit size of: fountains, swimming pools, hot tubs	•	•	•	•	•
Limit area of turf	•	•			
Limit turf	•	•	•	•	•
No driveway washing	•				

Water Conservation Measures	SFR	MFR	CIO	INST	TURF
No front yard hose bibs	•	•			
No front yard turf	•	•			
No hardscape wash down		•	•		
No irrigation runoff	•	•	•	•	•
No overhead irrigation in strips < 5'	•	•	•	•	•
No spray irrigation of non-turf areas	•	•	•	•	
No window planter boxes		•	•		
Overuse shut off valves	•	•	•	•	•
Permit for landscaping	•	•	•	•	
Prepaid audits	•	•	•	•	
Prohibit ponds, water fountains, and swimming pools		•	•	•	
Prohibit private car washing	•				
Prohibit timer controllers	•	•	•	•	
Prohibit turf			•		
Recycle water at car wash			•		
Require proper turf type					•
Require rain shutoff of controllers	•	•	•	•	
Turf guidelines					•
Vandal proof hose bibs	•	•			
<b>Public Relations and Billing</b>					
Bilingual training materials		•	•	•	•
Certified landscape maintenance contractors	•	•	•	•	•
Certify landscape contractors	•	•	•	•	•
Discount for reduced water use	•				
Flyers & pamphlets at garden center		•	•	•	
Fourth tier water rate	•	•	•	•	•
Sliding scale connection fee	•	•	•	•	
Tiered rates	•	•	•	•	•
Training of landscape maintenance workers	•	•	•	•	•
Water budget					•
Water budget based billing	•	•	•	•	•
Water conservation information in billing	•	•			
Water management education					•

**TABLE 5-8**

**FATAL FLAW ANALYSIS RESULTS FOR POTENTIAL "OFF-SITE" WATER CONSERVATION MEASURES**

Water Conservation Measures	SFR	MFR	CIO	INST	TURF
<i>Indoor Water Conservation Measures</i>					
<b>Programs - Retrofit</b>					
½ gal/flush urinals			•	•	
City submeters each unit such as strip malls		•	•		
Connectionless food steamers			•		
Cooling tower meters (can provide evaporation credit on the sewer bill)			•	•	
Flow regulating nozzles	•	•	•	•	
High efficiency appliances (dish & clothes washers, ice machines, etc.) Provide a "list" of what is water efficient.	•	•	•	•	
Hot water on demand	•	•	•	•	
Leak detection	•	•	•	•	
Low-flow shower heads	•	•	•	•	
Process efficiency improvements			•		
Roof catchment/ rainfall harvesting		•	•		
Self-closing faucets			•	•	

<b>Water Conservation Measures</b>	<b>SFR</b>	<b>MFR</b>	<b>CIO</b>	<b>INST</b>	<b>TURF</b>
Sensing faucets	•	•	•	•	
Smart meter	•	•	•	•	
Submetering – equitable billing		•	•		
Water Miser for autoclaves (lab/hospital)			•		
Waterless urinals			•	•	
<b>Ordinances and Controls</b>					
Buyer agreement to maintain low use fixtures on resale	•	•	•		
Mandate retrofit by certain date- paired with other items	•	•	•	•	
Prohibit water cooled ice machines upon replacement through a restaurant water conservation program with list of rebates for approved appliances upon replacement			•		
Low income retrofit program	•	•			
Retrofit on resale/ time of name change on water bill	•	•	•	•	
Water management plan requirement			•	•	
<b>Public Relations and Billing</b>					
Capacity buyback options			•	•	
Centralized website with high efficient appliances and rebates or where to buy	•	•	•	•	
Commercial laundry water reduction incentives			•		
Direct installation program instead of rebates	•	•	•	•	
Direct installation program for high efficiency toilets/ 1 gal toilets	•	•	•	•	
Generic/ economic incentives for reduced water use- behavior rebates similar to energy ones. Can use reductions in peak or annual use.	•	•	•	•	
Restaurants to serve water on request			•		
Tiered water pricing- lower blocks and increase prices or by other method	•		•		
Water efficiency guide for businesses (see EBMUD)			•		
Work with hardware stores to promote and stock water conservation appliances and info	•	•			
<b>Outdoor Water Conservation Measures</b>					
<b>Programs - Retrofit</b>					
Artificial turf					•
Automatic pool cover rebates	•	•	•	•	•
Community garden		•			
Rebate for rain shutoff of controllers	•	•	•	•	•
Rebate on ET controllers	•	•	•	•	•
Rebate on low water use turf	•	•	•	•	•
Retrofit for efficient or low flow spray irrigation of non-turf areas or drip	•	•	•	•	•
Require proper soil preparation by developer upon renovation or rebate for mulch	•	•	•	•	•
<b>Ordinances and Controls</b>					
Approved planting & irrigation plans for common area upon renovation		•	•	•	
Approved water budget requirement allocation or for large lots for SFR	•	•	•	•	•
Approved/recommended (list of plants)	•	•	•	•	•
Prohibit overhead irrigation in strips < 5' or meandering sidewalks upon renovation	•	•	•	•	•
Turf guidelines/limitations incl. choice of turf. Specify turf that is sold in Petaluma	•	•	•	•	•
<b>Public Relations and Billing</b>					

Water Conservation Measures	SFR	MFR	CIO	INST	TURF
Bilingual training materials		•	•	•	•
Certify landscape contractors for renovation	•	•	•	•	•
Demonstration projects	•	•	•	•	
Flyers & pamphlets at garden center		•	•	•	
Fourth tier water rate/ Tiered water rates	•	•	•	•	•
Generic landscape plans	•	•			
Train/ certify of landscape maintenance workers for renovation	•	•	•	•	•
Turf conversion incentives	•	•	•	•	•
Water budget based billing		•	•	•	•
Water conservation information in billing- graphs of historical use and comparison with other customers	•	•	•	•	•
Water management education					•
Working with Home Owner Associations on hiring qualified landscapers	•	•	•	•	•

The next step of the Water Conservation Plan process was to further reduce the number of potential water conservation measures and place the remaining measures into a water conservation program for further evaluation. Since many water conservation measures reduce the same water demand such as turf limits, proper landscape materials, and ET controllers all reduce irrigation use, each group of potential measures must be evaluated together in order to determine the net water reduction and the program's overall cost-effectiveness. A highly sophisticated computer model known as the Least Cost Planning Decision Support System (DSS) was used to complete this task. The model coordinates water savings between measures and does not "double-count" water savings, thus allowing the user to accurately calculate water savings for the overall program. The model is licensed through Maddaus Water Management and the California Urban Water Conservation Council (CUWCC) and has been used by more than one hundred and fifty (150) communities throughout the world, including the City of Petaluma and SCWA, to analyze the cost-effectiveness and water savings of water conservation programs. One hundred and twelve (112) water conservation measures, after the fatal flaw analysis, were compiled into comprehensive tables for future evaluation by the project team to determine which measures would be included in a water conservation program for further analysis using the DSS Model. Table 5-9 includes all remaining potential water conservation measures after the fatal flaw analysis was performed and combines on-site and off-site potential measures. Table 5-9 includes the following information.

- ◆ Potential Water conservation Measures are categorized into the following groups:
  - Audits
  - Laundry (Clothes Washers)
  - Dishwashers
  - Hot Water Systems
  - Fixtures
  - Toilets
  - Urinals
  - Incentives
  - Water Budget
  - Training

- Irrigation Systems
  - Turf
  - Plan Check
  - Outdoor
  - Connection Fee
  - Commercial/Industrial/Office (CIO)
  - CIO Programs
  - CIO Equipment
  - CIO Ordinances
  - Meters
  - Rates
  - Public Relations
  - Education
  - Water Wasting
- ◆ Measures were identified as having been included in a prior water conservation program DSS Model evaluation, either by the City of Petaluma or SCWA. Where a measure had previously been evaluated using the DSS Model, its program and measure number were identified. Information on past programs was distributed to all team members during the screening process. This information is included in **Appendix F – Water Conservation Programs and Measures from Previous Efforts**. The Petaluma programs include measures that were identified under this Water Conservation Plan (WCP) and measures that were included in the recommended water conservation program under the Water Demand and Supply Analysis (Program C). The SCWA programs include measures that were included in SCWA’s water conservation work during preparation of their Urban Water Management Plan. These programs include Tier 1, Tier 2, and New Development (ND) measures.
  - ◆ Each measure is identified as applicable to off-site/existing customers (E) and on-site/new development customers (N).
  - ◆ Each measure identifies which customer sectors are applicable. SF = single-family, MF = multi-family, CIO = commercial/industrial/office, INST = institution, and Turf = irrigation customer.
  - ◆ Prior program benefit-cost measure ratios are provided where available from previous DSS Model analysis. The higher the benefit-cost ratio, the more beneficial the measure, namely the lower the cost per unit of water saved. Benefit-cost ratios can be used to compare particular measures to each other to determine which measures are more beneficial and cost effective. Utility benefit-cost ratios only look at the costs and benefits to the utility provider whereas the Community benefit-cost ratio takes into account the utility, developer, and customer.
  - ◆ The cost of water saved is included in the table when available from prior program DSS Model evaluation. The cost of water saved indicates the measures cost to save a million gallons of potable water. This cost represents the cost to the utility and does not include the costs to developers or customers.
  - ◆ The percent range column in Table 5-9 indicates the percentage of implementation of the customer sector in prior DSS Model evaluation work.



Upon evaluation of the potential water conservation measures outlined in Table 5-9, the project team identified the measures which should be included in a water conservation program for further evaluation using the DSS Model. The evaluation criteria outlined in Table 5-6 was used to determine which measures should be included. The selected measures were then prioritized based on the evaluation criteria for inclusion into three water conservation programs each with a varying number of water conservation measures for further evaluation. For each of the water conservation measures remaining, the project team determined the customer sectors and implementation rate to be evaluated within the program. When the screening process was complete, twenty-eight water conservation measures remained for inclusion into one or more of the three water conservation programs to be modeled utilizing the DSS Model. In addition, twenty-four other measures were identified as measures that would not be modeled, but rather included into the City of Petaluma's Water Conservation Plan with respect to water rates and ordinance items. Such items reduce water use with little cost to implement, such as increase publicity for water efficient products and require training on water conserving practices for landscape maintenance workers. The team agreed that such items should be incorporated into the City's Water Conservation Plan and future ordinances although water savings cannot be quantified by the DSS model. Table 5-10 shows the twenty-eight water conservation measures selected for inclusion into one or more of the three water conservation programs for further evaluation utilizing the DSS Model. (D) denotes a requirement for developers for implementing "on-site" measures. All measures were included in Program 3 with fewer measures included in Programs 1 and 2.

**TABLE 5-10**  
**WATER CONSERVATION MEASURES INCLUDED IN WATER CONSERVATION PROGRAMS 1, 2, AND 3**

Description of Conservation Activity	Water Conservation Program 1 (WCP1)	Water Conservation Program 2 (WCP2)	Water Conservation Program 3 (WCP3)
Residential Water Surveys - Indoor	X	X	X
Residential Water Surveys - Outdoor	X	X	X
Plumbing Retrofit Kits (Giveaways)	X	X	X
Water Budgets for Large Irrigators (Separate Meters)	X	X	X
Commercial Water Audits	X	X	X
High Efficiency (HE) Washing Machine Rebate	X	X	X
HE Washing Machine Requirement (D)	X	X	X
HE Dishwasher Requirement (D)	X	X	X
HE Faucets and Showerheads Requirement (D)	X	X	X
Hot Water System (D)	X	X	X
High Efficiency Toilet (HET) Requirement (D)	X	X	X
Direct Installation of HETs for toilets >3 gallons per flush (gpf) (w/ low income assistance)	X	X	X
Mandate Retrofit on Resale (urinals >1.6 gpf, toilets >3.5 gpf)			X
Require 0.5 gal/flush or Waterless Urinals in New Buildings (D)	X	X	X
Waterless Urinal Rebate			X
Public Information Program	X	X	X
Smart Irrigation Controller Rebates- SF		X	X
Smart Irrigation Controller Rebates- Non SF	X	X	X
Smart Controller with Rain-sensor Shutoff Device Requirement (D)	X	X	X
Landscape and Irrigation Requirements (D)	X	X	X

Description of Conservation Activity	Water Conservation Program 1 (WCP1)	Water Conservation Program 2 (WCP2)	Water Conservation Program 3 (WCP3)
Financial Incentives/ Rebates for Irrigation Upgrades	X	X	X
Plan Check for Renovation and for New Development (Over 1000 sf) (D)	X	X	X
Increase Enforcement of Landscape Requirements at Resale	X	X	X
Residential Landscape Training Classes			X
New Accounts Reduced Connection Fees- for installing efficient process equipment for selected businesses (restaurants, laundry mat, food/groceries and hospital) (D)			X
Hotel Retrofit (with financial assistance)			X
CIO Rebates - replace inefficient water using equipment			X
Submetering, meter each unit (by City)		X	X
<b>TOTAL NUMBER OF MEASURES</b>	<b>20</b>	<b>22</b>	<b>28</b>

(D) denotes a requirement for developers for implementing “on-site” measures.

A description of each of the twenty-eight measures included in Table 5-10 is shown in Table 5-11.

**TABLE 5-11**  
**WATER CONSERVATION MEASURE DESCRIPTION AND IMPACTED CUSTOMER SECTORS**

Name of Measure	Customer Sector	Description
Residential Water Surveys - Indoor	Existing Customers: SF, MF	This is the indoor component of water surveys for existing single-family and multi-family residential customers. Normally those with high water use are targeted. Audits are mandated before resale occurs, and customer call-ins are also included in this program.
Residential Water Surveys - Outdoor	Existing Customers: SF, MF	This is the outdoor component of water surveys for existing single-family and multi-family residential customers. Normally those with high water use are targeted. Audits are mandated before resale occurs, and customer call-ins are also included in this program.
Plumbing Retrofit Kits (Giveaways)	Existing Customers: SF, MF	Provide owners of pre-1992 homes with retrofit kits that contain easy-to-install low flow showerheads, faucet aerators hose end nozzles, and toilet tank retrofit devices.
Water Budgets for Large Irrigators (Separate Meters)	Existing and New Customers: Large Irrigators in CIO, TURF	Provide all irrigators of landscapes with separate irrigation accounts with a monthly irrigation water use budget on the water bill.
Commercial Water Audits	Existing Customers: CIO	Offer high water use accounts a free water audit that would evaluate ways for the business to save water and money.
High Efficiency (HE) Washing Machine Rebate	Existing Customers: SF, MF, CIO	Offer homeowners a rebate on a new water efficient clothes washer. Rebates will be offered to businesses if requested, but water savings for businesses was not included in the model.

Name of Measure	Customer Sector	Description
HE Washing Machine Requirement (D)	New Customers: SF, MF, CIO	Require developers to install an efficient washer before new home, commercial, or public building occupancy.
HE Dishwasher Requirement (D)	New Customers: SF, MF, CIO	Require developers to install a qualified efficient dishwasher.
HE Faucets and Showerheads Requirement (D)	New Customers: SF, MF, CIO, INST	Require developers to install Lavatory faucets that flow at no more than 1.5 gpm, kitchen faucets at 2.2 gpm, and showerheads at 2.0 gpm.
High Efficiency Toilet (HET) Requirement (D)	New Customers: SF, MF, CIO, INST	Require developers to install high efficiency toilets (HETs).
Direct Installation of HETs for toilets >3 gallons per flush (gpf) (w/ low income assistance)	Existing Customers: SF, MF, CIO, INST	Provide a rebate or voucher for the installation of a high efficiency toilet (HET).
Mandate retrofit on resale (urinals >1.6 gpf, toilets >3.5 gpf)	Existing Customers: SF, MF, INST	Mandate that all high use toilets (> 3.5 gpf to 1.6 gpf) and urinals (>1.6 gpf to 1.0 gpf) be replaced at resale.
Require 0.5 gpf or waterless urinals in new buildings (D)	New Customers: CIO, INST	Require that new buildings be fitted with 0.5 gpf urinals or waterless urinals (developer option) rather than the current standard of 1.0-gal/flush models.
Waterless Urinal Rebate	Existing Customers: CIO, INST	Offer rebates for installation waterless urinals.
Public Information Program	Existing and New Customers: SF	Raise awareness for water conservation through public education programs such as poster contests, speakers to community groups, radio and television time, and printed educational material such as bill inserts.
Smart Irrigation Controller Rebates	Existing Customers: SF	Provide a rebate for the purchase of a SMART irrigation controller and associated signal fees. Assume one controller. Minimum participant requirements: at least 500 sf of well maintained turf.
Smart Irrigation Controller Rebates	Existing Customers: MF, CIO, INST	Provide a rebate for the purchase of a SMART irrigation controller and associated signal fees. Assume two controllers. Minimum participant requirements: at least 500 sf of well maintained turf.
Smart Controller with Rain-sensor Shutoff Device Requirement (D)	New Customers: SF, MF, CIO, INST	Require installation of smart controllers with rain sensor for all new irrigation systems.
Landscape and Irrigation Requirements (D)	New Customers: SF, MF, CIO, INST	Enforce a regulation that specifies that homes be landscaped according to water efficient principals, with appropriate irrigation systems. (Combines with Smart Controller listed above). Goal is an overall 25% reduction of irrigation water use.

Name of Measure	Customer Sector	Description
Financial Incentives/ Rebates for Irrigation Upgrades	Existing Customers: MF, CIO, INST	For customers with landscape, provide rebates for selected types of irrigation equipment upgrade including rain sensors.
Plan Check for Renovation and for New Development (Over 1000 sf) (D)	Existing and New Customers over a certain size (>1000 sf): SF, MF, CIO, INST	Developer or contractor to submit irrigation and planting plans to the City for approval of turf areas greater than 1000 sf. This area can be revised based on summer water use of turf areas in the City of Petaluma.
Increase Enforcement of Landscape Requirements at Resale	Existing Customers: SF, MF	Enforce landscape requirements on renovated landscaping including use of low water use plants and efficient irrigation.
Residential Landscape Training Classes	Existing and New: SF	Combination of three types of training classes: (1) Low Water Use Landscaping (2) Homeowner Irrigation, and (3) Promotion of Water Efficient Plants.
New Accounts Reduced Connection Fees- for installing efficient process equipment for selected businesses (restaurants, laundry mat, food/groceries and hospital) (D)	New Customers: CIO	Offer reduced water and sewer connection fees to new facilities that install water efficient equipment that exceeds the building code requirements.
Hotel Retrofit (w/financial assistance)	Existing Customers: CIO	Following a free water audit, offer the hotel a rebate for equipment identified that would save water. Provide a rebate schedule for certain efficient equipment such as air-cooled ice machines, steamers, washers, cooling towers, and spray rinse valves.
CIO Rebates – replace inefficient water using equipment	Existing Customers: CIO	Following a free water audit, provide a list of rebates for water efficient equipment such as air-cooled ice machines, steamers, washers, cooling towers, and spray rinse valves.
Submetering, meter each unit (by City)	New Customers: MF, CIO, INST	City to require submetering of each commercial unit, such as strip malls, and all multi-family accounts.
Hot Water System (D)	New Customers: SF, MF	All new single-family and multi-family housing units have a hot water on demand systems installed. This includes a recirculation pump and insulated hot water pipes.

(D) denotes a requirement for developers for implementing “on-site” measures.

Table 5-12 includes the twenty-four (24) other water conservation measures that were determined by the project team not to be included in the DSS Model, but to be included within the Water Conservation Plan. These items include water rate items, ordinance items, and additional programs. Such items reduce water use with little cost to implement, such as increase publicity for water efficient products and require training on water conserving practices for landscape maintenance workers. The team agreed that such items should be incorporated into the City’s Water Conservation Plan and future ordinances although water savings cannot be quantified by the DSS model.

**TABLE 5-12**

**WATER CONSERVATION MEASURES FOR INCLUSION IN WATER CONSERVATION PLAN**

Conservation Item		New/ Existing Customer	Customer Sectors
<b>Rates</b>			
	Tiered Rates During Peak Times/ 4th Tier Rates for Highest Demand Residential Water Users	E,N	ALL
	Water Budget Based Billing	E,N	ALL
<b>Ordinance</b>			
	Contract Language Added to Hire Only Certified Landscapers	E,N	BUS,IND
	Water Management Education for Large Irrigation. In Contract Language	E	BUS,IND,TURF
	Dual Meter Requirements for Large Irrigation. (Current)	N	RSF,BUS,IND,PUB,TURF
	AMR Meter Requirement (Current)	N	ALL
	Require Auto Close Faucets (D)	N	BUS,IND, PUB
<b>Programs</b>			
	Demonstration Projects- Parks	E,N	ALL
	Centralized Website for Rebates/ Vouchers/ List	E,N	ALL
	Provide Templates for Landscape	E	RSF,RMF
	Restaurants to Serve Water Upon Request	E,N	BUS,IND
	Work with HOAs to Hire Certified Contractors	E	RSF,RMF
	Train/Certify Workers/Contractors, Bilingual Education Materials	E,N	ALL
	Developer Trains Buyer on Irrigation System: Certified Person (D)	N	RSF,RMF
	Model Homes with Water Saving Practices/ Pamphlets (D)	N	RSF,RMF
	Water Conservation Info at Related Stores	E,N	ALL
	Water Conservation Info in Billing	E, N	ALL
<b>Wasting</b>			
	Prohibit Overhead Irrigation of strips <8'	E,N	ALL
	Prohibit Irrigation Runoff	E,N	ALL
	Prohibit Once-Thru Cooling	E,N	ALL
	Prohibit Non-Recirculating Fountains	E,N	ALL
	Require Car Washes to Recycle Water	E,N	CIO
	Prohibit Water Cooled Ice Machines	E,N	ALL
	Hardscape and Car Washing with Self Closing Nozzle Only	E,N	ALL

(D) denotes a requirement for developers for implementing “on-site” measures.

## Evaluation of Potential Water Conservation Programs

### DSS Model

The three programs outlined in Table 5-10 were analyzed for cost effectiveness and water savings using the Least Cost Planning Decision Support System (DSS) Model. An article summarizing the DSS Model is found in **Appendix G - DSS Model Description**. The DSS Model also serves as an end use model for the community of how water is used by each customer sector. Within the model a water demand baseline profile is developed for the community. Each customer class is analyzed for water use based on historical data, and published end use consumption estimates are used to

determine how water is used by each customer for each water end use at a particular customer site. Wastewater savings and energy savings costs are also estimated and included in the cost benefit analysis.

Projected water demands developed under the Water Demand and Supply Analysis Project were used to calibrate the model forecasts. New single-family residences were considered a separate category from existing single-family residences since water use at new single-family residences was found to have a higher irrigation trend under the Water Demand and Analysis. The effects of the plumbing code were also separated within the model to account for water reduction with the effects of the plumbing code in place. A graphic of this process is shown in Figure 5-1.

The model incorporates the interaction between water conservation measures for each end use. For example hot water on demand systems, high efficiency faucets and showerheads, and submetering all target multi-family shower and faucet end uses. Savings for each measure when acting together decrease because one of the other measures has already decreased the use for the subsequent measure. The model takes the product of the reduction caused by each measure as the net reduction for the set of measures.

**FIGURE 5-1**  
**DSS MODEL PROCESS**

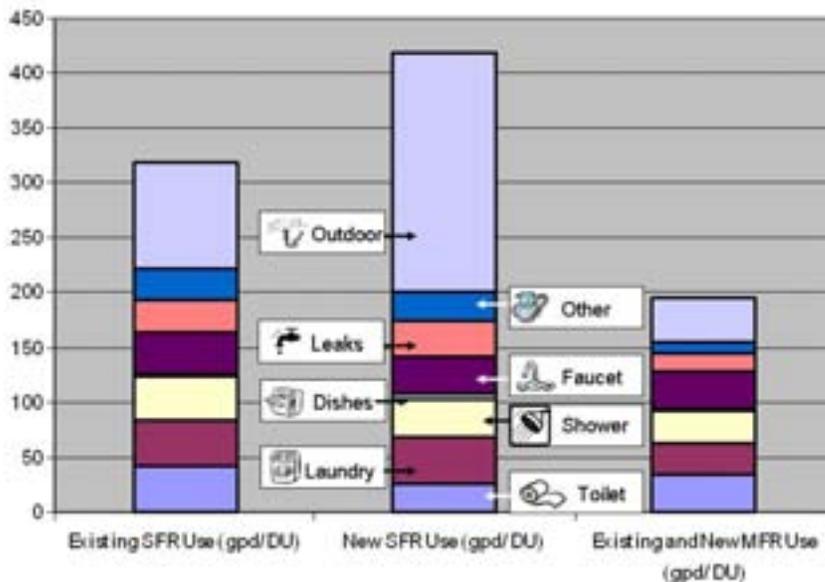


One feature of the model is that an end use model of the City is created. Each type of customer uses water differently. Although most customers have toilet and irrigation end uses, differences exist in percentages of total use. Each water conservation measure targets specific end uses. Main end uses include toilets, urinals, faucets, showers, laundry, kitchen, irrigation, process, and leakage. End uses for residential customers have been studied and can be predicted based on an average housing density. End use data for the City of Petaluma’s residential customers is shown in Figure 5-2. Commercial and institutional customers vary in type and therefore their end uses also vary. For such accounts an average can be determined.

New single-family homes constructed after 2002 is expected to have a higher potable water demand than existing single-family residences Year 2002. In the Water Demand and Supply Analysis Report

dated June 2006, the existing single-family residence water use factor was calculated as 317.4 gpd/unit. The increase was noted in billing data records for new homes within Petaluma and all other surrounding communities served by SCWA during preparation of the 2005 Urban Water Management Plan by SCWA. An average water use factor of 418 gpd/unit was calculated for new single-family homes within Petaluma constructed after 2002 through analysis of billing records. This factor will be applied to all new single-family homes to develop potable water demands for the City. More detail on the development of the water use factor can be found in Appendix B of the Water Demand and Supply Analysis Report. An understanding of this increase and the end uses that also increase is necessary to predict the water savings due to water conservation measures for new single-family residences. End uses for residential customers have been studied and can be predicted based on an average housing density. Water conservation measures target specific end uses of each customer sector. A majority of the water increase is due to increased outdoor irrigation water use. This increase in single-family residential water demand especially in outdoor use is reflected in Figure 5-2.

**FIGURE 5-2**  
**RESIDENTIAL END USES FOR EXISTING AND NEW SINGLE-FAMILY RESIDENCES AND MULTI-FAMILY RESIDENCE**



### Model Input Data

For each measure, assumptions about the percentage of implementation and the actual costs need to be developed. For example, under the residential retrofit fixture giveaway program, the City's goal could be to reach 75% of existing residential customers after a six year program. Such assumptions impact the cost to implement the program as well as the water savings achieved. The model includes a fixture model to account for the natural replacement of older and more water consuming water fixtures. Input data for each measure is found in **Appendix H - DSS Model Input for Each Evaluated Measure**. The input data is outlined below.

- ◆ Market penetration – percentage of accounts that will be impacted
- ◆ Measure length to reach goal – years to reach market penetration goal

- ◆ Measure life – length of time that the measure will continue to save water
- ◆ Year to begin measure - start year of measure implementation
- ◆ Water use reductions - anticipated reduction in end use water demand
- ◆ End use - use of water that the measure impacts such as toilet, laundry, irrigation, etc.
- ◆ Program length - duration of water conservation measure program
- ◆ Utility unit cost - cost for water utility to implement measure
- ◆ Customer unit cost – cost for customer and/or developer to implement measure, such as cost of installing new equipment
- ◆ Annual administration/ marketing cost – mark-up in utility cost to publicize and implement measure

### Model Output Data

Output data for the DSS Model for each program includes the following information:

- ◆ Program water savings for each year of the program.
- ◆ Program cost for each year of the program.
- ◆ Benefit-cost ratios for each measure included in the program. Utility benefit-cost ratios include only the impact on the utility or City. Utility-Developer benefit-cost ratios include the impact on the utility as well as the developer who may have to pay increased connection fees or pay for more water conserving devices as a baseline cost to the development. Community benefit-cost ratios include the impact to the utility (City), developer, and customer.
  - The benefit-cost ratio is a ratio of benefits and the costs. The higher the benefit-cost ratio, the more cost effective the water conservation measure is compared to the other measures considered.
  - Three viewpoints are considered in this analysis. Utility benefits include the reduced cost of purchasing less water and costs include additional staffing to check plans, purchasing meters, and offering rebates. Developer costs include the additional cost to purchase water efficient technology compared to the Building Code and increased connection fees. Community benefits include reduced energy costs.
- ◆ Amount of water saved for each measure included in the program.

Table 5-13 provides a detailed list of the twenty-eight water conservation measures included in the DSS Model and their associated model output information. A list of the information provided for each measure includes:

- ◆ New or Existing Customer
- ◆ Customer Sector
- ◆ Utility, Utility + Developer, and Community (Utility + Developer + Customer) Benefit-Cost Ratio
- ◆ Year 2025 Annual Water Savings
- ◆ Degree of Implementation/Market Penetration
- ◆ Program Length
- ◆ Program(s) where measure has been included

**TABLE 5-13**

**WATER CONSERVATION MEASURES INCLUDED IN THE DSS MODEL FOR THE PETALUMA WATER CONSERVATION PLAN**

Potential Water Conservation Measure	Customer		Benefit-Cost Ratio <sup>1</sup>			2025 Water Savings (MG/Year)	Degree of Implementation		Water Conservation Program		
	New/ Existing	Sector	Utility	Utility + Developer	Community (Utility + Developer+ Customer)		Market Penetration (%)	Program Length	1	2	3
Residential Water Surveys - Indoor	E	SF, MF	1.60	N/A	3.34	26.8	Resale, call-in	30	x	x	x
Residential Water Surveys - Outdoor	E	SF, MF	1.61	N/A	1.45	26.5	Resale, call-in	30	x	x	x
Residential Retrofit Kit (Giveaways)	E	SF, MF	6.75	N/A	11.41	6.6	75.0%	6	x	x	x
Water Budgets for Large Irrigators (Separate Meters)	E,N	CIO, TURF	4.56	N/A	4.56	33.3	90%	5	x	x	x
Commercial Water Audits	E	CIO	1.77	N/A	1.33	43.5	10%	3	x	x	x
Clothes Washer Rebate	E	SF, MF, CIO	2.72	N/A	0.89	11.3	10%	3	x	x	x
High Efficiency (HE) Washing Machine Requirement (D)	N	SF, MF, CIO	36.41	0.89	0.97	34.2	100%	Indefinite	x	x	x
HE Dishwasher Requirement (D)	N	SF, MF, CIO	4.70	0.15	0.16	4.6	100%	Indefinite	x	x	x
H.E Faucets and Showerheads (D)	N	SF, MF, CIO, INST	20.21	4.01	13.14	19.7	100%	Indefinite	x	x	x
High Efficiency Toilet (HET) Requirement (D)	N	SF, MF, CIO, INST	19.64	0.78	0.86	34.4	100%	Indefinite	x	x	x
Direct Install HETs for >3.5 gallons per flush (gpf) toilets (w/ Low Income Assistance)	E	SF, MF, CIO, INST	0.36	N/A	0.31	24.6	15%	10	x	x	x
Mandate Retrofit on Resale	E	SF, MF, INST	0.67	N/A	0.37	10.5	Resale	10			x
1/2 gpf or Waterless Urinal Requirement (D)	N	CIO, INST	5.10	0.17	0.30	3.7	100%	Indefinite	x	x	x
Waterless Urinal Rebate	E	CIO, INST	0.67	N/A	0.31	1.5	10%	30			x
Public Information Program	E,N	SF	1.96	N/A	3.67	22.4	50%	30	x	x	x
Smart Irrigation Controller Rebates (start 2010)	E	SF	0.29	N/A	0.24	4.2	5%	15		x	x
Smart Irrigation Controller Rebates (start 2010)	E	MF, CIO, INST	1.02	N/A	0.94	14.7	20%	15	x	x	x
Smart Irrigation Controller w/ Rain Sensor Requirement (D)	N	SF, MF, CIO, INST	47.32	1.15	1.27	46.9	100%	Indefinite	x	X	x

Potential Water Conservation Measure	Customer		Benefit-Cost Ratio <sup>1</sup>			2025 Water Savings (MG/Year)	Degree of Implementation		Water Conservation Program		
Landscape and Irrigation Requirements in Ordinance (D)	N	SF, MF, CIO, INST	31.55	0.13	0.14	31.3	100%	Indefinite	x	x	x
Irrigation System Upgrade Incentives/ Rebates	E	MF, CIO, INST	1.88	N/A	1.04	7.4	10%	15	x	x	x
Plan Check for New Development and Renovation (Over 1000 sf) (D)	E,N	SF, MF, CIO, INST	3.56	0.33	0.41	55.8	CDD Permit application/100 %	10	x	x	x
Increase Enforcement of Landscape Requirement for renovated landscaping as permitted and New Development	E	SF, MF	3.29	N/A	1.13	32.4	Audit upon work completion	Indefinite	x	x	x
Landscape Education Training Prog.	E,N	SF	8.33	N/A	0.53	15.6	180 people/yr	Indefinite			x
Reduced Connection Fee for Selected Customer Types (D)	N	CIO	3.17	0.29	0.35	5.9	100%	Indefinite			x
Hotel Retrofit (w/financial assistance)	E	CIO	2.30	N/A	0.89	2.6	20%	15			x
CII Rebates to Replace Inefficient Equipment	E	CIO	0.24	N/A	0.09	0.7	10%	25			x
Submetering, Metering of Each Unit (by City)	N	MF, CIO, INST	17.06	5.69	6.56	34.0	100%	Indefinite		x	x
Hot Water System (D)	N	SF, MF	7.33	0.26	0.16	24.1	100%	Indefinite	x	x	x
<b>TOTAL</b>									<b>20</b>	<b>22</b>	<b>28</b>

(D) denotes a requirement for developers for implementing "on-site" measures.

<sup>1</sup> Benefit -cost ratio is a ratio of benefits, estimated from cost savings due to purchasing less water from SCWA, and the costs, estimated from the Utility's cost to fund rebate programs, check that requirements have been made, install devices, etc. The higher the benefit-cost ratio, the more cost effective the water conservation measure is to the Utility compared to the other measures considered.

The DSS Model output data for the three water conservation programs evaluated indicated total program water savings at Buildout (2025). Each program's water savings exceeded the established goal of 495 MG/Year. All programs start in Year 2008, however some measures do not start until Year 2010 as noted in the input data. The water savings is shown in Table 5-14 and graphically in Figure 5-3.

**TABLE 5-14**  
**PROGRAM 1, 2, AND 3 YEAR 2025 WATER SAVINGS**

Program	Water Saved in 2025 (MG/Year)	ADMM Reduction in 2025 (mgd)
1	504	2.58
2	537	2.68
3	562	2.81

**FIGURE 5-3**  
**WATER CONSERVATION PROGRAM WATER SAVINGS PER YEAR FOR EACH OF THE PROPOSED WATER CONSERVATION PROGRAMS**

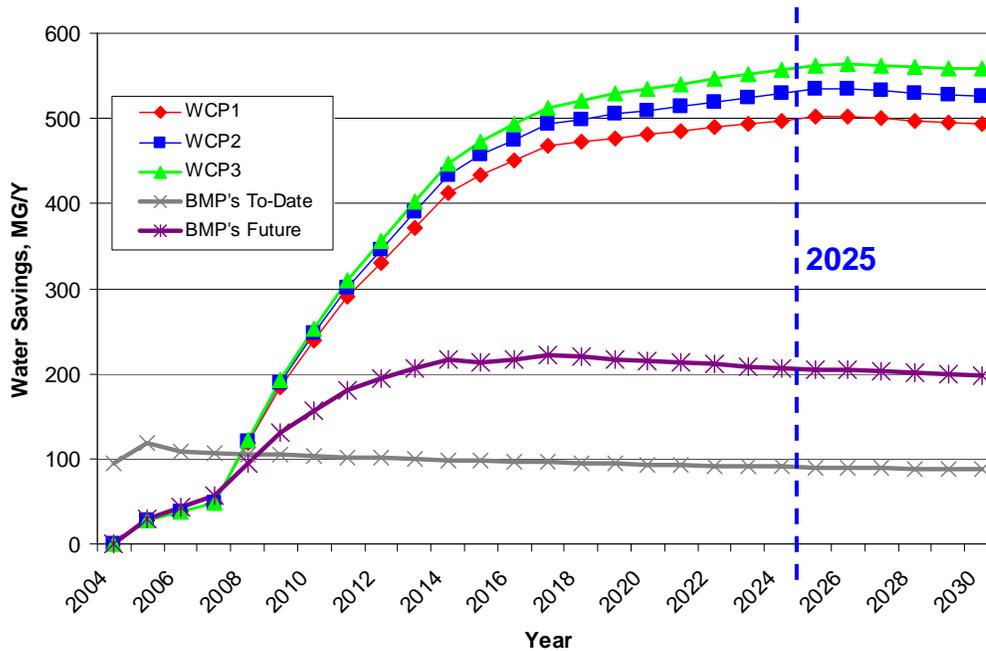


Figure 5-3 depicts increased water savings with time since water conservation measures are implemented over many years and it takes time for water savings to develop. In addition to water savings achieved by programs 1, 2, and 3, Figure 5-3 also illustrates the water savings expected by the existing BMPs already accomplished as well as the water savings expected from continued implementation of BMP's under the CUWCC MOU. Program costs were calculated within the DSS Model. Annual program costs as well as each program's annualized 80 year present worth cost are included in **Appendix I- Annual Program Costs and 80 Year Present Worth Analysis**. These costs were developed based on cost to the utility only and cost to the utility plus development community. Table 5-15 summarizes these costs.

**TABLE 5-15**  
**PROGRAM 1, 2, 3 COST INFORMATION**

Water Conservation Program	1		2		3	
<b>Annual Program Cost</b>						
Year	Utility	Utility+ Developer	Utility	Utility+ Developer	Utility	Utility+ Developer
2008	\$903,299	\$3,732,521	\$910,285	\$3,753,478	\$938,362	\$3,842,617
2009	\$843,829	\$3,575,038	\$850,805	\$3,595,966	\$879,454	\$3,685,676
2010	\$903,425	\$3,636,312	\$959,606	\$3,706,427	\$1,052,520	\$3,860,402
2011	\$845,576	\$3,396,669	\$902,018	\$3,467,569	\$996,355	\$3,624,182
2012	\$790,956	\$3,309,998	\$847,390	\$3,380,871	\$943,029	\$3,538,786
2013	\$859,274	\$3,355,781	\$915,700	\$3,426,628	\$1,012,640	\$3,585,845
2014	\$858,915	\$3,342,284	\$915,333	\$3,413,109	\$1,013,575	\$3,573,627
2015	\$787,381	\$2,822,423	\$843,792	\$2,893,226	\$943,336	\$3,055,047
2016	\$634,585	\$1,511,531	\$686,493	\$1,568,824	\$782,721	\$1,689,263
2017	\$636,727	\$1,511,300	\$688,634	\$1,568,593	\$785,354	\$1,689,522
2018	\$221,178	\$778,909	\$273,085	\$836,201	\$358,872	\$946,198
2019	\$159,665	\$717,396	\$211,571	\$774,687	\$297,741	\$885,066
2020	\$158,140	\$715,871	\$160,831	\$723,946	\$178,755	\$766,079
2021	\$161,725	\$748,874	\$164,818	\$758,154	\$183,658	\$808,840
2022	\$162,019	\$749,168	\$165,112	\$758,448	\$184,104	\$809,286
2023	\$150,339	\$737,490	\$153,432	\$746,767	\$160,322	\$785,503
2024	\$150,498	\$737,649	\$153,590	\$746,925	\$160,480	\$785,661
2025	\$150,657	\$737,808	\$153,748	\$747,083	\$160,638	\$785,819
<b>80 Year Present Worth Analysis</b>						
80 Year Present Worth	\$9,414,663	\$29,827,881	\$9,887,042	\$30,427,168	\$10,780,853	\$31,888,882
Annualized 80 Year Present Worth	\$311,736	\$987,653	\$327,377	\$1,007,497	\$356,973	\$1,055,897
<b>Annualized 80 Year Present Worth/ Unit of Water Saved</b>						
(\$/MG)	\$717	\$2,270	\$704	\$2,165	\$723	\$2,138
(\$/ Acre- Foot)	\$234	\$740	\$229	\$706	\$236	\$697

Note: All costs are in 2006 dollars

On an 80 year present worth cost basis all three programs evaluated are more cost effective than potable water supply. The annualized 80 Year present worth cost per unit of water saved for Programs 1, 2, and 3 is less than the current cost to purchase and distribute SCWA water to the City of Petaluma’s potable water customers. The current cost of purchasing potable water from SCWA and distributing the water to the City of Petaluma customers is \$2,661/MG or \$870/acre-foot. In addition, the water conservation program costs are also less than obtaining additional potable water supply for the City of Petaluma through recycled water offset (\$3,462/MG or \$1,128/acre-foot) or City-owned groundwater well supply (\$3,416/MG or \$1,113 acre-foot).

Since the three water conservation programs’ water savings in Year 2025, exceed the Water Conservation Program goal of 495 MG/Year, the three programs were further

evaluated by the project team and water conservation measures that are more costly than others, save only small quantities of water, or those which may be difficult to implement were removed. Through this process, the water conservation project team was able to develop a recommended program that met the water conservation plan goal for water savings of approximately 495 MG/Year at buildout, but also reduced the cost of the overall program and achieved a lower cost per unit of water saved. The recommended water conservation program includes nineteen of the original twenty-eight water conservation measures modeled. A list of the recommended water conservation program's measures is shown in Table 5-16.

**TABLE 5-16**  
**SUMMARY OF MEASURES INCLUDED IN THE RECOMMENDED WATER CONSERVATION PROGRAM**

Corresponding Measure Number	Description of Conservation Measure
P1	Residential Water Surveys - Indoor
P2	Residential Water Surveys - Outdoor
P3	Plumbing Retrofit Kits (Giveaways)
P4	Water Budgets for Large Irrigators (Separate Meters)
P5	Commercial Water Audits
P6	High Efficiency (HE) Washing Machine Rebate
P7	HE Washing Machine Offer (D)
P8	HE Faucets and Showerheads Requirement (D)
P9	High Efficiency Toilet (HET) Requirement (D)
P10	City Purchase and Install HET's (urinals >1.6 gpf, toilets >3.5 gpf)
P11	Public Information Program
P12	Smart Irrigation Controller Rebates- Non Single-Family Residential
P13	Smart Controller with Rain-Sensor Shutoff Device Requirement (D)
P14	Landscape and Irrigation Requirements (D)
P15	Application process for Landscape Renovation (Over 1000 sf and less than 500 sf) (D)
P16	Increase Enforcement of Landscape Requirements
P17	Residential Landscape Training Classes
P18	Hotel Retrofit (w/financial assistance)
P19	Submetering, meter each unit (by City)

(D) denotes a requirement for developers for implementing "on-site" measures.

# **SECTION SIX**

## **RECOMMENDED WATER CONSERVATION PROGRAM**

## SECTION SIX

# RECOMMENDED WATER CONSERVATION PROGRAM

Since the development of the water conservation programs 1, 2, and 3 and measures described in Section 5, two changes were made to the recommended program. First, California passed AB 715 which requires that on or after January 1, 2014, all toilets and urinals sold and installed in California be high efficiency models; therefore, measures P-9 and P-10 were revised to start implementation in 2008 and stop implementation at the end of 2013. Second, measure P-10 was modified from a mandated retrofit at resale program with City rebate to a program where the City will purchase and install high efficiency toilets for customers with high flow toilets. This change was implemented following discussions with the community. The model for the recommended water conservation program was updated and rerun to reflect the restructuring of measure P-10 and for incorporation of AB 715 into measures P-9, P-10, and future water demand projections.

The recommended water conservation program contains nineteen (19) measures. These measures are outlined in Table 6-1. Table 6-1 provides the measure number, name of measure, customer sector(s) affected, and a description of the measure.

**TABLE 6-1  
RECOMMENDED WATER CONSERVATION PROGRAM MEASURES**

Measure No.	Name of Measure	Customer Sector	Description
P1	Residential Water Surveys - Indoor	Existing Customers: SF, MF	This is the indoor component of water surveys for existing single-family and multi-family residential customers. Normally those with high water use are targeted. Water use evaluations that are marketed by realtors during the time of resale and customer call-ins are also included in this program.
P2	Residential Water Surveys - Outdoor	Existing Customers: SF, MF	This is the outdoor component of water surveys for existing single-family and multi-family residential customers. Normally those with high water use are targeted. Water use evaluations that are marketed by realtors during the time of resale and customer call-ins are also included in this program.
P3	Plumbing Retrofit Kits (Giveaways)	Existing Customers: SF, MF	Provide owners of pre-1992 homes with retrofit kits that contain easy-to-install low flow showerheads, faucet aerators hose end nozzles, and toilet tank leak detection devices. These are also provided during surveys.
P4	Water Budgets for Large Irrigators (Separate Meters)	Existing and New Customers: Large Irrigators in CIO, TURF	Provide all irrigators of landscapes with separate irrigation accounts a monthly irrigation water use budget on the water bill.
P5	Commercial Water Audits	Existing Customers: CIO	Offer high water use accounts a free water audit that would evaluate ways for the business to save water and money.

Measure No.	Name of Measure	Customer Sector	Description
P6	High Efficiency (HE) Washing Machine Rebate	Existing Customers: SF, MF, CIO	Offer homeowners a rebate on a new water efficient clothes washer. Rebates will be offered to businesses if requested, but water savings for businesses was not included in the model.
P7	HE Washing Machine Requirement (D)	New Customers: SF, MF, CIO	Require developers to offer to install an efficient washer before new home, commercial, or public building occupancy.
P8	HE Faucets and Showerheads Requirement (D)	New Customers: SF, MF, CIO, INST	Require developers to install Lavatory faucets that flow at no more than 1.5 gpm, kitchen faucets at 2.2 gpm, showerheads at 2.0 gpm.
P9	High Efficiency Toilet (HET) Requirement (D)	New Customers: SF, MF, CIO, INST	Require developers to install high efficiency toilets (HETs) for new development from 2008 to 2013. The plumbing code requirement begins in 2014.
P10	City Purchase and Install HETs	Existing Customers: SF, MF, INST	City to purchase and install HETs (1.3 gpf) for customers with high flow toilets from 2008 through 2013. City may work through a contractor and will target public facilities and then high water users.
P11	Public Information Program	Existing and New Customers: SF	Raise awareness for water conservation with public education programs such as seminars, videos, speakers to community groups, radio and television time, and printed educational material such as bill inserts.
P12	Smart Irrigation Controller Rebates	Existing Customers: MF, CIO, INST	Provide a rebate for the purchase of a SMART irrigation controller and associated signal fees. Assume one controller per site. Minimum participant requirements: at least 500 sf of well maintained turf.
P13	Smart Controller with Rain-sensor Shutoff Device Requirement (D)	New Customers: SF, MF, CIO, INST	Require installation of smart controllers with rain sensor for all new irrigation systems.
P14	Landscape and Irrigation Requirements (D)	New Customers: SF, MF, CIO, INST	Enforce a regulation that specifies that landscapes be designed and installed according to water efficient principals, with appropriate irrigation systems. (Combines with Smart Controller listed above). Goal is an overall 25% reduction of irrigation water use. Includes plan review as part of project approval process.
P15	Application Process for Landscape Renovations >1000 sf and < 5000 sf	Existing Customers (>1000 sf and < 5000 sf): MF, CIO, INST	Developer or contractor to submit application to the City for approval of renovations greater than 1000 sf and less than 5000 sf.

Measure No.	Name of Measure	Customer Sector	Description
P16	Increase Enforcement of Landscape Requirements	Existing Customers: SF, MF	Enforce landscape requirements on renovated and new development landscaping including use of low water use plants and efficient irrigation.
P17	Residential Landscape Training Classes	Existing and New: SF	Combination of three types of training classes: (1) Low Water Use Landscaping (2) Homeowner Irrigation, and (3) Promotion of Water Efficient Plants.
P18	Hotel Retrofit (w/financial assistance)	Existing Customers: CIO	Following a free water audit, offer the hotel a rebate for equipment identified that would save water. Provide a rebate schedule for certain efficient equipment such as air-cooled ice machines, steamers, washers, cooling towers, and spray rinse valves.
P19	Submetering, meter each unit (by City)	New Customers: MF, CIO, INST	City to require submetering of each commercial unit, such as strip malls, and all multi-family accounts. Sub-meters may be provided by the City or the owner depending upon congestion issues for efficient installation.

(D) denotes a requirement for developers for implementing “on-site” measures.

A summary of the DSS model input data for the recommended program is included in **Appendix H – DSS Model Input for Evaluated Measures**. Model output data is included in Table 6-2. The table includes information on each of the nineteen measures included in the recommended program. The table includes:

- ◆ New versus Existing Customer
- ◆ Customer Sector
- ◆ Utility, Utility + Developer, and Community (Utility + Developer + Customer) Benefit-Cost Ratio
  - The benefit-cost ratio is a ratio of benefits and the costs. The higher the benefit-cost ratio, the more cost effective the water conservation measure is compared to the other measures considered.
  - Three viewpoints are considered in this analysis. Utility benefits include the reduced cost of purchasing less water and costs include additional staffing to check plans, purchasing meters, and offering rebates. Developer costs include the additional cost to purchase water efficient technology compared to the Building Code. Community benefits include reduced energy costs.
- ◆ Year 2025 Annual Water Savings
- ◆ Degree of Implementation/Market Penetration
- ◆ Program Length

**TABLE 6-2  
WATER CONSERVATION MEASURES INCLUDED IN THE PETALUMA RECOMMENDED WATER CONSERVATION PLAN**

Measure Number	Water Conservation Measures	Customer		Benefit Cost Ratio <sup>1</sup>			Water Savings in 2025 (MG/Year)	Degree of Implementation	
		New/ Existing	Sector	Utility	Utility + Developer	Community (Utility + Developer+ Customer)		Market Penetration (%)	Program Length
P1	Residential Water Surveys - Indoor	E	SF, MF	1.60	N/A	3.33	26.7	100%	30
P2	Residential Water Surveys - Outdoor	E	SF, MF	1.61	N/A	1.45	26.5	100%	30
P3	Residential Retrofit Kit (Giveaways)	E	SF, MF	6.59	N/A	11.33	6.4	75%	6
P4	Water Budgets for Large Irrigators (Separate Meters)	E,N	CIO, TURF	4.56	N/A	4.56	33.3	90%	5
P5	Commercial Water Audits	E	CIO	1.73	N/A	1.29	35.3	10%	3
P6	Clothes Washer Rebate/ Incentive	E	SF,MF,CIO	2.72	N/A	0.89	11.3	10%	3
P7	High Efficiency (HE) Washing Machine Offer (D)	N	SF,MF,CIO	36.41	0.89	0.97	34.2	100%	Indefinite
P8	HE Faucets and Showerheads Requirement (D)	N	SF,MF,CIO, INST	20.21	4.01	13.14	19.7	100%	Indefinite
P9	High Efficiency Toilet (HET) Requirement (D)	N	SF,MF,CIO, INST	17.09	0.68	0.75	15.7	100%	Indefinite
P10	City Purchase and Install HET's	E	SF,MF,INST	0.25	N/A	0.25	3.8	SF 1386, MF 444, CII 25	5
P11	Public Information Program	E,N	SF	1.96	N/A	3.67	22.4	Varies	30
P12	Smart Irrigation Controller Rebates (start 2010)	E	MF,CIO,INST	1.02	N/A	0.94	14.7	20%	15
P13	Smart Irrigation Controller w/ Rain Sensor Requirement (D)	N	SF,MF,CIO, INST	47.32	1.15	1.27	46.9	100%	Indefinite
P14	Landscape and Irrigation Requirements (D)	N	SF,MF,CIO, INST	31.55	0.13	0.14	31.3	100%	Indefinite
P15	Application Process for Landscape Renovations (>1000 sf and < 500 sf ) (D)	E,N	SF,MF,CIO,INST	3.56	0.33	0.41	55.8	CDD Permit application/100%	10
P16	Increase Enforcement of Landscape Requirement for renovated landscaping as permitted in P15	E	MF, CIO, INST	3.29	N/A	1.13	32.4	Audit upon work completion	Indefinite
P17	Landscape Education Training Program	E,N	SF	8.33	N/A	0.53	15.6	180 people/yr	Indefinite
P18	Hotel Retrofit (w/financial assistance)	E	CIO	2.30	N/A	0.89	2.6	20%	15
P19	Submetering, Meter Each Unit	N	MF, CIO, INST	11.15	3.72	4.29	22.1	100%	Indefinite

(D) denotes a requirement for developers for implementing "on-site" measures.

<sup>1</sup> Benefit -cost ratio is a ratio of benefits, estimated from cost savings due to purchasing less water from SCWA, and the costs, estimated from the Utility's cost to fund rebate programs, check that requirements have been made, install devices, etc. The higher the benefit-cost ratio, the more cost effective the water conservation measure is to the Utility compared to the other measures considered.

Benefit-cost ratios and water savings for individual measures do not add up to total benefit-cost ratio and water savings for the program.

Results include passage of AB715 in October 2007 which requires that all toilets and urinals sold and installed be high efficient models by January 1, 2014.

The DSS model output data for the recommended program indicates a total annual water savings just below the established goal for the program of 495 MG/Year in Year 2025. In addition, the program provides for an ADMM reduction of 2.39 mgd in Year 2025. This information is presented in Table 6-3 and can be seen graphically in Figure 6-1.

**TABLE 6-3  
RECOMMENDED PROGRAM WATER SAVINGS**

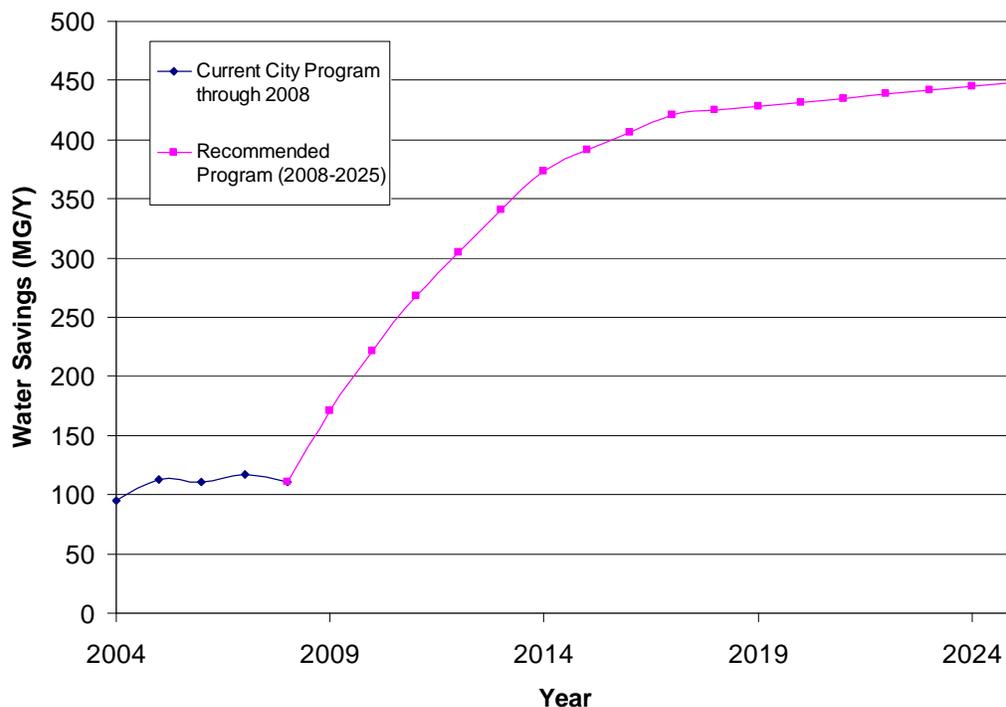
Year	Annual Water Savings (MG/Year)			ADMM Reduction (mgd)
	Total	Indoor	Outdoor	
2008	111	45	66	0.57
2009	171	72	99	0.88
2010	222	93	129	1.14
2011	268	109	158	1.39
2012	304	121	184	1.59
2013	341	132	209	1.79
2014	374	140	234	1.98
2015	391	148	244	2.07
2016	406	150	256	2.16
2017	421	152	269	2.26
2018	425	153	272	2.28
2019	429	155	274	2.30
2020	432	157	275	2.31
2021	435	158	277	2.33
2022	438	160	278	2.34
2023	442	161	280	2.36
2024	445	163	282	2.38
2025 (Buildout)	448	164	284	2.39

As a result of incorporating AB 715, the amount of indoor water savings within the recommended water conservation program has decreased. The overall combined water savings from the effect of the updated plumbing code which incorporates AB715 and the recommended water conservation program results in a potable water offset that exceeds the established goal for this project of 495 MG/Year. The recommended water conservation program results in a water savings of 448 MG/Year. The increase in water savings from the building code is estimated to be 55.6 MG/Year. Therefore the total net water savings is 503.6 MG/Year. A summary of the water conservation program features at buildout is shown in Table 6-4.

**TABLE 6-4  
RECOMMENDED PROGRAM FEATURES AT BUILDOUT (2025)**

Water Conservation Program Summary	
Number of Measures	19
Water Savings with Contingency	448 MG/Year
Water Savings without Contingency	315 MG/Year
Indoor Water Savings	164 MG/Year
Outdoor Water Savings	284 MG/Year

**FIGURE 6-1  
WATER SAVINGS EACH YEAR FOR THE RECOMMENDED WATER CONSERVATION PROGRAM**



The recommended program’s costs were also calculated using the DSS Model. Annual program costs as well as annualized 80 year present worth cost and annualized 80 year present worth cost per unit of water saved are summarized in Table 6-5 and described in Table 6-6. These costs were calculated based on the cost to the City of Petaluma (Utility) only and cost to the utility plus development community. Annual capital and operations costs for implementation of the nineteen water conservation measures under the recommended program for Years 2008 through Year 2025 are detailed in **Appendix I: Annual Program Costs and 80 Year Present Worth Analysis**.

**TABLE 6-5  
RECOMMENDED WATER CONSERVATION PROGRAM 80 YEAR PRESENT WORTH COSTS**

Cost	Utility Cost	Utility + Development
80 Year Present Worth	\$7,126,129	\$24,895,880
Annualized 80 Year Present Worth	\$235,959	\$824,346
Annualized 80 Year Present Worth/Unit of Water Saved	\$612 / MG	\$2,137 / MG
	\$199 / acre-foot	\$696 / acre-foot

On an 80 year annualized present worth basis, the recommended water conservation program is more cost effective than any of the three preliminary programs evaluated (Table 5-15), more cost-effective than obtaining additional water for the City through recycled water (\$3,462/MG or \$1,128/Ac-Ft) or City-owned groundwater wells(\$3,416/MG or \$1,113/Ac-Ft), and even more cost-effective than the current cost to purchase potable water from SCWA and distribute it to the City’s potable water customers (\$2,662/MG or \$870/Ac-Ft). Hence, water conservation is the most economical new water supply/offset source available to the City of Petaluma and the Development community.

**TABLE 6-6  
RECOMMENDED WATER CONSERVATION PROGRAM ANNUAL COST**

Year	Utility Cost			Developer Cost	Utility + Developer Cost		
	Capital Cost	Operations Cost	Total Cost	Total Cost	Capital Cost	Operations Cost	Total Cost
2008	\$465,100	\$126,156	\$591,256	\$2,407,112	\$2,872,368	\$126,156	\$2,998,368
2009	\$461,291	\$126,924	\$588,216	\$2,203,652	\$2,664,943	\$126,924	\$2,791,868
2010	\$505,921	\$140,678	\$646,599	\$2,204,543	\$2,710,464	\$140,678	\$2,851,142
2011	\$460,500	\$127,895	\$588,395	\$2,031,253	\$2,491,753	\$127,895	\$2,619,648
2012	\$409,232	\$117,566	\$526,798	\$2,032,233	\$2,441,465	\$117,566	\$2,559,031
2013	\$463,499	\$131,780	\$595,280	\$2,033,214	\$2,496,714	\$131,780	\$2,628,494
2014	\$364,685	\$98,589	\$463,274	\$1,900,389	\$2,265,075	\$98,589	\$2,363,663
2015	\$368,722	\$100,130	\$468,853	\$1,901,373	\$2,270,096	\$100,130	\$2,370,226
2016	\$258,308	\$56,300	\$314,608	\$981,944	\$1,240,301	\$56,300	\$1,296,602
2017	\$259,071	\$56,504	\$315,575	\$982,365	\$1,241,436	\$56,504	\$1,297,940
2018	\$168,769	\$42,693	\$211,462	\$378,197	\$546,966	\$42,693	\$589,659
2019	\$119,468	\$30,393	\$149,862	\$378,197	\$497,665	\$30,393	\$528,059
2020	\$120,157	\$28,093	\$148,250	\$378,197	\$498,354	\$28,093	\$526,447
2021	\$123,596	\$28,634	\$152,230	\$412,025	\$535,621	\$28,634	\$564,255
2022	\$123,756	\$28,674	\$152,430	\$411,825	\$535,780	\$28,674	\$564,455
2023	\$121,193	\$28,034	\$149,227	\$412,023	\$533,216	\$28,034	\$561,250
2024	\$121,319	\$28,066	\$149,385	\$412,022	\$533,341	\$28,066	\$561,407
2025 (Buildout)	\$121,446	\$28,097	\$149,543	\$412,021	\$533,467	\$28,097	\$561,564

In addition to the nineteen (19) water conservation measures included in the recommended program, a number of items were identified during the evaluation process that will be considered for implementation by the City. These items are outlined in Table 6-7 and include water rates, ordinance items, and additional programs.

**TABLE 6-7  
ADDITIONAL WATER CONSERVATION PLAN ITEMS**

	Conservation Item	New/Existing Customer	Customer Sector
<b>Rates</b>			
	Tiered Rates During Peak Times/4 <sup>th</sup> Tier Rates for Highest Demand Residential Water Users	E,N	ALL
	Water Budget Based Billing	E,N	ALL
<b>Ordinance</b>			
	Contract Language Added to Hire Only Certified Landscapers	E,N	CIO
	Water Management Education for Large Irrigators in Contract Language	E	CIO
	Dual Meter Requirements for Large Irrigators (Current)	N	SF,CIO,INST
	AMR Meter Requirement (Current)	N	ALL
	Require Sensing Faucets (D)	N	CIO,INST
<b>Programs</b>			
	Demonstration Projects-Parks	E,N	ALL
	Centralized Website for Rebates/Vouchers/Lists	E,N	ALL
	Provide Templates for Landscape	E	SF,MF
	Restaurants to Serve Water Upon Request	E,N	CIO
	Work with HOAs to Hire Certified Contractors	E	SF,MF
	Train/Certify Workers/ Contractors, Bilingual Education Materials	E,N	ALL
	Developer Trains Buyer on Irrigation System: Certified Person (D)	N	SF,MF
	Model Homes with Water Saving Practices/Pamphlets (D)	N	SF,MF
	Water Conservation Info@ Related Stores	E,N	ALL
	Water Conservation Info in Building	E,N	ALL
<b>Wasting</b>			
	Prohibit Overhead Irrigation of Strips <8'	E,N	ALL
(currently included)	Prohibit Irrigation Runoff	E,N	ALL
	Prohibit Once-Thru Cooling	E,N	ALL
	Prohibit Non-Recirculation Fountains	E,N	ALL
	Require Car Washes to Recycle Water	E,N	CIO
	Prohibit Water Cooled Ice Machines	E,N	ALL
	Hardscape and Car Washing with Self Closing Nozzle Only	E,N	ALL

(D) denotes a requirement for developer for implementing "on-site" measures.

## Funding Mechanism

The recommended water conservation plan modifies the overall recommended water supply project outlined in the Water Demand and Supply Analysis dated 2006. The modifications include increased

water conservation, elimination of City-owned groundwater well supply, and incorporation of a contingency factor to ensure that potable water demands will be met. To meet the annual buildout shortfall amount of 772.72 MG/Year and the ADMM shortfall amount of 5.0 mgd as outlined in the Water Demand and Supply Analysis Report, both the recommended water conservation plan detailed above and the recycled water system developed within the Water Demand and Supply Analysis, will need to be implemented. Combined, they are referred to as the recommended water supply project. The recommended water supply project as modified supersedes the project recommended in the Water Demand and Supply Analysis and is described in **Appendix J: Recommended Water Supply Project**. An update to the City's water utility capacity charge for new development was prepared based on the recommended water supply project. The charge incorporates the cost for additional potable water supply through recycled water and water conservation offset. The Water Capacity Charge Update prepared by Bartle Wells Associates is included in **Appendix K- Water Capacity Charge Update**. The capacity charge defrays the capital costs of facilities to serve growth. The capacity charge includes a buy-in for the value of the City's existing facilities, a proportion of planned water capital improvements cost, and the cost for new water supply as described herein. Bartle Wells Associates is currently developing an updated water capacity fee study that will address the improvements and projects outlined in this report as well as review current water, storm water, and wastewater charges. This report is scheduled to be submitted in February of 2008. This section will be updated after approval of the revised study.

## Implementation

The water conservation program developed is projected to save 448 MG/Year by Year 2025. This program is very aggressive and will require considerable effort by City staff to implement. Since the program must start in Year 2008 to achieve the water savings goal in Year 2025, the City should begin work immediately to get the required ordinances, development standards, and programs in place. Of the nineteen measures identified for implementation, five of the measures are directly related to new development and will require developers to utilize water efficient practices and install certain water efficient devices. A detailed implementation plan for each of the water conservation measures between Year 2008 and Year 2025 (Buildout) has been developed to aid the City to implement the program.

Table 6-8 provides a detailed implementation analysis for each of the water conservation measures between Year 2008 and Year 2025 (Buildout). The level of implementation required for each customer sector within each measure to achieve the annual and ADMM water savings is indicated. The information shown in Table 6-8 is direct output from the DSS model.

**TABLE 6-8**  
**IMPLEMENTATION PLAN FOR THE RECOMMENDED WATER CONSERVATION PROGRAM (2008-2025)**

Measure Number	Conservation Activity	# Participating Accounts	New/ Existing	Customer Type	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total		
P1	Residential Water Surveys - Indoor	# of surveys	E	SF	810	810	810	810	238	810	810	810	810	810	810	238	810	810	810	810	809	809	13,434		
			E	MF Accounts	27	29	30	32	8	35	36	38	38	39	40	8	41	41	42	42	42	42	42	610	
			E	MF DU	370	397	411	438	110	480	493	521	521	534	548	110	562	562	575	575	575	575	575	575	8,357
P2	Residential Water Surveys - Outdoor	# of surveys	E	SF	810	810	810	810	238	810	810	810	810	810	810	238	810	810	810	810	810	809	809	13,434	
			E	MF Accounts	27	29	30	32	8	35	36	38	38	39	40	8	41	41	42	42	42	42	42	610	
			E	MF DU	370	397	411	438	110	480	493	521	521	534	548	110	562	562	575	575	575	575	575	575	8,357
P3	Plumbing Retrofit Kits (Giveaways)	# of accounts	E	SF	211	210	210	210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	841	
			E	MF Accounts	5	5	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
			E	MF DU	69	69	69	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	260
P4	Water Budgets for Large Irrigators	# of accounts	N, E	CIO Turf	64	64	64	65	65	65	65	65	33	33	33	33	33	39	39	39	38	38	875		
P5	Commercial Water Audits	# of accounts	E	CIO	15	16	16	17	17	18	18	19	0	0	0	0	0	0	0	0	0	0	0	136	
			E	SF	561	561	561	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,683	
			E	MF Accounts	12	13	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38
P6	High Efficiency Washing Machine Rebate	# of rebates	E	MF DU	164	178	178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	521	
			E	CIO	51	52	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157	
			N	SF	216	216	216	184	184	184	184	184	54	54	54	54	54	54	57	57	57	57	57	57	2,123
P7	High Efficiency Washing Machine Requirement	# of accounts	N	MF Accounts	18	18	18	20	20	20	20	20	8	8	8	8	8	8	6	6	6	6	5	223	
			N	MF DU	247	247	247	274	274	274	274	274	110	110	110	110	110	82	82	82	82	82	69	3,055	
			N	CIO	49	49	49	50	50	50	50	50	19	19	19	19	19	19	25	25	25	25	25	25	620
P8	High Efficiency Faucets and Showerheads Requirement	# of accounts	N	SF	216	216	216	184	184	184	184	184	54	54	54	54	54	57	57	57	57	57	57	2,123	
			N	MF Accounts	18	18	18	20	20	20	20	20	8	8	8	8	8	8	6	6	6	6	5	223	
			N	MF DU	247	247	247	274	274	274	274	274	110	110	110	110	110	82	82	82	82	82	69	3,055	
P9	High Efficiency Toilet (HET's) Requirement	# of accounts	N	CIO	50	50	50	50	50	50	50	50	19	19	19	19	19	25	25	25	25	25	25	620	
			N	INST	5	5	5	4	4	4	4	4	2	2	2	2	2	1	1	1	1	1	1	50	
			N	SF	216	216	216	184	184	184	184	0	0	0	0	0	0	0	0	0	0	0	0	0	1,200
P10	City to replace and install toilets with HETs	# of accounts	N	MF Accounts	18	18	18	20	20	20	20	0	0	0	0	0	0	0	0	0	0	0	0	114	
			N	MF DU	247	247	247	274	274	274	274	0	0	0	0	0	0	0	0	0	0	0	0	0	1,562
			N	CIO	49	49	49	50	50	50	50	0	0	0	0	0	0	0	0	0	0	0	0	0	297
P11	Public Information Program	# of people	N	INST	5	5	5	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	27	
			E	SF	105	105	105	105	105	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	630
			E	MF Accounts	4	4	4	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
P12	Smart Irrigation Controller Rebates	# of rebates	E	MF DU	55	55	55	69	69	69	0	0	0	0	0	0	0	0	0	0	0	0	0	370	
			E	INST	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	12	
			E	SF	8,413	8,413	8,413	8,413	8,413	8,413	8,413	8,413	8,413	8,413	8,413	8,413	8,413	8,413	8,412	8,412	8,412	8,412	8,412	8,412	151,429
P13	Smart Controller with Rain-sensor Shutoff Device Requirement	# of accounts	N	SF	432	540	648	740	832	924	1,015	1,108	1,135	1,162	1,189	1,216	1,243	1,272	1,300	1,329	1,357	1,386	1,386	18,828	
			E	MF Accounts	0	0	8	8	9	9	9	10	10	10	10	10	11	0	0	0	0	0	0	0	95
			E	MF DU	0	0	110	115	120	126	131	137	139	141	143	145	0	0	0	0	0	0	0	0	1,307
P14	Landscape and Irrigation Requirements	# of accounts	E	CIO	0	0	33	34	34	35	36	37	38	39	39	39	0	0	0	0	0	0	0	363	
			E	INST	0	0	6	6	5	5	5	5	5	5	5	5	0	0	0	0	0	0	0	52	
			N	SF	216	216	216	184	184	184	184	184	54	54	54	54	54	54	57	57	57	57	57	57	2,123
P15	Plan Check for Renovation and for New Development	# of accounts/ DU	N	MF Accounts	18	18	18	20	20	20	20	20	8	8	8	8	8	6	6	6	6	6	5	223	
			N	MF DU	247	247	247	274	274	274	274	274	110	110	110	110	110	82	82	82	82	82	69	3,055	
			N	CIO	51	51	51	52	51	51	51	51	19	19	19	19	19	25	25	25	25	25	25	629	
P16	Increase Enforcement of Landscape Requirements	# of accounts/ DU	N	INST	5	5	5	4	4	4	4	4	2	2	2	2	2	1	1	1	1	1	1	50	
			N	SF	216	216	216	184	184	184	184	184	54	54	54	54	54	54	57	57	57	57	57	57	2,123
			N	MF Accounts	18	18	18	20	20	20	20	20	8	8	8	8	8	8	6	6	6	6	6	5	223
P17	Residential Landscape Training Classes	# of people	N, E	SF	1,024	1,024	1,024	992	992	992	991	991	861	861	0	0	0	0	0	0	0	0	0	9,752	
			N, E	MF Accounts	46	47	49	52	54	55	57	58	46	47	0	0	0	0	0	0	0	0	0	0	511
			N, E	MF DU	630	644	671	712	740	754	781	795	630	644	0	0	0	0	0	0	0	0	0	0	7,001
P18	Hotel retrofit (w/financial assistance) - CIO Existing	# of accounts	N, E	CIO	50	50	50	51	51	51	51	51	19	19	0	0	0	0	0	0	0	0	0	444	
			N, E	INST	5	5	5	4	4	4	4	4	2	2	2	2	2	1	1	1	1	1	1	39	
			E	SF	808	808	808	808	808	808	807	807	807	807	0	0	0	0	0	0	0	0	0	0	8,076
P19	Submetering, meter each unit (by City)	# of accounts	E	MF Accounts	28	29	30	32	33	35	36	38	39	39	0	0	0	0	0	0	0	0	0	339	
			E	MF DU	384	397	411	438	452	480	493	521	534	534	0	0	0	0	0	0	0	0	0	0	4,644
			N, E	SF	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	180	3,240
P19	Submetering, meter each unit (by City)	# of accounts	N	MF Accounts	19	19	19	21	21	21	21	21	8	8	8	8	8	6	6	6	6	6	5	231	
			N	MF DU	266	265	264	291	290	289	289	288	105	105	105	105	105	80	80	80	80	80	80	3,167	
			N	CIO	50	50	50	51	51	51	51	51	20	20	20	20	20	20	26	26	26	26	26	25	634
			N	INST	5	5	5	5	5	5	5	5	2	2	2	2	2	1	1	1	1	1	1	1	51
Total Utility Project Cost (\$)					\$ 591,256	\$ 588,216	\$ 646,599	\$ 588,395	\$ 526,798	\$ 595,280	\$ 463,274	\$ 468,853	\$ 314,608	\$ 315,575	\$ 211,462	\$ 149,862	\$ 148,250	\$ 152,230	\$ 152,430	\$ 149,227	\$ 149,385	\$ 149,543			
Total Utility + Developer Project Cost (\$)					\$ 2,998,368	\$ 2,791,868	\$ 2,851,142	\$ 2,619,648	\$ 2,559,031	\$ 2,628,494	\$ 2,363,663	\$ 2,370,226	\$ 1,296,602	\$ 1,297,940											

The City has obtained a copy of the DSS Model for in-house use. This model is a powerful tool and will serve as a great asset to the City throughout implementation of the program. The model should be updated annually with the actual implementation data for each measure to determine if the City is on track to meet the water savings goal. In addition, the model can be modified to determine how implementation rate adjustments and changes such as additions or deletions of measures will affect the final water savings outcome. The program developed under this study is meant to be an evolving program allowing the City to adjust implementation rates and/or measures over the life of the program to meet changing conditions and technology over the life of the 18-year plan to achieve the overall water savings goal.

Water conservation is much easier to implement at new development than at existing sites. For new development, water conservation practices and equipment can be implemented during initial construction by requiring developers to use water conservation practices. Such practices can be easily enforced through ordinances and plan check procedures. Historically, water conservation measures and practices have been much more difficult and costly to implement at existing sites due to difficulty in reaching the target market, high retrofit costs, and low incentive to make changes.

Ned Orrett, P.E. of Resource Performance Partners, Inc. has researched a program that has been developed and used with success with other utilities that seeks to remove such barriers to customers associated with purchasing and installing proven, cost effective equipment. This same program can be applied to water utilities such as the City of Petaluma for water efficiency improvements at existing facilities. The program works by having a third party provide capital for upfront costs for the water efficient equipment and administration. The third party is guaranteed payback through future water bills. The cost associated with the equipment is assigned to a meter location rather than a customer. This ensures that the party that receives the benefit from the efficient equipment is the party that is benefiting from the equipment during that particular billing cycle. Therefore, if the customer moves, the next customer at that location will benefit and pay, so that the initial customer does not incur any debt. This removes the barrier associated with a party paying upfront costs to install initial equipment. A monthly tariff charge for the equipment is added to the customers' bill during each billing cycle, but there is a guarantee that the monthly charge is lower than the estimated cost savings from water savings. This allows the customer to have a lower bill each month while paying for the equipment. The length of the payback is dependent upon the water savings generated and the cost of the equipment. The program also addresses barriers to the installation of water efficient technology by utilizing a certification agent to ensure that the equipment results in sufficient savings to cover the costs of not only the equipment, but also the installation, financing and management associated with the program. Barriers normally associated with water conservation implementation at existing sites that may be overcome by this program include lack of capital or competing demands for capital, limited debt capacity, uncertainty about length of occupancy especially with renters, risk that measure may fail before savings are achieved, and that the building owner is not the bill payer. Under this program, the City would incur setup costs of the program but this may be more cost-effective for the City than direct installation and more cost effective for the customer than rebates.

Although such a program has not been used with water utilities previously, it offers potential cost savings and increased implementation rates for off-site water conservation measures over the proven implementation methods recommended within this report. The City has agreed to work with Ned Orrett during the initial startup of the water conservation program to develop a pilot test for one or

more of the recommended off-site water conservation measures to utilize the program outlined above rather than standard implementation practices.

## Wastewater Reduction

The implementation of water conservation measures that reduce indoor water use also reduce wastewater production. Although this is advantageous since the overall hydraulic loading on wastewater facilities will be reduced, this also means that less recycled water can be produced. A detailed analysis of the anticipated recycled water production rates were conducted under the Water Demand and Supply Analysis. This work was included in Appendix W of that report. In addition, an analysis of the City’s secondary effluent recycled water system was also conducted and provided in Appendix V of that report. That work was based on recycled water production rates of the water conservation program presented in the Water Demand and Supply Analysis Report. Since additional water conservation is recommended under this work, the impact of the additional wastewater reduction was evaluated. This work is included in **Appendix L – Wastewater Reduction Projections**. Since recycled water use occurs in the summer, its production is directly attributed to wastewater average dry weather flows (ADWF) rates (Table 6-9).

**TABLE 6-9  
PROJECTED WASTEWATER ADWF'S BASED ON THE RECOMMENDED WATER CONSERVATION PROGRAM**

Year	Projected Wastewater ADWF (mgd)
2010	5.67
2015	5.93
2020	6.03
2025 (Buildout)	6.11

The projected wastewater ADWFs are shown in Table 6-9. The previously projected wastewater ADWF in Year 2025 was 6.37 mgd as shown in Appendix W of the Water Demand and Supply Analysis Report. Under the recommended water conservation program within this work, the wastewater ADWF is projected to decrease to 6.11 mgd in Year 2025. This means that the recycled water available in Year 2025 will be reduced. This reduction can be handled by reducing the amount of secondary effluent that is produced and distributed to secondary recycled water users and sufficient wastewater will be available to serve the tertiary recycled water system needs required for potable water offset as outlined in the Water Demand and Supply Analysis. Peak demands at night can be met by utilizing treatment wetland pond water to augment flow to the filters and proper storage amounts in the recycled water system.