

APPENDIX E

2010 Urban Water Management Plan Water Demand Analysis and
Water Conservation Measures Update
(Maddaus Water Management, November 2010)



Town of Windsor



2010 Urban Water Management Plan Water Demand Analysis and Water Conservation Measures Update

November 22, 2010



*MADDAUS
WATER
MANAGEMENT*

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY	3
1.1 Introduction.....	3
1.2 Long-Term Demand and Conservation Program Analysis Results.....	3
2. INTRODUCTION AND PURPOSE	6
2.1 Contents	6
3. OVERVIEW OF EVALUATION PROCESS.....	7
4. WATER DEMANDS WITH AND WITHOUT PLUMBING CODE.....	9
4.1 Future Population and Employment Projections	9
4.2 Water Use and Demographic Data Inputs to the Model.....	12
4.3 Key Assumptions for the DSS Model	16
4.4 Water Demand Projections With and Without the Plumbing Code.....	17
4.5 Water Demand Projections – 2005 Urban Water Management Plan (UWMP) Format	20
5. COMPARISON OF INDIVIDUAL CONSERVATION MEASURES.....	21
5.1 Selecting Conservation Measures to be Evaluated (Conservation Measure Screening).....	21
5.2 Perspectives on Benefits and Costs.....	30
5.3 Present Value Parameters	31
5.4 Assumptions about Measure Costs.....	31
5.5 Assumptions about Measure Savings.....	31
5.6 Assumptions about Avoided Costs	31
5.7 Measure Assumptions including Unit Costs, Water Savings, and Market Penetrations.....	32
5.8 Comparison of Individual Measures	32
6. RESULTS OF CONSERVATION PROGRAM EVALUATION.....	34
6.1 Selection of Measures for Programs	34
6.2 Results of Program Evaluation.....	36
7. CONCLUSIONS.....	40
7.1 Relative Savings and Cost-Effectiveness of Programs.....	40

1. EXECUTIVE SUMMARY

1.1 Introduction

The 2010 Urban Water Management Plan demand and conservation technical analysis was conducted by Maddaus Water Management (MWM) for the Town of Windsor. The purpose of the analysis was to:

1. Calculate a demand forecast for the year 2010 to 2035.
2. Calculate the range of conservation costs and savings for the year 2010 to 2035. This effort included:
 - Incorporate activity from current conservation measures for the year 2005 and 2009 into the DSS model.
 - Evaluate up to three new conservation measures that will reduce future water demand.
 - Estimate the costs and water savings of these measures.
 - Combine the measures into increasingly more aggressive programs and evaluate the costs and water savings of these programs.

1.2 Long-Term Demand and Conservation Program Analysis Results

The project for the Sonoma County Water Agency (SCWA) contractors included two main parts, (1) create a demand and conservation analysis for 2010 to 2035 and (2) evaluate conservation savings potential for the years 2010 to 2035 with a variety of different measures and conservation programs.

The first step in the analysis was to review and analyze historical water use production and billing data. For most contractors, the billing data was provided for the years 2000 to 2009 (a few contractors had data back to 1995 and one contractor has new meters, so data is only available after the year 2006). The data was graphically analyzed and discussed with the individual contractors. The historical water use along with the selected population and employment projections were used to create a demand forecast for the year 2010 to 2035.

Once the demands were completed, the conservation measures were analyzed for a total of 31 measures. The conservation analysis included all the measures from the 2005 conservation study that MWM completed for the SCWA contractors along with up to three new measures for each contractor. The following important assumptions about the conservation measures were included in this analysis:

1. Due to increased regulations and additional research and analysis on conservation measures, conservation measures Tier 2-8 (Reduced Connection Fees), Tier 2-9 (Synthetic Turf Rebate) and Tier 2-11 (Dishwasher Rebate) were removed from all programs at the request of the contractors.
2. No modifications to costs or savings assumptions were made to any of the Tier One and Tier Two Measures. To comply with new regulations and ordinances, minimal changes were made to the New Development measures ND-1 to ND-8.
3. The table of the new measures for each contractor is listed in Section 5.1. An analysis of the new state law SB 407 was included for all contractors.
4. New development ordinances were updated to reflect new local ordinances, the Model Water Efficient Landscape Ordinance, and the Cal Green building code.

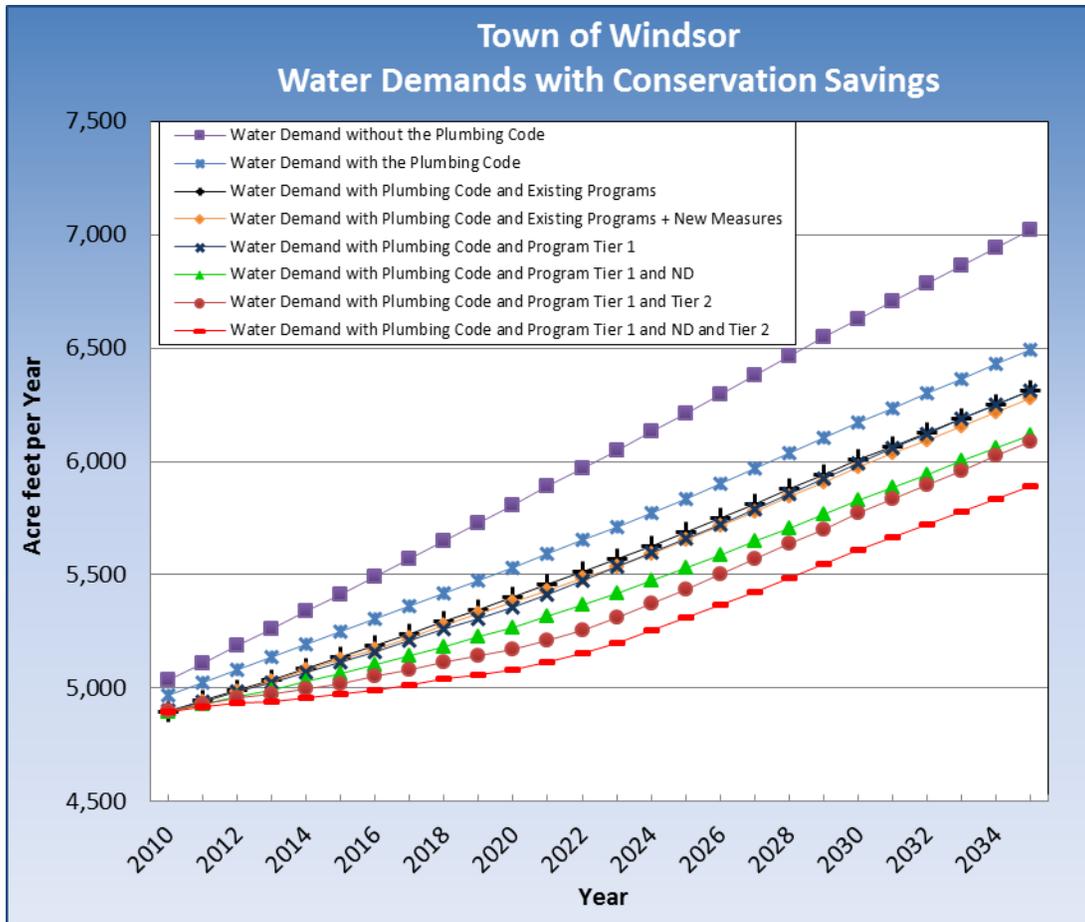
Table ES-1, ES-2 and ES-3 and Figure ES-1 show the water demands and conservation savings for the years 2010 to 2035. The Plumbing Code includes the new California State Law requiring High Efficiency Toilets and High Efficiency Urinals by 2014.

**Table ES-1
Conservation Measures**

Town of Windsor Conservation Measures in each Program						
Measure Name	Program Existing	Program Existing & New	Program Tier 1	Program Tier 1 & ND	Program Tier 1 & Tier 2	Program Tier 1 & Tier 2 & ND
CUWCC #1a - Residential Water Surveys - Interior	✓	✓	✓	✓	✓	✓
CUWCC #1b - Residential Water Surveys - Outdoor	✓	✓	✓	✓	✓	✓
CUWCC #2 - Plumbing Retrofit Kits	✓	✓	✓	✓	✓	✓
CUWCC #5a - Large Landscape Water Budgets			✓	✓	✓	✓
CUWCC #5b - Large Landscape Audits	✓	✓	✓	✓	✓	✓
CUWCC #6 - Washer Rebates	✓	✓	✓	✓	✓	✓
CUWCC #7 - Residential Public Education	✓	✓	✓	✓	✓	✓
CUWCC #9 - Commercial Water Audits	✓	✓	✓	✓	✓	✓
CUWCC #14a - RSF Toilet Replacement	✓	✓	✓	✓	✓	✓
CUWCC #14b - RMF Toilet Replacement	✓	✓	✓	✓	✓	✓
Tier 2 - 1 Rain Sensor Retrofit				✓	✓	
Tier 2 - 2 Cash for Grass				✓	✓	
Tier 2 - 3 Financial Incentives for Being Below Water Budget				✓	✓	
Tier 2 - 4 Irrigation Meter Rebates				✓	✓	
Tier 2 - 5a Smart Irrigation Controller Rebates - RSF				✓	✓	
Tier 2 - 5b Smart Irrigation Controller Rebates - RMF, CII, IRR				✓	✓	
Tier 2 - 6 Financial Incentives/Rebates for Irrigation Upgrades		✓		✓	✓	
Tier 2 - 7 Hotel Retrofit				✓	✓	
Tier 2 - 10 High Efficiency Toilets				✓	✓	
Tier 2 - 12 CII Rebates - Replace Inefficient Water Using Equipment				✓	✓	
Tier 2 - 13 New Commercial Urinals				✓	✓	
Tier 2 - ND1 Rain Sensor Retrofit	✓	✓		✓		✓
Tier 2 - ND2 Smart Irrigation Controller	✓	✓		✓		✓
Tier 2 - ND3 High Efficiency Toilets				✓		✓
Tier 2 - ND4 Dishwasher New Efficient				✓		✓
Tier 2 - ND5 Clothes Washing Machine Requirement				✓		✓
Tier 2 - ND6 Hot Water on Demand				✓		✓
Tier 2 - ND7 High Efficiency Faucets and Showerheads				✓		✓
Tier 2 - ND8 Landscape and Irrigation Requirements				✓		✓
SB 407 Requirements (Plumbing Retrofit on Resale or Remodel)		✓				

NOTE – Due to increased regulations and additional research and analysis, conservation measures Tier 2-8, Tier 2-9 and Tier 2-11 are out of date and were removed from analysis at the request of all the contractors.

**Figure ES-1
Long Term Demands with Conservation Programs**



**Table ES-2
Water Demand Projections**

Town of Windsor Water Demand with Conservation Program Savings						
Water Demand with Plumbing Code and Conservation Program Savings (AFY)	2010	2015	2020	2025	2030	2035
Water Demand without the Plumbing Code	5,037	5,415	5,808	6,213	6,629	7,019
Water Demand with the Plumbing Code	4,966	5,247	5,533	5,837	6,172	6,493
Water Demand with Plumbing Code and Existing Programs	4,897	5,136	5,401	5,688	6,007	6,312
Water Demand with Plumbing Code and Existing Programs + New Measures	4,897	5,125	5,377	5,654	5,974	6,279
Water Demand with Plumbing Code and Program Tier 1	4,900	5,114	5,356	5,660	5,995	6,315
Water Demand with Plumbing Code and Program Tier 1 and ND	4,895	5,065	5,266	5,529	5,830	6,116
Water Demand with Plumbing Code and Program Tier 1 and Tier 2	4,900	5,022	5,170	5,437	5,770	6,089
Water Demand with Plumbing Code and Program Tier 1 and ND and Tier 2	4,895	4,973	5,081	5,309	5,608	5,893

**Table ES-3
Economic Analysis of Alternative Programs**

Town of Windsor Comparison of Conservation Program Costs and Savings									
Conservation Program	Water Utility Benefit-Cost Ratio	Community Benefit-Cost Ratio	2035 Water Savings (AFY)	2035 Indoor Water Savings (AFY)	2035 Outdoor Water Savings (AFY)	Total Water Savings as a % of Total Production in 2035*	30 Year Present Value of Water Utility Costs (\$1,000)	Total Utility Cost for Five Years 2011-2015 (\$1,000)	Utility Cost of Water Saved (\$/AF)
Existing Program	1.66	1.58	181	52	129	2.8%	\$1,355	\$447	\$359
Existing Program + New Measures	1.49	1.43	214	56	158	3.3%	\$1,734	\$646	\$396
Tier One	1.89	2.27	178	52	126	2.7%	\$1,356	\$453	\$316
Tier One + Tier Two	1.72	0.81	404	74	331	6.2%	\$2,863	\$1,498	\$332
Tier One + New Development	2.44	0.91	377	133	244	5.8%	\$1,660	\$547	\$234
Tier One + Tier Two + New Development	2.02	0.67	600	154	446	9.2%	\$3,167	\$1,592	\$279

2. INTRODUCTION AND PURPOSE

The purpose of this report is to present an overview of the demand and conservation evaluation process which has been completed for the Town of Windsor (Town). The goal was to develop forecasts of demand and conservation savings for the 2010 Urban Water Management Plan.

The Town of Windsor has a current water conservation program. This report evaluates whether expanding existing efforts is a cost-effective way to meet future water needs.

The conservation measures and programs were analyzed using the Least Cost Planning Water Demand Management Decision Support System (DSS Model). In this report demand management and water conservation are used interchangeably. The evaluation includes measures directed at existing accounts as well as new development measures to make new residential and business customers more water efficient. Six programs were provided to help evaluate the net effect of running multiple measures together over time. Assumptions and results for each of the 31 individual measures and six programs will be described in detail in this report.

2.1 Contents

This report provides a general overview for the methodology, assumptions, and results for the demand forecast and conservation analysis. The following information is included in this report and is discussed in individual sections below:

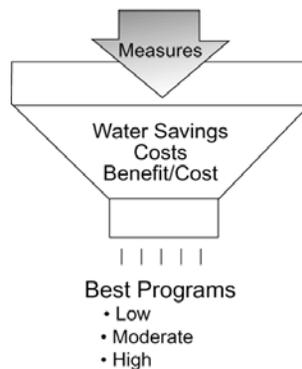
- Overview of evaluation process
- Baseline water demands with and without the plumbing code
- Comparison of individual conservation measures
- Results of the conservation analysis
- Conclusions
- Appendix A: Assumptions for the Conservation Measures Evaluated
- Appendix B: Water Production and Billing Data Graphs for all Customer Categories

3. OVERVIEW OF EVALUATION PROCESS

Long Term Demand and Conservation Evaluation Process

During the evaluation process, water demand and savings were estimated. Benefits and costs were compared in a formal present value analysis and conclusions were drawn about which measures produce cost-effective water savings. The measure costs were previously developed by MWM and the contractors as part of the 2005 conservation study MWM completed for the SCWA contractors. This process can be thought of as an economic screening process, shown in Figure 1. Packaging the best measures into alternative programs allows Town of Windsor to consider what level of conservation implementation is appropriate.

Figure 1
Evaluation Process



Benefit-cost analysis has been used by many water agencies to evaluate and help select a water conservation measure best suited to local conditions. This analysis requires a locale-specific set of data, such as historical water consumption patterns by customer class, population projections, age of housing stock, and prior conservation efforts.

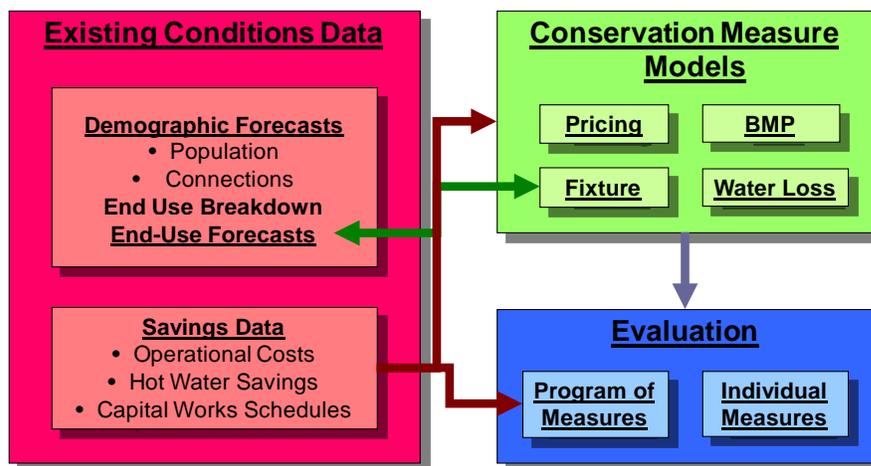
The following ten steps were used to implement the methodology by expanding upon the same DSS Model used to prepare the demand projections.

1. **Generate water use projections with and without the state and national plumbing code.** Projections cover each key customer category and are broken down into indoor and outdoor end uses. Evaluate the impact of the plumbing code changes arising from the 1992 and 2005 Federal Energy Policy Act. The plumbing code also includes fixture changes that will result from the State of California plumbing code which requires only high efficiency toilets and high efficiency urinals be sold in the state after the year 2014.
2. **Evaluate previous conservation measures and up to three new measures** to identify those that are applicable to the service area. Develop appropriate unit water savings and costs for each measure.
3. **Estimate the affected customers (or number of accounts) for each conservation measure** by dividing the measure's projected customers (or accounts) that implement the measure by the total service area customers (accounts). This factor is called the market penetration or installation rate.

4. **Estimate total annual average day water savings.** The water savings are computed by multiplying unit water savings, per measure, by the market saturation or installation rate (i.e. 10% to 90% of accounts), and then multiplying by the number of units in the service area (such as dwelling units) targeted by a particular measure. The indoor and outdoor water savings were also calculated.
5. **Identify benefits to the water agency** including potential reduced water purchases from SCWA, calculated as the wholesale water rate and delivery cost per acre-foot for each contractor with an escalator based on historical water rates and Consumer Price Index (CPI).
6. **Quantify total benefits for each year** in the planning period by multiplying average water savings for each measure by the computed value of the benefits.
7. **Determine initial and annual costs to implement the measures** based upon current conservation program data, local experience, and the costs of goods, services, and labor in the community. This is multiplied by the number of units participating each year and then added to overall administration and promotion costs to arrive at a total measure cost, which may be spread over a number of years. For this project the costs for all measures were used from the 2005 study, except for the three new measures selected by each contractor which had all new parameters developed.
8. **Compare costs of measures** by computing the present value of costs and costs of water saved over the planning period.
9. **Compile six programmatic packages** or programs containing various new and existing measures.
10. **Evaluate the six programs for water savings and cost-effectiveness** and identify the point of diminishing returns from further investments in conservation.

For conservation measure evaluation, the DSS Model performs economic analysis by using net present value and benefit-to-cost ratio as economic indicators. The benefit cost analysis is performed from various perspectives including the utility and community (community perspective equates to the utility plus customer). Figure 2 shows the structure of the model. Results are presented in subsequent sections.

Figure 2
Structure of the DSS Model



4. WATER DEMANDS WITH AND WITHOUT PLUMBING CODE

4.1 Future Population and Employment Projections

Description of Population and Employment Forecasts

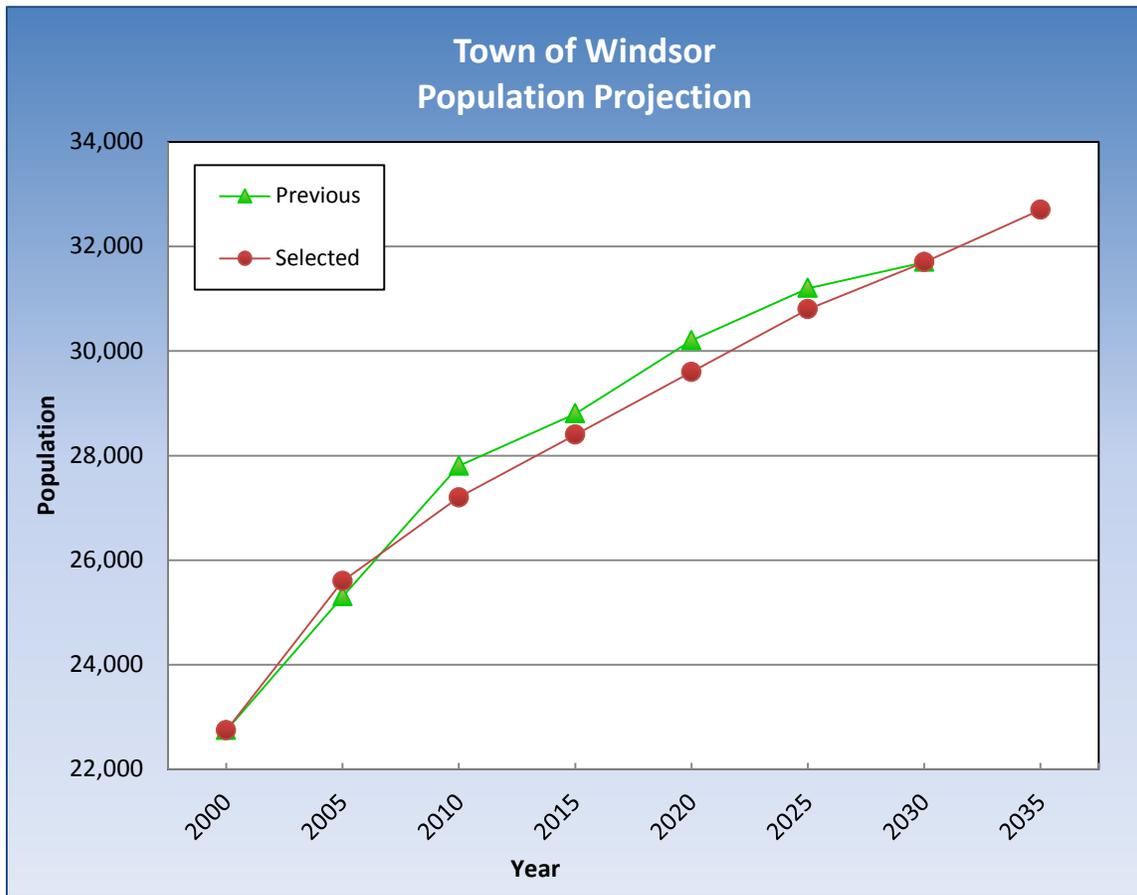
There are generally three main sources of population and employment projections used to generate future water demands for the 2010 Urban Water Management Plans.

Available Demographic Projections

- *Local General Plan (population and employment)* – Typically these plans, depending upon when they were published, have a population and jobs forecast for 2030 and build out.
- *Association of Bay Area Governments (ABAG) (population and employment)* - ABAG recently published a new projections report in 2009 that includes population and employment estimates for each city in the Bay Area. This report provides estimates for 2000, 2005, 2010, 2015, 2020, 2025, 2030 and 2035. ABAG publishes demand projections every two years. The previous DSS Model projections and ABAG projections for 2005, 2007, and 2009 were reviewed to determine the most appropriate data set to use in this DSS Model update.
- *Water Supply Assessments*

At the Town of Windsor's request, the population and employment projections were based on the 2007 ABAG Subregional data as shown in Figure 3, 4 and Table 1 and 2. The values shown in the "Selected" column were used to create the demand projections.

**Figure 3
Population Projections**



**Table 1
Table of Population Projections**

Town of Windsor Population Projection		
Year	Previous ^{1,3}	Selected ²
2000	22,744	22,744
2005	25,300	25,600
2010	27,800	27,200
2015	28,800	28,400
2020	30,200	29,600
2025	31,200	30,800
2030	31,700	31,700
2035		32,700

Notes:

- 1) ABAG Subregional data not including rural areas
- 2) Based on 2007 ABAG Subregional data
- 3) The previous DSS Model data was based on the 2005 ABAG data

**Figure 4
Employment Projections**



**Table 2
Table of Employment Projections**

Town of Windsor Employment Projection		
Year	Previous ^{1,3}	Selected ²
2000	5,960	5,960
2005	6,080	5,970
2010	6,450	6,680
2015	8,670	7,730
2020	10,830	8,850
2025	11,490	10,030
2030	12,010	11,460
2035		12,690

Notes:

- 1) ABAG Subregional data not including rural areas
- 2) Based on 2007 ABAG Subregional data
- 3) The previous DSS Model data was based on the 2005 ABAG data

4.2 Water Use and Demographic Data Inputs to the Model

Description of “Water Use Data Input Sheet”

Figure 5 is a two-page print out of an Excel spreadsheet. The purpose of this “Water Use Data Input Sheet” is to gather and document basic information about the individual service area. The data shown on the “Water Use Data Input Sheet” can be broken into two main categories, (a) current water use data and (b) demographic data. Each area is broken out below and helps to provide some basic definitions and assumptions.

(a) Water Use Data

- *Model Start Year* – This is the starting year for the analysis. For this project, the start year for the model is 2005. The selection of 2005 as a model start year allowed the historical conservation efforts to be included for the past 5 years (2005 to 2009). The DSS Model includes 30 years of data projecting information until the year 2035.
- *Base Year for Future Water Factors* - Based on an analysis of historical water billing data, each contractor selected a year or average of multiple years that is representative of current water use and used as a base year demand factor for developing future water use projections. The year(s) was chosen by the contractors for the following reasons:
 1. The selected years shows less of an effect of the recession. For all contractors the years 2008 and 2009 show a dip in water demand in many areas due to reduction in economic activity.
 2. The years selected had relatively “normal” climate conditions – i.e. not a drought or excessively wet year, so no significant weather adjustments were necessary. For all contractors the years 2008 and 2009 were affected by drought conditions. The water billing or production data was not weather normalized for this analysis.
 3. Many contractors elected to average a few years of data for the analysis. Some contractors selected an individual year as they felt it was representative in terms of weather, vacancy, and customer water use for demand projection purposes.
 4. No additional adjustment factors were added other than the “new single family home category” for three of the contractors (City of Santa Rosa, Valley of the Moon and North Marin Water District). The adjustment was made based on analysis of actual data which showed an increase in water use for homes built since 2000.
- *Average gal/day/acct* – This is the amount of water in gallons that is used per day, per account.
- *Indoor/outdoor water use* – This is the amount of water per account split into the percent that is used indoors and outdoors.
- *Consumption by customer class* – This shows the annual amount of water used for an entire calendar year, broken down by customer class (Single Family, Multi Family, Commercial, Irrigation, etc.)
- *Provision for New Single Family Account Use* – For selected agencies, and upon their specific request, a new category was created to model water use of new single family homes. This value is held constant in the baseline projection and not subject to plumbing codes. All new homes include the plumbing code change in the State of California that requires HETs in 2014. The new homes will also be affected by Cal Green building code after July 1, 2011 and required to install efficient fixtures for the toilets, low flow shower heads and faucets. The effects from Cal Green were run as a conservation measure as they were not in effect at the time of this analysis.

- *Unaccounted for water (UFW) also known as Non-Revenue Water* – This is the sum of all water input to system that is not billed (metered and unmetered) water consumption, including apparent (metering accuracy) and real losses. The values were calculated by taking the difference between the amount of water produced and the amount of water that was sold. Data provided by the water contractor was used, if provided, unless UFW was less than 7 percent, in which case 7 percent was used.
- *Water Produced* – This is the total amount of potable water produced. The water can come from multiple sources including amount purchased from SCWA, purchased from other agencies, local surface water, or obtained from groundwater. This does not include recycled water.
- *Peak day factor* – The ratio of water produced on the maximum day of the year to that produced on the average day.

(b) Demographic Data

- *Census 2000* – The 2000 Census data was used as a general reference when determining population and household sizes for each individual city (and/or unincorporated area) serviced by the water agencies.
- *2005 Town of Windsor Service Area Population* – The 2005 total population for the Town of Windsor was taken directly from the 2005 selected population source discussed earlier in this report.
- *Single and multi family dwelling units* – The 2005 single family dwelling units is equal to the number of single family accounts for 2005. The 2005 multi family dwelling unit estimate was calculated by applying a growth factor to the 2000 data as noted on the water use data sheet in Figure 5.
- *Procedure for service areas not contiguous with city boundaries* – When a service area serves outside a city boundary, estimates were generated either from census tract data when available for the unincorporated areas, Department of Finance data, ABAG Projections, DWR reported data, General Plan or by the local water district if known. If none of the six sources were available, then the modeling team worked with the local water district to make reasonable estimates.
- *Employment data* – The employment figures were obtained from the selected source as discussed earlier in this report.

In summary, the key features of this sheet include the existing 2005 level of water use, 2005 baseline accounts in each customer category, and 2005 baseline forecasts for population and employment.

Effects of Household Size Changes and Housing Vacancy Rates

- The effects of household size changes on future water demand can either increase or decrease future water demands. If household size decreases it takes more housing units to accommodate the existing population. From 2000 to the 2006-2008 period average Town household size increased slightly from 2.98 to 3.02. This could be because during the housing boom that occurred in this period not all new housing units were occupied. Nevertheless the rate of change is very small (0.2 percent per year) and will have a negligible effect on future water demand if the trends continue at the current rate. If the Town feels this trend will continue it could be factored into a revised demand projection.
- Housing vacancy has increased from 1.8 percent in 2000 to 2.9 percent in the 2006-2008 period. This could be because during the housing boom that occurred in this period not all new housing units were occupied. Some vacancy is normal and it is not clear what normal vacancy is for the Town. As the base water use for the Town was in the period of 2006-2008 the impact is reflected in the base water use used for starting the water demand projection. If indeed 1.8 percent is the normal vacancy then the starting value might be 1.1 percent low. If the Town wishes to submit data showing what "normal" vacancy is the demands could be adjusted for the final report.

**Figure 5
Water Use Data Input Sheet**

Town of Windsor Water Service Area ¹								
DSS Input Sheet								
October 1, 2010								
Base Year Average Use and Indoor Percentages by Billing Category for DSS Model ²								
Year	Single family		Multifamily		Commercial		Irrigation	
	Average, gpd/a	Indoor	Average, gpd/a	Indoor	Average, gpd/a	Indoor	Average, gpd/a	Indoor
1997-2006	357	55%	1303	91%	1132	70%	1667	0%
Other								
Average, gpd/a	Indoor							
256	50%							
Data for DSS Model - - Start Year: 2005								
Category	Number of Accounts in Start Year ³	Water Use in Base Year(s) gpd/a ²	Water Use mgd	Use Profile Percent	Water Use gpd	Indoor Water Use gpd		
Single family	7,559	357	2,698	69.48%	112	62		
Multifamily	55	1,303	0.072	1.85%	51	46		
Commercial	402	1,132	0.455	11.72%				
Irrigation	343	1,667	0.572	14.72%				
Other	338	256	0.086	2.23%				
Total Billed ⁹	8,697	4,714	3.882	100.00%				
Projected UFW for DSS Model⁵			7.0%	Percent				
Water Produced for use in DSS Model⁴			4.17	MGD	Add UFW % to Total Billed Water Use			
					Water Produced = Billed / (1 - Projected UFW for DSS Model) = 4.17			
Peaking Factor			1.90	Provided by Agency				
Peaking Factor for DSS Model=			1.90	Provided by Agency				
- Blue cells are entered by modeler								
- Yellow cells are input to DSS Model								
NOTES								
1 - Communities served (includes all or portions of) Windsor and surrounding rural areas								
2 - Average gpd/a is based on a 12-month moving average through December 2009. Indoor use is based on average of 2 lowest consecutive months in the winter if meters read bimonthly, or single lowest month if meters read monthly.								
3 - Number of accounts is from data provided by water agency for this project (see worksheet with account data in this file)								
4 - Total water produced is calculated from the total billed water use and the projected UFW								
5 - Unaccounted for Water (UFW) is the percent difference between the total water purchased and the total billed water use. If the current calculated UFW was less than 7%, then 7% was used for planning purposes.								
6 - For reference see additional population estimates provided in population and employment estimates corresponding to service area table.								
7 - Initial estimate based on census data for renter occupied units. For reference see table below that has 2000 census data for corresponding water service area city or cities.								
8 - Group Quarters Population includes Institutionalized and non-Institutionalized and assumes their water use is in the Commercial sector								
9 - Total accounts taken from billing data								
Mobile homes in Town of Windsor								
As of September 9, 2010								
Units	Park Name	Address	Phone	Account Type				
24	EVERGREEN MOBILE PARK	10281 OLD REDWOOD HW	(650) 589-8757	Sewer Only				
190	COLONIAL PARK MOBILE HOME ESTATES	5649 OLD REDWOOD HW	(707) 544-5626 Jerr	Sewer Only				
136	MOBILE HOME ESTATES	5761 OLD REDWOOD HW	(707) 576-0377	Sewer Only				
127	SHAMROCK MOBILE HOME PARK	6418 OLD REDWOOD HW(10381)	(707) 838-4389	Sewer Only				
82	ROYAL MOBILE MANOR	6555 OLD REDWOOD HWY DOM	(707) 838-2546	Water & Sewer				
336	WINDSOR MOBILE COUNTRY CLUB	8109 CONDE LN(15968)	(916) 399-4993	Water & Sewer				
Per Reso 2543-09 - approved for 403 residential units (including 219 replacement residential units)	BELL VILLAGE PROJECT (WINDSORLAND LLC)	9290 OLD REDWOOD HW	(707) 838-4882	Sewer Only				
Definitions / Abbreviations								
ABAG	Association of Bay Area Governments		HHS	household size				
DOF	Department of Finance		NA	not available				
DSS	Decision Support System Model		MF	multi family				
du	dwelling unit		MGD	million gallons per day				
DWR	Department of Water Resources		No.	number				
FY	Fiscal Year		Pop	population				
gpd	gallons per capita / per day		Res	residential				
gpd/a	gallons per day / per account		SF	single family				
gpd	gallons per day		UFW	unaccounted for water				
Data Prepared:	June 23, 2005	By: M. Maddaus						
Revised:	July 21, 2010	By: C. Matyas						
Revised:	September 9, 2010	By: M. Maddaus						

Water Use Data Input Sheet (Page 2)

Town of Windsor Water Service Area¹						
Reconcile agency account billing data and census data						
Total Dwelling Units in Census 2000 for Windsor by Census Tract						
				Service Area Billing Accounts - Year 2000³	Difference between billing and census data	
Single family	2000 Units	No. Buildings				Data Sources / Notes
1-detached	5,471	5,471				
1-attached	421	211				<i>Some units in SF category are individual mobile home meters</i>
Subtotal	5,892	5,681		6,455	774	<i>When this happens some of the attached units classified by City as Multifamily</i>
Multi family						
2-units	128	64				
3-4 units	267	76				
5 to 9 units	177	25				
10 to 19 units	68	5				
20 to 49 more units	113	3				
50 or more units	173	2				
mobile homes	880	18				<i>September 1, 2005. New data from the Town of Windsor indicates there are over 1,200 mobile homes as of September 9, 2010. The data to the left is for the base year of 2006, which is more relevant to the 880 homes provided as of September 1, 2005.</i>
Subtotal	1,807	194		60	-134	<i>Must be more than one building on an MF meter.</i>
	MF Average =	9.3	units/building	30.1	units/account	<i>This is a typical value of DUs/account</i>
	Total SF + MF units =	7,699	<i>This includes all mobile home units. Some of these units are on well water and will be subtracted from Town of Windsor service area units</i>			
2000 Group Quarters Data			2000 Census Data			
Institutionalized	24		Average household size	2.74		
Non-Institutionalized	67		Average household size of a single family unit	3.24		
Total	91		Average household size of a multifamily unit	1.88		
			Homeowner vacancy rate (percent)	0.4%		
			Rental vacancy rate (percent)	1.5%		
Population and Household Size in Census 2000 for Windsor Water District						
	Census Data	ABAG 2007	Estimated Service Area			
	Total Population	Total Population	Population			
	2000	2005	2005		Data Sources / Notes	
Total Population from Census data ⁶ =	21,976	25,600			12.56%	<i>Estimated growth from 2000 to 2005:</i>
Subtract Institutionalized =	91	102			0.17%	<i>Estimated employment growth from 2000 to 2004:</i>
Residential Population =	21,885	25,498				<i>Water use for the institutionalized population is accounted for in nonresidential billing category</i>
Avg. HHS ⁷ =	2.84	2.84				<i>Population and employment based on ABAG 2007 Subregional data</i>
MF Pop @ MF HHS ⁷ =	1.00	1,257	1,415	1,415	5.5%	<i>Percent of Population that is MF</i>
SF Pop =	20,628	24,083	24,083	94.1%		<i>Percent of Population that is SF</i>
SF HHS ⁷ =	3.20	3.19	102	0.4%		<i>Percent of Population in Group Quarters</i>
		Total	25,600	100.0%		
<i>NOTE: MF household size is small because according to Town of Windsor most of the people living in mobile homes are elderly and living alone (most are retirement homes age 55+)</i>						
Estimate Service Area Dwelling Units for						
SF Res	7,559	<i>Equals No. of Single Family accounts for</i>				
MF Res	1,257	<i>Equals No. Dwelling Units plus growth in accounts</i>				
Total	8,816					

4.3 Key Assumptions for the DSS Model

Table 3 shows the key assumptions used in the model. The assumptions having the most dramatic effect on future demands are the natural replacement rate of fixtures, how residential or commercial future use is projected, and finally the percent of estimated water losses.

Table 3
List of Baseline Demand Projection Assumptions for DSS Model

Town of Windsor	
List of Baseline Demand Projection Assumptions for DSS Model	
Parameter	Model Input Value, Assumptions, and Key References
Model Start Year	2005
Water Demand Factor Year(s)	1997-2006
Peak Day Factor	1.90
Unaccounted for Water in the Start Year	7.0%
Population Projection Source	2007 ABAG Subregional Projections
Employment Projection Source	2007 ABAG Subregional Projections
Number of Water Accounts for Start Year	8697
Avoided Cost of Water \$/AF (includes escalated SCWA cost + \$27.7 /AF pumping cost)	\$991
Distribution of Water Use Among Categories	Single Family: 69.5% Multifamily: 1.8% Commercial: 11.7% Irrigation: 14.7% Institutional: 2.2%
Indoor Water Use by Category	Single Family: 55.4% Multifamily: 90.5% Commercial: 70.4% Irrigation: 0% Institutional: 0%
Residential End Uses	AWWARF Report "Residential End Uses of Water" 1999
Non-Residential End Uses, %	AWWARF Report Commercial End Uses of Water" 1999
Efficient Residential Fixture Current Installation Rates	U.S. Census, Housing age by type of dwelling plus natural replacement plus rebate program (if any). Reference "High Efficiency Plumbing Fixtures - Toilets and Urinals" Koeller & Company July 23, 2005. Reference Consortium for Efficient Energy (www.cee1.org)
Water Savings for Fixtures, gal/capita/day	AWWARF Report "Residential End Uses of Water" 1999, , CUWCC Cost and Savings Study April 28, 2005, Agency supplied data on costs and savings, professional judgement where no published data available
Non-Residential Fixture Efficiency Current Installation Rates	U.S. Census, assume commercial establishments built at same rate as housing, plus natural replacement
Residential Frequency of Use Data, Toilets, Showers, Washers, Uses/user/day	Falls within ranges in AWWARF Report "Residential End Uses of Water" 1999
Non-Residential Frequency of Use Data, Toilets and Urinals, Uses/user/day	Estimated based using AWWARF Report "Commercial and Institutional End Uses of Water" 1999
Natural Replacement Rate of Fixtures	Residential Toilets 3% (1.28 gpf toilets), 4% (1.6 gpf and higher toilets) Commercial Toilets 3% (1.28 gpf toilets), 4% (1.6 gpf and higher toilets) Residential Showers 4% Residential Clothes washers 6.7% A 3% replacement rate corresponds to 33 year life of a new fixture. A 6.67% replacement rate corresponds to 15 year washer life based on "Bern Clothes Washer Study, Final Report, Energy Division, Oak Ridge National Laboratory, for U.S. Department of Energy, March 1998, Internet address: www.energystar.gov
Future Residential Water Use	Increases Based on Population Growth
Future Non-Residential Water Use	Increases Based on Employment Growth

4.4 Water Demand Projections With and Without the Plumbing Code

Development of the Water Demand Projections Table and Graph

Water demand projections were developed to the year 2035 using the Demand Side Management Least Cost Planning Decision Support System (DSS) model. This model incorporates information from the:

- “Water Use Data Sheet” and the “Key Assumptions”
- Questions asked of agencies
- Contractor provided data
- 2000 Census data and 2006-08 American Community Survey 3 year estimates
- Local General Plans
- Association of Bay Area Governments Projections

Water demand projections were input for 30 years using the DSS Model. This model incorporates information from the:

- Contractor selected population and employment forecasts.
- Data provided by Town of Windsor staff including estimates for value of water saved, historical water use, past conservation efforts, and water system facilities.

Table 4 shows the projected demands with and without plumbing codes and appliance standards. This page includes both a table and a graph. Each will be described below.

National Plumbing Code

The Federal Energy Policy Act of 1992, as amended in 2005 requires only fixtures meeting the following standards can be installed in new buildings:

- Toilet – 1.6 gal/flush maximum
- Urinals – 1.0 gal/flush maximum
- Showerhead - 2.5 gal/min at 80 psi
- Residential Faucets – 2.2 gal/min at 60 psi
- Public Restroom Faucets - 0.5 gal/min at 60 psi
- Dishwashing pre-rinse spray valves – 1.6 gal/min at 60 psi

Replacement of fixtures in existing buildings is also governed by the Federal Energy Policy Act that requires only devices with the specified level of efficiency (shown above) can be sold today (2010). The net result of the plumbing code is that new buildings will have more efficient fixtures and old inefficient fixtures will slowly be replaced with new more efficient models. The national plumbing code is an important piece of legislation and must be carefully taken into consideration when analyzing the overall water efficiency of a service area.

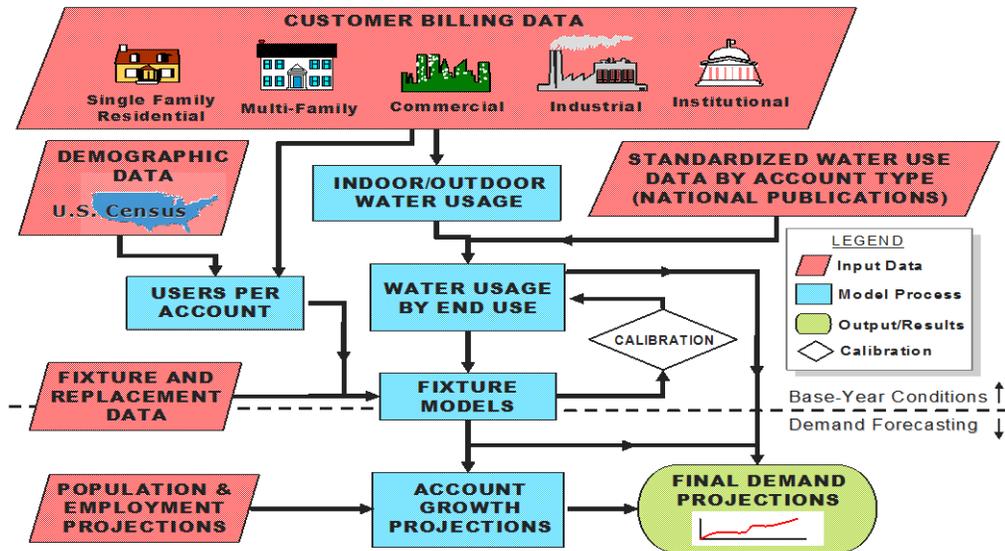
In addition to the plumbing code the US Department of Energy regulates appliances such as residential clothes washers. Regulations to make these appliances more energy efficient has driven manufactures to dramatically reduce the amount of water these efficient machines use. Generally horizontal axis washing machines use 30-50 percent less water than conventional models (which are still available). In the analysis for Town of Windsor, the DSS Model forecasts a gradual transition to high efficiency clothes washers (using 19 gallons or less) so that by the year 2020 this will be the only type of machines purchased. In addition to the industry becoming more efficient, rebate programs for washers have been

successful in encouraging customers to buy more water efficient models. Given that machines last about 15 years eventually all machines in the Town of Windsor area will be of this type.

State Plumbing Code

The Plumbing Code includes the new California State Law requiring High Efficiency Toilets and High Efficiency Urinals be exclusively sold in the state by 2014. Figure 6 below describes conceptually how the above listed items are incorporated into the flow of information in the DSS Model.

Figure 6
DSS Model Overview Used to Make Potable Water Demand Projection
“With the Plumbing Code”



Graph of projected demands (Figure 7)

Figure 7 shows the potable water demand projection at five-year increments. The graph shows projections for demand with and without the plumbing code through 2035.

Table of water demand projections (Table 4)

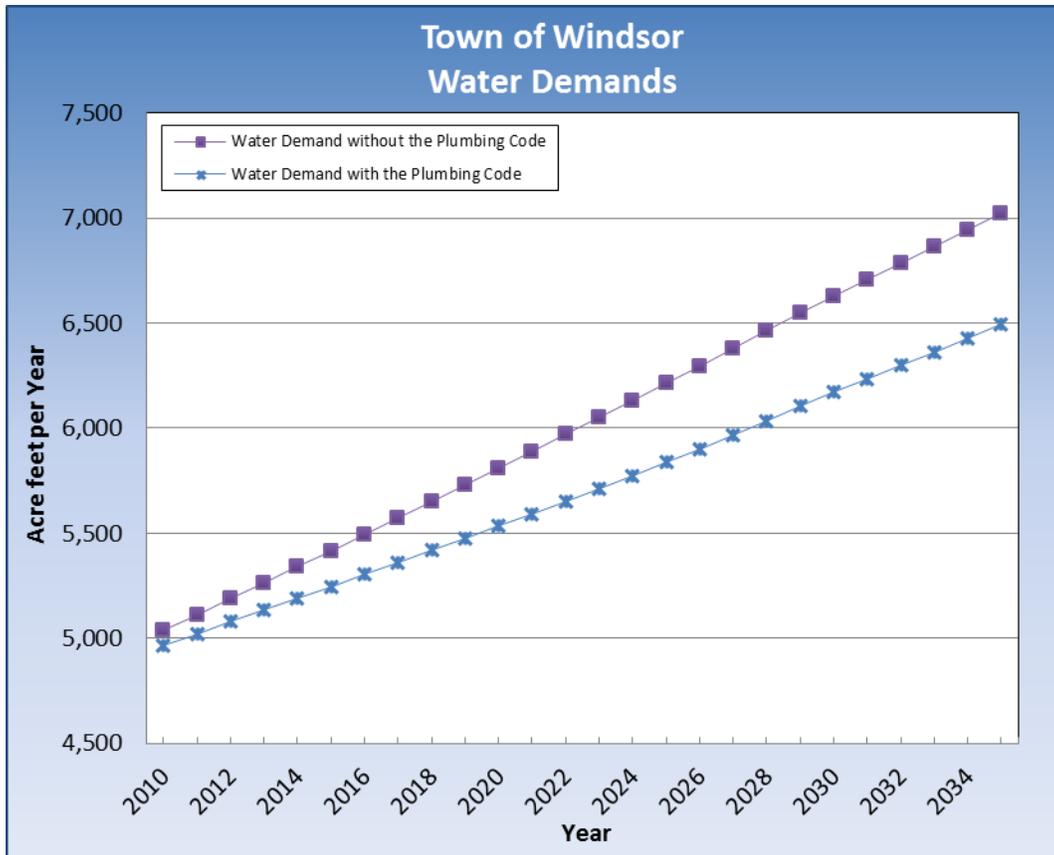
The table of water demands projections includes:

1. The water demand projections shown in Table 4 are based on the future population and employment projections provided in Table 1 and Table 2.
2. Projections were made *with and without* the plumbing codes.
3. Projections are for potable water only. It does not include recycled water use. Recycled water use and projections are included in a separate Chapter of the UWMP.

Dry Year Demands

The demand projections reflect average weather conditions and **do not** reflect drier and hotter drought conditions. Climate change, which might alter weather patterns possibly increasing irrigation demand in the spring and fall due to a warmer climate, or increase or decrease rainfall have also not been addressed.

**Figure 7
Potable Water Use Projections for Town of Windsor**



**Table 4
Potable Water Use Projections for Town of Windsor**

Town of Windsor Water Demands						
Water Demand (AFY)	2010	2015	2020	2025	2030	2035
Water Demand without the Plumbing Code	5,037	5,415	5,808	6,213	6,629	7,019
Water Demand with the Plumbing Code	4,966	5,247	5,533	5,837	6,172	6,493

*Data is not weather normalized. Total Water use is potable only. Does not include recycled water use. Recycled water use and projection are in a separate section in the UWMP.

4.5 Water Demand Projections – 2005 Urban Water Management Plan (UWMP) Format

The 2010 Urban Water Management Plan Guidance Document from the California Department of Water Resources is not planned to be released until after December 2010. Without the guidance document, the exact formatting of the tables for the 2010 UWMP are not known. Therefore, it was elected to place the demand data into the 2005 UWMP format.

Conversion of the Water Demand Projections Table and Graph to 2005 UWMP Format

The 2005 Urban Water Management Plan Guidance Document from the California Department of Water Resources (Ca DWR) requests that future demand information be in a specific format. Provided below are the five tables relating to future average day demands they requested. The demand projection shown is the “with Plumbing Code” demands and is otherwise the same as Table 4 and Figure 7. The demand projections in the Urban Water Management Plan appeared in the required DWR tables 2, 12, 13, 14, and 15 (2005 Plan requirement table numbers).

Urban Water Management Plan Tables for of 2005 UWMP

Table 5 below provides population projections for Town of Windsor service area.

Table 5 (DWR Table 2) Population – Current and Projected

Town of Windsor	
Year	Population
2010	27,200
2015	28,400
2020	29,600
2025	30,800
2030	31,700
2035	32,700

Current and Future Water Use by Customer Type

The current and projected number of connections and deliveries to the Town of Windsor’s water distribution system, by sector are identified below on Table 6.

Table 6 (DWR Table 12) Past, Current and Projected Water Deliveries

Town of Windsor Demands and Accounts By Customer Category (Based on Demand with Plumbing Code, excluding UFW)								
Year		Single Family	Multifamily	Commercial	Irrigation	Institutional	Agriculture	Total
2010	Number of Accounts	8,031	58	450	384	359	0	9,283
	Deliveries AF/Y	3,154	82	562	716	103	0	4,618
2015	# of accounts	8,386	61	521	444	375	0	9,786
	Deliveries AF/Y	3,221	82	641	829	107	0	4,881
2020	# of accounts	8,740	64	596	508	391	0	10,299
	Deliveries AF/Y	3,278	82	725	949	112	0	5,147
2025	# of accounts	9,094	66	675	576	407	0	10,819
	Deliveries AF/Y	3,340	81	815	1,076	117	0	5,429
2030	# of accounts	9,360	68	772	658	419	0	11,277
	Deliveries AF/Y	3,386	81	926	1,229	120	0	5,742
2035	# of accounts	9,655	70	855	729	432	0	11,741
	Deliveries AF/Y	3,453	82	1,021	1,361	124	0	6,040

Water Sales to Other Agencies

The Town of Windsor does not currently sell water to any other agency. According to Town of Windsor, all “outside sales” are local businesses and residents, and not to another agency.

Table 7 (DWR Table 13) Sales to Other Agencies

Town of Windsor Sales to Other Agencies						
	2010	2015	2020	2025	2030	2035
Water Distributed (AFY)	N/A	N/A	N/A	N/A	N/A	N/A

Unaccounted-for Water and Additional Water Use

For this project unaccounted for water is defined to be the difference between water produced and water sold to customers. Unaccounted-for water use normally includes unmetered water use such as for fire protection and training, system and street flushing, sewer cleaning, construction, system leaks, meter inaccuracy, and unauthorized connections. Unaccounted-for water can also result from meter inaccuracies.

Table 8 (DWR Table 14) Additional Water Uses and Losses, AF/yr

Town of Windsor Unaccounted for Water						
	2010	2015	2020	2025	2030	2035
Unaccounted-for system losses (AFY)	348	367	386	407	430	453

Total Water Use

The total current and future water use for the system is shown in the table below.

Table 9 (DWR Table 15) Total Potable Water Use, AF/yr*

Town of Windsor Total Demand with Plumbing Code						
	2010	2015	2020	2025	2030	2035
Total Demand with Plumbing Code and UFW (AFY)	4,966	5,247	5,533	5,837	6,172	6,493

*Total Water use is potable only. Does not include recycled water use. Recycled water use and projection are in another section of the UWMP.

5. COMPARISON OF INDIVIDUAL CONSERVATION MEASURES

5.1 Selecting Conservation Measures to be Evaluated (Conservation Measure Screening)

An important step in updating the water conservation program is the review and screening of new water conservation measures. In 2005 a list of 75 potential conservation measures was developed by Maddaus Water Management from known technology that included devices or programs (e.g., such as a high efficiency toilet) that would save water if installed by a water retailer, contractor, or customer. These measures are considered to be beyond the Tier One measures. A description of the potential conservation measure was developed that addressed the methods through which the device or program will be implemented, including the distribution method, or mechanism, that would be used to activate the device or program.

A screening process was undertaken to reduce the number of measures to a more manageable number and to eliminate those measures that are not as well suited to the Marin-Sonoma County area as other potential measures. Each potential measure was screened based on four qualitative criteria (below), scored on a scale of 1 to 5, with 5 being the most acceptable, and 20 being the maximum possible number of points for all criteria. The screening was completed by local conservation professionals, in a one day meeting in July 2005, facilitated by Maddaus Water Management.

Qualitative Criteria

The rating group used the following criteria to evaluate the measures:

- **Technology/Market Maturity** – Refers to whether the technology needed to implement the conservation measure, such as an irrigation control device, is commercially available and supported by the local service industry. A measure was scored low if the technology was not commercially available or high if the technology was widely available in the service area. A device may be screened out if it is not yet commercially available in the region.
- **Service Area Match** – Refers to whether the measure or related technology is appropriate for the area’s climate, building stock, or lifestyle. For example, promoting Xeriscape gardens for multi-family or commercial sites may not be appropriate where water use analysis indicates little outdoor irrigation. Thus, a measure scored low in this category if it was not well suited for the area’s characteristics and could not save water. A measure scored high in this criterion if it was well suited for the area and could save water.
- **Customer Acceptance/Equity** – Refers to whether retail customers within the wholesale customer service area would be willing to implement and accept the conservation measures. For example, would retail customers attend homeowner irrigation classes and implement lessons learned from these classes? If not, then the water savings associated with this measure would not be achieved and a measure with this characteristic would score low for this criterion. This criterion also refers to retail customer equitability (i.e., one category of retail customers receives benefit while another pays the costs without receiving benefits). Retail customer acceptance may be based on:
 - Convenience
 - Economics
 - Perceived fairness
 - Aesthetics
- **Relative Effectiveness of Measure Available** – Refers to the selection of the most effective measure if alternate conservation measures address the same end use (example – irrigation for single family customers). If the measures are equally effective the most appropriate was selected (e.g., the measure that was easier or less expensive to implement).

Measures with low scores were eliminated from further consideration, while those with high scores passed into the next evaluation phase (cost-effectiveness analysis using the DSS Model). To reduce the list to a more manageable number, normally a score of 17 or more was necessary to pass. The process reduced the measures to be evaluated further down to 22 new measures in addition to the 10 Tier One measures.

Upon inspection of the overall list of new measures it became apparent that some measures could be combined and others could be separated into two categories as follows:

- Measures that were voluntary and incentive based
- Measures that were regulatory and applied to new development only

This division was used to create two lists of measures that could be evaluated separately. Tier Two targets various types of customers and offers a range of incentives to enhance participation. New Development measures were originally targeted at single family homes (including town homes and

condos), as this category represents the largest category of new development with the most water savings potential.

The following table presents the measure descriptions that were originally analyzed as part of the 2005 study for “Tier 2” and “New Development” (ND) as well as the new measures that the contractors selected for this analysis. We have not modified the Tier 2 and New Development measure descriptions from their original description other than to add information for Cal Green, SB 407, and the Model Water Efficient Landscape Ordinance. The Tier 1 measures follow the definition of the CUWCC BMPs.

Cal Green (New Development Building Code): MWM added the Cal Green requirements that effect all new development in the State of California after January 1, 2011. MWM modeled water savings from the Cal Green building code by adding Multifamily and Commercial customer categories as appropriate to the following six measures: Tier 2 – 13 (Urinals), ND 1 (Rain Sensors), ND 2 (Smart Controllers), ND 3 (HETs), ND 7 (High Efficiency Faucets and Showerheads) and ND 8 (Landscape Requirements). As this is a new development law and based on discussions with contractors it was assumed actual water savings seen by contractor would begin to occur in the year 2012. The new development ordinances for each contractor are listed in Table 10.

SB 407 (Plumbing Fixture Retrofit on Resale or Remodel): MWM included the new California Law SB 407 to the measure description table and in all of the contractors’ models as a new measure. In the model MWM worked carefully such that SB 407 takes into account the overlap with the plumbing code (natural replacement), Cal Green and rebate programs (such as through Tier 2-10 Toilets). SB 407 begins from the year 2017 in residential and 2019 in commercial properties. SB 407 program length continues until all the older high flush toilets have been replaced in each service area.

Tables 11, 12, 13 and 14 summarize the new measures selected for each contractor. Note that measures Tier 2-8, Tier 2-9 and Tier 2-11 were removed from this program at the request of all the contractors on August 2, 2010 for the following reasons:

- Measure Tier 2-8 was removed because new development regulations have changed significantly since this measure was analyzed in 2005 and the regulations require higher efficiency fixtures than this measure.
- Measure Tier 2-9 was removed as rebates for installing synthetic turf are incorporated into Measure Tier 2-2, Cash for Grass.
- Measure Tier 2-11 was removed because this measure is not cost-effective.

The removed measures are included in Table 13 for reference purposes only, but were not included in any of the DSS Model or any of the quantitative water saving calculations.

**Table 10
New Development Ordinances**

New Development Ordinances								
ND Measure	NMWD	City of Rohnert Park ¹	City of Cotati ²	City of Santa Rosa	Town of Windsor	City of Sonoma	Valley of the Moon WD	Draft Cal Green Requirement
Applicability (Customer Classes)	All	All	All	All	All	All	All	All
ND1-Rain Sensor Retrofit	2005	No	No	2010	2010 (SF>4 lots) & >2,500 sq ft/lot	No	2010, SF>5,000 sq ft	No
ND2-Smart Irrigation Controller	2005	No	2010	2010	2010 (SF>4 lots) & >2,500 sq ft/lot	No	2010, SF>5,000 sq ft	Yes
ND3- High Efficiency Toilets	2005	No	2009	2011	No	No	No	Yes
ND4-Dishwasher New Efficient	2005	No	2009	No	No	No	No	No
ND5-Clothes Washing Machine Requirement	2000	No	2009	No	No	No	No	No
ND6-Hot Water on Demand	No	No	No	No	No	No	No	No
ND7-High Efficiency Faucets and Showerheads	2006	No	2009	2011	No	No	No	Yes
ND8-Landscape and Irrigation Requirements	2004	2010 (State ordinance)	2010	SF since 2007. All other since 1993	2011 for landscapes > 2,500 sq ft (applies to all but SF<5 lots)	2010 (adopted ordinance planned to be adopted September 1, 2010, budgets w/ 60% ET	2010 for All except SF<5,000 sq. ft. and turf<600 sq ft	Yes
Urinals	2008	No	No	2011	No	2009	No	Yes
Source	NMWD Reg 15	Use Build it Green Checklist (Mandatory)	Use Build it Green Checklist (Mandatory)	Adopting Cal Green 2010	Adopting Landscape ordinance June 2010	Use Build it Green Checklist (Mandatory)	County ordinance effective Jan 1, 2010	State Reqmt; May take effect 2012

¹City of Rohnert Park has extensive green building ordinance requiring developers to select from a set of green building measures including some of the listed measures.

²City of Cotati ND-3 confirmed to start in 2009 based on July 27, 2010 with City of Cotati at the request of Damien O'Bid. Build It Green Checklist mandatory, beginning in the year 2004. The year 2009 was selected as a start date for 100% deployment of measures, as the measures can be selectively deployed providing the overall point minimum is achieved.

**Table 11
Cal Green Building Code**

Cal Green Building Code						
Building Class	Component	Effective Date[i]	Indoor Fixtures Included	Indoor Requirement	Landscaping & Irrigation Requirements	Are the Requirements Mandatory?
Residential	Indoor	1/1/2011	Toilets, Showers, Lavatory & Kitchen Faucets, Urinals	Achieve 20% savings overall below baseline		Yes
	Outdoor	1/1/2011			Provide weather adjusting controllers	Yes
Non Residential	Indoor	1/1/2011	Submeter leased spaces	Only if building >50,000 sq. ft. & if leased space use >100 gpd		Yes
			Toilets, Showers, Lavatory & Kitchen Faucets, Wash Fountains, Metering Faucets, Urinals	Achieve 20% savings overall below baseline		Yes
	Outdoor	1/1/2011			Provide water budget	> 1,000 sq ft. landscaped area
					Separate meter	As per Local or DWR ordinance
					Prescriptive landscaping requirements	> 1,000 sq ft. landscaped area
				Weather adjusting irrigation controller	Yes	

[i] Effective date is 7/1/2011 for toilets

Table 12
Tier One Conservation Measures Evaluated in the DSS Model

Measure Number	Original CA BMP Number	Target Customer Category	Measure	Description
1	1	RSF, RMF	Residential Water Surveys - Indoor	This is the <u>indoor</u> component of indoor and outdoor water surveys for existing single-family and multi family residential customers. Normally those with high water use are targeted and provided customized report to homeowner.
2	1	RSF, RMF	Residential Water Surveys - Outdoor	This is the <u>outdoor</u> component of indoor and outdoor water surveys for existing single-family and multi family residential customers. Normally those with high water use are targeted and provided customized report to homeowner.
3	2	RSF, RMF	Residential Retrofit	Provide owners of pre-1992 homes with retrofit kits that contain easy-to-install low flow showerheads, faucet aerators, and toilet tank retrofit devices, until saturation reaches 75%.
4	5a	IRR	Water Budgets	90% of all irrigators of landscapes with separate irrigation accounts would receive a monthly or bi-monthly irrigation water use budget.
5	5b	IND	Large Landscape Conservation Audits	All public and private irrigators of landscapes larger than one acre would be eligible for free landscape water audits upon request.
6	6	RSF	Clothes Washer Rebate	Homeowners would be eligible to receive a rebate on a new water efficient clothes washer.
7	7	RSF, NRSF	Public Information Program	Public education would be used to raise awareness of other conservation measures available to customers. Programs could include poster contests, speakers to community groups, radio and television time, and printed educational material such as bill inserts, etc.
8	9	COM	Commercial Water Audits	High water use accounts would be offered a free water audit that would evaluate ways for the business to save water and money.
9	14	RSF	Single Family Residential ULF Toilet Rebate	Homeowners would be eligible to receive a rebate to replace an existing high volume toilet with a new water efficient toilet.
10	14	RMF	Multi family Residential ULF Toilet Rebate	Homeowners would be eligible to receive a rebate to replace an existing high volume toilet with a new water efficient toilet.

Notes:

RSF = Residential Single Family

RMF = Residential Multi Family

NRSF = New Residential Single Family

COM = Business

INS = Institutional

IND = Industrial

Table 13
Tier Two and New Development Conservation Measures Evaluated in the DSS Model

Measure Number	Name of Measure	Target Customer Category	Description
Tier 2-1	Rain-sensor (shut off device) retrofit on irrigation controllers	Existing Customers SF	Agency pays for the rain sensor, homeowner pays for the optional installation (\$35).
Tier 2-2	Cash for Grass (turf removal program)	Existing Customers SF, MF, CII	Provide a rebate for customers who remove irrigated turf grass and replace it with low water using plants. The rebate would require that an appropriate irrigation system be installed for the replacement landscaping. Limited to \$500 rebate at \$1.00 per square foot.
Tier 2-3	Financial Incentives for Being Below Water Budget	All Dedicated Irrigation Meter customers	For dedicated irrigation customers, link a landscape water budget to a retail water agency's rate schedule so that the dedicated irrigation meter customer pays less when their water use is at or under their water budget.
Tier 2-4	Financial Rebates for Irrigation Meters	Existing CII Customers with mixed water use (indoor and outdoor)	Provide financial incentives/rebates for selected permits and equipment to convert mixed use meters to a separate dedicated irrigation meter. Model implementation program after City of Santa Rosa's Service Split program. Utility will provide a water budget for the new irrigation meter.
Tier 2-5	Smart Irrigation Controller Rebates	Existing Customers SF, MF, CII, IRR	Provide an up to \$450 rebate for the purchase of a SMART irrigation controller and associated signal fees (up to \$150). Assume one controller for RSF and two for others. Minimum participant requirements: at least 500 sq ft of well maintained turf irrigated with an automatic irrigation control system.
Tier 2-6	Financial Incentives/ Rebates for Irrigation Upgrades	Existing Customers MF, CII, IRR, and SF for some contractors if requested as a new measure	For MF & CII customers with landscape provide rebates for selected types of irrigation equipment upgrade including rain sensors, rain harvesting, and grey water. Each contractor can include any equipment desired and allow the customers to select the items they prefer up to the maximum rebate value per customer. Water savings assumes a mixture of many different irrigation technologies. Model program after water agencies such as EBMUD or Contra Costa Water District or Santa Rosa.
Tier 2-7	Hotel retrofit (w/financial assistance) - CII Existing	Existing Customers: CII	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.
Tier 2-8 MEASURE REMOVED FROM 2010 ANALYSIS	Offer new accounts reduced connection fees for installing efficient process equipment for selected businesses (restaurants, laundry mat, food/groceries and hospital)	New Customers: CII	Offer reduced water and sewer connection fees to new facilities to install water efficient equipment in new facilities that goes above and beyond the building code requirements. Model program after Santa Rosa's BAT program.

Measure Number	Name of Measure	Target Customer Category	Description
Tier 2-9 MEASURE REMOVED FROM 2010 ANALYSIS	Synthetic Turf Rebate	Existing Customers: SF (North Marin only) , IRR	Provide a rebate for replacing existing turf with synthetic turf. Market program to all irrigation customers and single family for North Marin only.
Tier 2-10	High Efficiency Toilet (HET)	Existing Customers: SF & MF	Provide a rebate or voucher for the installation of a high efficiency toilet (HET). HET are defined as any toilet to flush 20% less than an ULFT and include dual flush technology. Rebate amounts would reflect the incremental purchase cost.
Tier 2-11 MEASURE REMOVED FROM 2010 ANALYSIS	Dishwasher New Efficient	Existing Customers: SF	Provide a rebate to encourage homeowners to replace old inefficient dishwashers with new efficient dishwashers (meeting certain water efficiency standards, such as gallons/load).
Tier 2-12	CII Rebates - replace inefficient water using equipment	Existing Customers: CII	Provide a rebate for a standard list of water efficient equipment. Included would be x-ray machines, icemakers, air-cooled ice machines, steamers, washers, spray valves, efficient dishwashers, replace once through cooling, add conductivity meters on cooling towers, etc.
Tier 2-13	0.5 gal/flush urinals in new buildings	New Customers: CII	Require that new buildings be fitted with 0.5 gpf or less urinals rather than the current standard of 1.0-gal/flush models.
ND1	Rain-sensor shut off device on irrigation controllers	New Customers: SF, MF and CII depending upon local ordinances and contractor request of new measures	Require-sensor or rain shut off devices with all new automatic irrigation system installations on new homes.
ND2	Smart Irrigation Controller	New Customers: SF, MF and CII depending upon local ordinances and contractor request of new measures	Require developers to provide the latest state of the art SMART irrigation controllers. These SMART controllers have on-site temperature sensors or rely on a signal from a central weather station that modifies irrigation times at least weekly.
ND3	High Efficiency Toilet (HET)	New Customers: SF, MF and CII depending upon local ordinances and contractor request of new measures	Require new single family and multifamily residents to install a high efficiency toilet (HET). HET are defined as any toilet to flush 20% less than an ULFT and include dual flush technology.
ND4	Dishwasher New Efficient	New Customers: SF, MF and CII depending upon local ordinances and contractor request of new measures	Require new single-family residents to install an efficient dishwasher (meeting certain water efficiency standards, such as gallons/load).
NDS	Clothes washing machines requirement for new residential	New Customers: SF, MF and CII depending upon local ordinances and contractor request of new measures	Building departments would be responsible to ensure that an efficient washer was installed before new home occupancy.

Measure Number	Name of Measure	Target Customer Category	Description
ND6	Hot Water on Demand	New Customers: SF, MF and CII depending upon local ordinances and contractor request of new measures	Require developers to equip new homes with a hot water on demand system or tankless hot water heaters, such as those made by Metland Systems and others. These systems use a pump placed under the sink to recycle water sitting in the hot water pipes to the water heater.
ND7	High efficiency faucets and showerheads	New Customers: SF, MF and CII depending upon local ordinances and contractor request of new measures	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
ND8	Landscape and irrigation requirements	New Customers: SF, MF and CII depending upon local ordinances and contractor request of new measures	Enforce a regulation that specifies that homes be landscaped according to Xeriscape principals and the Model Water Efficient Landscape Ordinance, with appropriate irrigation systems. (Combines with Smart Controller listed above). Goal is overall 25% reduction in irrigation water use.
New Measure	SB 407	Existing: SF, MF and CII	Measure will start in the year 2017 for SF accounts and 2019 for MF and CII accounts to coincide with the California State Law SB 407. The law includes working with the real estate industry to require a certificate of compliance be submitted to the City stating that, when a property is sold, information on whether or not indoor water fixtures are efficient was disclosed to the buyer.
Potential New Measure Selected by One or More Contractors	Rainwater harvesting	New Customers SF; Existing SF, MF	Provide a rebate (\$100 RSF and \$200 RMF) to assist a certain percentage of single family homeowners per year with installation of rain barrels or cisterns.
Potential New Measure Selected by One or More Contractors	Grey Water System Rebate	New Customers SF; Existing SF	Provide a rebate (up to \$500) to assist a certain percentage of single family homeowners per year to install gray water systems. Parts cost approx \$200, installation is approx \$400-\$500
Potential New Measure Selected by One or More Contractors	Tiered Water Rates	Existing Customers: SF, MF, CII	Change Rate Structure to an inclining block rate and increase prices significantly periodically to maintain savings, such as every ten years.
Potential New Measure Selected by One or More Contractors	Submetering and Consumption Billing of Apartments and Mobile Homes	New Customers: MF	Require installation of submeters on all new MF and mobile home accounts unless the building has a central, circulating hot water system (which precludes a meter on all water going to each unit).

RSF = Residential Single Family

RMF = Residential Multi Family

NRSF = New Residential Single Family

COM = Business

INS = Institutional

IND = Industrial

Table 14
New Conservation Measures Evaluated in the DSS Model

New Conservation Measures for Analysis (New for the 2010 analysis)							
Measure	North Marin				Valley of the		
	City of Cotati	Water District	City of Rohnert Park	City of Santa Rosa	City of Sonoma	Moon Water District	Town of Windsor
Rainwater Harvesting Rebate				✓			
Grey Water System Rebate				✓		✓	
Tiered Water Rates (Conservation Pricing)	✓				✓		
Submetering and Consumption Billing of Apartments and Mobile Homes - New and Existing			✓				
Add CII to New Development Requirements	✓	✓					✓
SB407 - Retrofit of High Efficiency Fixtures	✓	✓	✓	✓	✓	✓	✓
Add SF Residential to Irrigation System Upgrades (T2-6)		✓			✓	✓	✓

5.2 Perspectives on Benefits and Costs

The determination of the economic feasibility of water conservation programs depends on comparing the costs of the programs to the benefits provided. The analysis was performed using the DSS Model. The DSS Model calculates savings at the end-use level; for example, the model determines the amount of water a toilet rebate program saves in daily toilet use for each single family account.

Present value analysis using constant 2010 dollars and a real discount rate of 3% is used to discount costs and benefits to the base year. From this analysis, benefit-cost ratios of each measure are computed. When measures are put together in programs, the model is set up to avoid double counting savings from multiple measures that act on the same end use of water. For example, multiple measures in a program may target toilet replacements. The model includes assumptions to apportion water savings between multiple measures.

Economic analysis can be performed from several different perspectives, based on which party is affected. For planning water conservation programs for utilities, the perspectives most commonly used for benefit-cost analyses include the utility and the community. The “utility” benefit-cost analysis is based on the benefits and costs to the water provider. The “community” benefit-cost analysis includes the utility benefit and costs together with account owner/customer benefits and costs. These include customer energy and other capital or operating cost benefits plus costs of implementing the measure, beyond what the utility pays.

The utility perspective offers two advantages for this analysis. First, it considers only the program costs that will be directly borne by the utility. This enables the utility to fairly compare potential investments for saving and supplying water. Second, because revenue shifts are treated as transfer payments, the analysis is not complicated with uncertainties associated with long-term rate projections and retail rate design assumptions. Because it is the water provider’s role in developing a conservation plan that is paramount in this study, the utility perspective was primarily used to evaluate elements of the plan.

The community perspective is defined to include the utility and the customer costs and benefits. Costs incurred by customers striving to save water while participating in conservation programs are considered, as well as the benefits received in terms of reduced energy bills (from water heating costs) and wastewater savings, among others. Other factors external to the utility, such as environmental effects and climate change, are not included in the benefit-cost analysis. Because these external factors are often difficult to quantify and are not necessarily under the control of the utility, they are therefore frequently excluded from economic analyses, including this one.

5.3 Present Value Parameters

The time value of money is explicitly considered. The value of all future costs and benefits is discounted to 2005 (the model start year) at the real interest rate of 3.0%. The DSS Model calculates this real interest rate, adjusting the current nominal interest rate (assumed to be approximately 6.1%) by the assumed rate of inflation (3.0%). Cash flows discounted in this manner are herein referred to as “Present Value” sums.

5.4 Assumptions about Measure Costs

Costs were determined for each of the measures based on industry knowledge, past experience and data provided by the Town of Windsor. Costs may include incentive costs, usually determined on a per-participant basis; fixed costs, such as marketing; variable costs, such as the costs to staff the measures and to obtain and maintain equipment; and a one-time set-up cost. The set-up cost is for measure design by staff or consultants, any required pilot testing, and preparation of materials that will be used in marketing the measure. Measure costs were estimated for 30 years, (each year between 2005 and 2035). Costs were spread over the time period depending on the length of the implementation period for the measure and estimated voluntary customer participation levels.

Lost revenue due to reduced water sales is not included as a cost because the conservation measures evaluated herein generally take effect over a span of time that is sufficient to enable timely rate adjustments, if necessary, to meet fixed cost obligations.

5.5 Assumptions about Measure Savings

Data necessary to forecast water savings of measures include specific data on water use, demographics, market penetration, and unit water savings. Savings normally develop at a measured and predetermined pace, reaching full maturity after full market penetration is achieved. This may occur three to ten years after the start of implementation, depending upon the implementation schedule.

5.6 Assumptions about Avoided Costs

The most expensive source of water for almost all of the contractors, and in some cases the only source of water is the SCWA Russian River Supply. The price of the water to the contractors is set by SCWA every year and varies by contractor location, depending upon which aqueduct they draw from. Since 1990 the annual price of water has increased significantly. The annual rate of increase for 1989/1990 to 2010/11 has varied from 4.5 to 5.1% per year depending upon the aqueduct.

Since 1990 the annual rate of inflation has increased 2.64% per year in the San Francisco Bay Area, as measured by the Consumer Price Index (CPI). Based on this data the price of SCWA water has increased faster than the CPI.

Therefore in evaluating the benefit cost ratio of conservation measures and programs it is appropriate to consider the net increase in benefits (i.e., the net increase in the avoided cost of water). Other costs, such as the cost of conservation will increase presumably at the CPI rate. Also the cost of conservation programs will be paid for with inflated dollars.

For this evaluation the avoided costs were escalated from the 2010/11 value to a projected 2025/26 value (15 years). The cost escalated was the 2010/11 current price plus a distribution cost of \$27.70 per acre-foot taken from pumping costs documented by North Marin Water District, which was the only contractor that had pumping costs readily available, and used for all contractors.

The net increase and the avoided costs used in this evaluation are listed below:

- Santa Rosa aqueduct contractors - 1.86% per year escalation or \$ 832 per acre-foot
- Petaluma aqueduct contractors - 1.81% per year escalation or \$ 827 per acre-foot
- Sonoma aqueduct contractors - 2.43% per year escalation or \$1,006 per acre-foot
- Windsor was escalated at the Santa Rosa aqueduct rate to \$ 991 per acre-foot

This has the effect of raising the benefit-cost ratios in our evaluation by the amount that is roughly the percentage difference in the future vs. the current price of SCWA water. In our opinion this escalation represents a more realistic comparison of benefits and costs of conservation.

5.7 Measure Assumptions including Unit Costs, Water Savings, and Market Penetrations

Appendix A includes assumptions in the DSS Model for each of the following variables for all measures modeled:

- *Targeted Water User Group; End Use* – Water user group (e.g., single-family residential) and end use (e.g., indoor or outdoor water use).
- *Utility Unit Cost (for contractor)* – Cost of rebates, incentives, and contractors hired (by the utility) to implement measures.
- *Retail Customer Unit Cost* – Cost for implementing measures that is paid by retail customers (i.e., the remainder of a measure’s cost that is not covered by a utility rebate or incentive).
- *Utility Administration and Marketing Cost* – The cost to the utility administering the measure, including consultant contract administration, marketing, and participant tracking. The mark-up is sufficient (in total) to cover local agency conservation staff time and general expenses and overhead.

The unit costs vary according to the type of account and implementation method being addressed. For example, a measure might cost a different amount for a residential single family account, than a residential multi-family account, and for a rebate versus a direct installation implementation method. Typically water utilities have found that there are increased costs associated with achieving higher market saturation, such as more surveys per year. Appendix A shows the unit costs used in the study. The model calculates the annual costs based on the number of participants each year. The general formulas for calculating annual costs are:

Annual Utility Cost = Annual market saturation x total accounts in category x utility unit cost per account x (1+administration and marketing markup)

Annual Customer Cost = Annual number of participants x retail customer unit cost

Annual Community Cost = Annual utility cost + annual customer cost

5.8 Comparison of Individual Measures

Table 15 presents how much water the measures would save over 30 years, how much they would cost, and what cost of water saved is *if the measures were run on a stand-alone basis (i.e. without interaction or overlap from other measures that might address the same end use(s))*. Only the net or highest water savings for overlapping conservation measures was included in each program.

Economic indicators are defined below:

- *Utility costs*: those costs that the utility would spend include measure set-up, annual administration, and payment of rebates or purchase of devices or services as specified in the measure design.
- *Customer costs*: those costs customers would spend to participate in Town of Windsor programs and maintaining its effectiveness over the life of the measure.
- *Community costs*: Community costs include utility and customer costs to implement measures.

The column headings in Table 15 are defined as follows:

- *Year 2035 Water Savings (AF/Yr)* = Water savings in 2035 (AF/Yr) where AF/Yr = acre-feet per year.
- *Present Value of Water Utility Costs* = 30 year present value of the time stream of annual costs.
- *Utility Benefit-Cost ratio* = NPV of utility costs/NPV of utility benefits over 30 years.
- *Community Benefit-Cost ratio* = (NPV of Utility Benefits plus NPV of customer energy savings)/NPV of utility plus NPV of customer costs).
- *Utility Cost of Savings per Unit Volume (\$/AF, by cost category)* = NPV of Category Costs divided by 30-year volume of water saved.
- *Total Utility Cost for Five Years 2011-2015* = Total cost in dollars to run the program for the years 2011 to 2015 (five years). This is a five year cost often useful for short term financial budgeting purposes.

Table 15
Conservation Measure Cost and Savings

Town of Windsor Conservation Measure Cost and Savings						
Measure Name	Year 2035			Community Benefit Cost Ratio	Utility Cost of Savings per Unit Volume (\$/AF)	Five Year Total Utility Cost 2011 -2015
	Water Savings (AFY)	Present Value of Water Utility Costs	Utility Benefit Cost Ratio			
CUWCC #1a - Residential Water Surveys - Interior	8.94	\$123,741	1.15	2.32	\$533	\$31,365
CUWCC #1b - Residential Water Surveys - Outdoor	17.85	\$123,171	2.10	1.91	\$287	\$31,196
CUWCC #2 - Plumbing Retrofit Kits	1.71	\$5,149	6.63	25.80	\$98	\$0
CUWCC #5a - Large Landscape Water Budgets	80.90	\$199,307	4.64	4.64	\$120	\$66,447
CUWCC #5b - Large Landscape Audits	2.61	\$35,210	1.24	0.82	\$499	\$0
CUWCC #6 - Washer Rebates	6.36	\$55,719	2.83	3.75	\$234	\$0
CUWCC #7 - Residential Public Education	32.90	\$274,503	2.25	3.97	\$288	\$64,407
CUWCC #9 - Commercial Water Audits	27.06	\$517,191	0.76	0.89	\$778	\$259,367
CUWCC #14a - RSF Toilet Replacement	0.00	\$19,856	0.05	0.02	\$13,653	\$0
CUWCC #14b - RMF Toilet Replacement	0.00	\$1,858	0.00	0.00	\$0	\$0
Tier 2 - 1 Rain Sensor Retrofit	12.10	\$34,574	3.83	1.59	\$146	\$12,260
Tier 2 - 2 Cash for Grass	2.17	\$27,659	1.10	0.61	\$532	\$34,036
Tier 2 - 3 Financial Incentives for Being Below Water Budget	133.50	\$233,814	5.61	0.37	\$96	\$101,250
Tier 2 - 4 Irrigation Meter Rebates	0.15	\$1,956	1.04	0.58	\$562	\$2,407
Tier 2 - 5a Smart Irrigation Controller Rebates - RSF	9.59	\$228,792	0.45	0.38	\$1,232	\$120,569
Tier 2 - 5b Smart Irrigation Controller Rebates - RMF, CII, IRR	32.51	\$242,653	1.51	1.39	\$368	\$156,878
Tier 2 - 6 Financial Incentives/Rebates for Irrigation Upgrades	30.39	\$377,596	0.82	0.74	\$662	\$198,435
Tier 2 - 7 Hotel Retrofit	2.10	\$8,333	2.55	0.98	\$213	\$4,102
Tier 2 - 10 High Efficiency Toilets	14.12	\$316,101	0.70	0.40	\$838	\$400,582
Tier 2 - 12 CII Rebates - Replace Inefficient Water Using Equipment	2.05	\$21,665	0.97	0.96	\$562	\$10,665
Tier 2 - 13 New Commercial Urinals	3.46	\$13,845	2.19	0.24	\$248	\$4,102
Tier 2 - ND1 Rain Sensor Retrofit	32.74	\$205,306	1.15	0.85	\$462	\$56,118
Tier 2 - ND2 Smart Irrigation Controller	54.57	\$14,763	26.57	0.71	\$20	\$4,872
Tier 2 - ND3 High Efficiency Toilets	3.02	\$5,227	8.67	0.38	\$68	\$6,431
Tier 2 - ND4 Dishwasher New Efficient	1.71	\$13,643	0.90	0.03	\$584	\$4,872
Tier 2 - ND5 Clothes Washing Machine Requirement	25.28	\$13,643	15.54	0.42	\$35	\$4,872
Tier 2 - ND6 Hot Water on Demand	31.38	\$17,024	13.09	0.65	\$40	\$5,880
Tier 2 - ND7 High Efficiency Faucets and Showerheads	24.21	\$16,855	9.99	6.76	\$53	\$5,678
Tier 2 - ND8 Landscape and Irrigation Requirements	36.38	\$17,975	14.55	0.07	\$36	\$5,678
Tier 2 - SB 407 Requirements	3.90	\$1,189	26.43	0.66	\$19	\$0

6. RESULTS OF CONSERVATION PROGRAM EVALUATION

6.1 Selection of Measures for Programs

Table 16 provides a summary of which measures are included in each of the six draft alternative programs. The six packages are designed to illustrate a range of various measure combinations and resulting water savings.

These programs are not intended to be rigid programs but rather to demonstrate the range in savings that could be generated if selected measures were run together. In this step we account for a percent overlap in water savings (and benefits) and estimate combined savings and benefits from programs or packages of measures.

A description of each program evaluated follows. For most contractors Tier Two measures are modeled to commence in 2011. The only reason the measure would not start in 2011 is if an agency had submitted data showing activity in one of the Tier 2 programs from 2005 to 2009. Most agencies have shown significant activity on the Tier One measures since the model start year of 2005.

Program – Existing

Savings for the “Existing Program” include the measures that have been run during the time period of 2005 and 2009 as submitted by each individual contractor. For the Town of Windsor, the following measures were included:

Existing Program Conservation Measures:

Existing Program Conservation Measures:

- CUWCC #1 - Residential Water Surveys - Interior
- CUWCC #1 - Residential Water Surveys - Outdoor
- CUWCC #2 - Plumbing Retrofit Kits
- CUWCC #5b - Large Landscape Audits
- CUWCC #6 - Washer Rebates
- CUWCC #7 - Residential Public Education
- CUWCC #9 - Commercial Water Audits
- CUWCC #14 - RSF Toilet Replacement
- CUWCC #14 - RSF Toilet Replacement
- Tier2 - ND1 Rain Sensor Retrofit
- Tier2 - ND2 Smart Irrigation Controller

Program – Existing + New Measures

Savings for the “Existing Program + New Measures” include the measures that have been run during the time period of 2005 and 2009 as submitted by each individual contractor in addition to the three new measures evaluated for each contractor. The new measures for each contractor are listed in Table 14.

Program – Tier One Measures

This program was designed to be the future program with full compliance for “Tier One Measures” including all the CUWCC BMPs. Program water savings includes actual achievements for the years 2005 to 2009 and then projected participation rates starting in 2011 in accordance with those specified in the

California Urban Water Conservation Council's Memorandum Of Understanding, which may be higher (or lower) than you are currently achieving. If you continue to implement the BMPs as planned, your future demands will be reduced by the amount of savings from Tier One future measures.

Program - Tier One + New Development Measures

Savings for Tier One + New Development Measures were designed to isolate the effects of the New Development measures that would be implemented as well as the completion of Tier One measures. These eight New Development measures target new single family homes, multifamily homes, and commercial development based on the local ordinances or Cal Green as shown in Table 12 and 13.

Program – Tier One + Tier Two Measures

Savings for Tier One + Tier Two Measures includes 13 additional measures beyond the CUWCC BMPs. Tier One Future was designed to be the future program with full compliance for all the CUWCC BMPs. The participation rates starting in 2005 are in accordance with historical conservation efforts for the years 2005 to 2009. Then they proceed with the rate specified in the California Urban Water Conservation Council's Memorandum Of Understanding, which may be higher (or lower) than you are currently achieving. If you continue to implement these measures, your future water demands will be reduced by the amount of conservation savings. Descriptions of the Tier Two measures are in Table 13 and cost and saving assumptions for each individual measure can be found in Attachment A. Note that due to increased regulations and additional research and analysis on conservation measures, measures Tier 2-8, Tier 2-9 and Tier 2-11 were removed from this program at the request of all the contractors on August 2, 2010.

Program: Tier One, Tier Two, New Development

Savings for Tier One, Tier Two, and New Development includes all analyzed conservation measures except for the "new measures" because the new measures are unique to each contractor and did not go through the original measure screening process as the other measures in 2005. Also note that measures that either saved a small amount of water or were not cost-effective (Benefit-Cost ratio less than 1.0 and a high cost of water saved) were included here. Some of the Tier Two measures are small programs in that the target number of accounts is very small. So even though they appear to be relatively expensive from a measure point of view, their impact on the overall program costs and savings is relatively minor. Note that due to increased regulations and additional research and analysis on conservation measures, measures Tier 2-8, Tier 2-9 and Tier 2-11 were removed from this program at the request of all the contractors on August 2, 2010.

**Table 16
Conservation Measures Selected for Programs**

Town of Windsor Conservation Measures in each Program						
Measure Name	Program Existing	Program Existing & New	Program Tier 1	Program Tier 1 & ND	Program Tier 1 & Tier 2	Program Tier 1 & Tier 2 & ND
CUWCC #1a - Residential Water Surveys - Interior	✓	✓	✓	✓	✓	✓
CUWCC #1b - Residential Water Surveys - Outdoor	✓	✓	✓	✓	✓	✓
CUWCC #2 - Plumbing Retrofit Kits	✓	✓	✓	✓	✓	✓
CUWCC #5a - Large Landscape Water Budgets			✓	✓	✓	✓
CUWCC #5b - Large Landscape Audits	✓	✓	✓	✓	✓	✓
CUWCC #6 - Washer Rebates	✓	✓	✓	✓	✓	✓
CUWCC #7 - Residential Public Education	✓	✓	✓	✓	✓	✓
CUWCC #9 - Commercial Water Audits	✓	✓	✓	✓	✓	✓
CUWCC #14a - RSF Toilet Replacement	✓	✓	✓	✓	✓	✓
CUWCC #14b - RMF Toilet Replacement	✓	✓	✓	✓	✓	✓
Tier 2 - 1 Rain Sensor Retrofit					✓	✓
Tier 2 - 2 Cash for Grass					✓	✓
Tier 2 - 3 Financial Incentives for Being Below Water Budget					✓	✓
Tier 2 - 4 Irrigation Meter Rebates					✓	✓
Tier 2 - 5a Smart Irrigation Controller Rebates - RSF					✓	✓
Tier 2 - 5b Smart Irrigation Controller Rebates - RMF, CII, IRR					✓	✓
Tier 2 - 6 Financial Incentives/Rebates for Irrigation Upgrades		✓			✓	✓
Tier 2 - 7 Hotel Retrofit					✓	✓
Tier 2 - 10 High Efficiency Toilets					✓	✓
Tier 2 - 12 CII Rebates - Replace Inefficient Water Using Equipment					✓	✓
Tier 2 - 13 New Commercial Urinals					✓	✓
Tier 2 - ND1 Rain Sensor Retrofit	✓	✓		✓		✓
Tier 2 - ND2 Smart Irrigation Controller	✓	✓		✓		✓
Tier 2 - ND3 High Efficiency Toilets				✓		✓
Tier 2 - ND4 Dishwasher New Efficient				✓		✓
Tier 2 - ND5 Clothes Washing Machine Requirement				✓		✓
Tier 2 - ND6 Hot Water on Demand				✓		✓
Tier 2 - ND7 High Efficiency Faucets and Showerheads				✓		✓
Tier 2 - ND8 Landscape and Irrigation Requirements				✓		✓
SB 407 Requirements (Plumbing Retrofit on Resale or Remodel)		✓				

NOTE – Due to increased regulations and additional research and analysis on conservation measures, Measures Tier 2-8, Tier 2-9 and Tier 2-11 were removed from analysis at the request of all the contractors

6.2 Results of Program Evaluation

Figure 8 shows annual water demand with no conservation, plumbing code only, and the six programs. Table 17 shows the savings in 5 year increments for all six programs. The savings in Table 17 are just from the conservation programs alone and do not include the plumbing code savings. The separate starting points for the demand with and without the plumbing code versus the conservation programs is directly correlated to the fact that the contractors have existing conservation programs active from 2005 and 2009 that are already saving water by the year 2010.

Figure 8
Long Term Demands with Conservation Programs

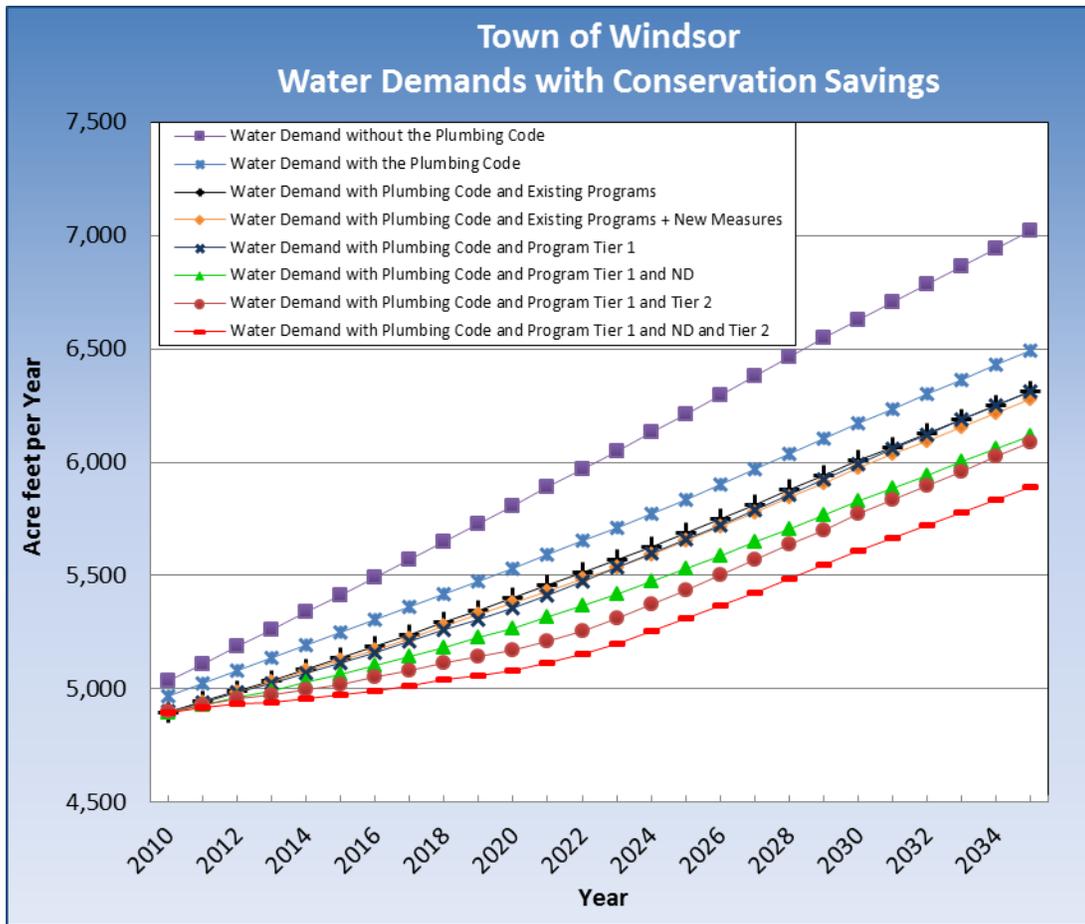


Table 17
Long Term Conservation Program Savings

Town of Windsor Water Conservation Savings							Benefit Cost Ratio	Benefit Cost Ratio
Conservation Savings (AFY)	2010	2015	2020	2025	2030	2035	Utility	Community
Existing Programs	69	111	132	149	165	181	1.7	1.6
Existing Programs + New Measures	69	122	156	182	198	214	1.5	1.4
Program Tier 1	66	133	177	177	177	178	1.9	2.3
Program Tier 1 and ND	70	182	267	308	342	377	2.4	0.8
Program Tier 1 and Tier 2	66	225	363	399	402	404	1.7	0.9
Program Tier 1 and ND and Tier 2	70	274	452	528	563	600	2.0	0.7

Figure 9 shows how marginal returns change as more money is spent to achieve savings. As the figure shows the cost versus saving curve is starting to decline after Program Tier One + New Development. This means that the added cost of going from that Program to Tier One + Tier Two will save less water per unit expenditure. In other words there are diminishing returns when the curve starts to flatten out as Tier Two measures are added to the program. It is clear that the New Development measures are more cost-effective to the utility than Tier Two measures. It is not to say that the Tier Two measures are a poor

investment. The decision on which program is appropriate for each agency is dependent on many factors. Most recently it may be impacted by the goals set forth by SB7x-7 which calls for a reduction in per capita water use by 2020, which is independent of the economic analysis.

Figure 9
Present Value of Utility Costs versus Cumulative Water Saved

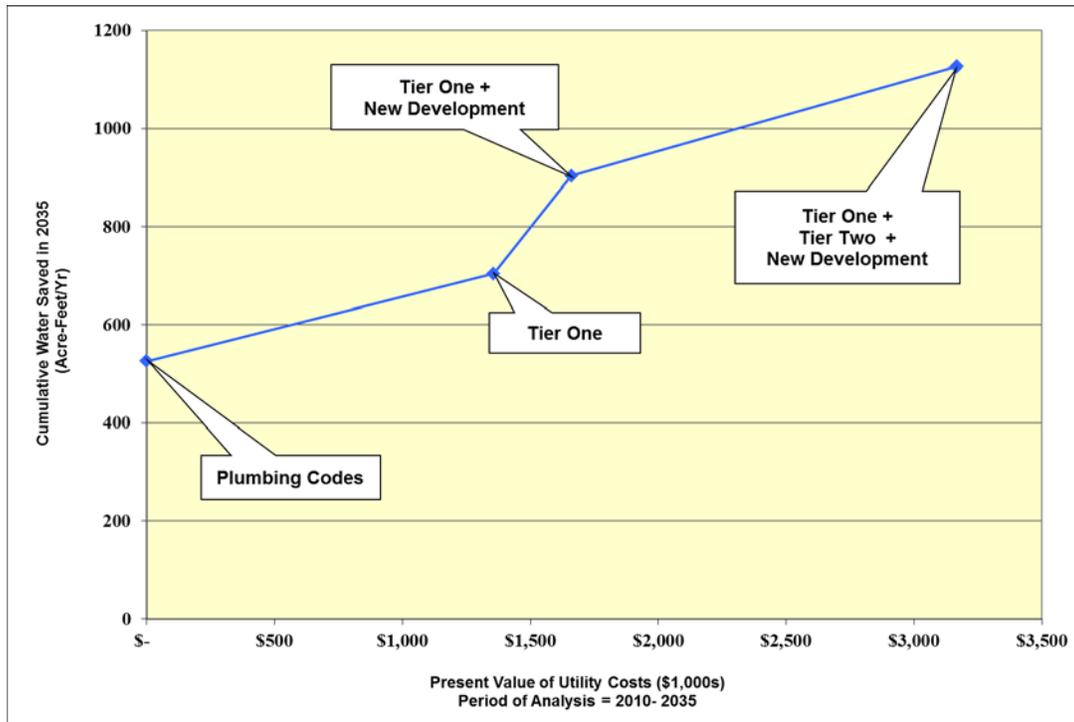


Table 18 presents key evaluation statistics compiled from the DSS Model. Assuming all measures are successfully implemented, projected water savings for 2030 in AF are shown, as are the costs of achieving this reduction. Water savings for programs have been shown for 2035 in Table 18.

The costs are expressed two ways.

1. Total present value over the analysis period,
2. The cost of water saved. Cost of water saved is presented two ways: for the utility and the total community (customer plus utility).

These cost parameters are derived from the annual time stream of utility, customer and community costs.

The water savings are expressed as a percentage of the projected 2035 demand. One column indicates the percentage of the new water demand in 2035 each program could provide. The new water needed by new customers over the full planning period is the difference between 2005 demand and 2035 demand without the plumbing code. The plumbing code is an additional savings that could be added on top of the water savings shown in Table 18. This allows the plumbing code savings percent and water savings in AF/Yr shown in Table 4 and to be additive to the conservation program savings in AF/Yr and percentages shown in Table 18.

**Table 18
Comparison of Long-Term Conservation Programs – Utility Costs and Savings**

Town of Windsor Comparison of Conservation Program Costs and Savings												
Conservation Program	Water Utility Benefit-Cost Ratio	Community Benefit-Cost Ratio	2015		2035		2035		Total Water Savings as a % of Total Production in 2035*	30 Year Present Value of Water Utility Costs (\$1,000)	Total Utility Cost for Five Years 2011-2015 (\$1,000)	Utility Cost of Water Saved (\$/AF)
			Water Savings (AFY)	Water Savings (AFY)	Indoor Water Savings (AFY)	Outdoor Water Savings (AFY)						
Existing Program	1.66	1.58	111	181	52	129	2.8%	\$1,355	\$447	\$359		
Existing Program + New Measures	1.49	1.43	122	214	56	158	3.3%	\$1,734	\$646	\$396		
Tier One	1.89	2.27	133	178	52	126	2.7%	\$1,356	\$453	\$316		
Tier One + Tier Two	1.72	0.81	225	404	74	331	6.2%	\$2,863	\$1,498	\$332		
Tier One + New Development	2.44	0.91	182	377	133	244	5.8%	\$1,660	\$547	\$234		
Tier One + Tier Two + New Development	2.02	0.67	274	600	154	446	9.2%	\$3,167	\$1,592	\$279		

Notes:

- Present Value is determined using an interest rate of 3%
- Cost of water saved is present value of water utility cost divided by total 30-year water savings.
- * % of water saved refers to the demand without the plumbing code
- Total water savings in 2035 as a percent of production is relative to no plumbing code production
- Conversion 1 MGD is equal to 1120 AFYr

7. CONCLUSIONS

7.1 Relative Savings and Cost-Effectiveness of Programs

The Town of Windsor service area has a relatively high portion of residential water use and a significant amount of outdoor water use. Consequently, residential conservation programs produce the most savings. Town of Windsor's service area is not a heavy manufacturing sector so the conservation potential in the commercial sector is relatively low. Based on the assumed avoided cost of new water, water conservation programs are cost-effective. Overall conclusions are:

- The decrease in demand for the Town of Windsor compared to the water demand projections in the 2005 Demand and Water Conservation Measure Analysis completed by MWM was due to the reduction in population and employment projections and change to lower water factors for each customer category used to project the water use for each customer category. The water factors decreased for all contractors compared to the 2005 study.
- Water savings from implementation of the Tier One, Tier Two and New Development conservation programs would reduce water needs in 2035 by about 9.2 percent (600 AF/Yr as shown on Table 18) when compared to 2035 water demand without the plumbing code.
- Water savings from implementation of the Tier One conservation programs would reduce water needs in 2035 by about 2.7 percent (178 AF/Yr) as shown on Table 18) when compared to 2035 water demand without the plumbing code.
- For Future Tier One measures, more than half of the conservation potential in 2035 is in reducing outdoor use; the rest is indoor use reduction potential.
- The average cost of water saved over 30-years is lower than the current price of SCWA water. Thus measures that are cost-effective at today's water rates will be more so if SCWA rates rise in the future.
- Savings contributed by Tier Two measures alone are 226 acre-feet in 2035.
- Savings contributed by the New Development measures alone are 199 acre-feet in 2035.
- Benefit-cost ratios of program combinations range from 1.49 to 2.44 so all program combinations are cost-effective from the utility standpoint.
- The average cost of water saved for all of the programs from the utility standpoint (as shown on Table 18) is lower than the forecasted 2025 price of \$991 per AF.
- The cost for the new development measures is largely funded by the builders of the new homes, which tends to reduce the overall cost to the utility for all measures.

Appendix A - Assumptions for Water Conservation Measures Evaluated in the DSS Model

Account Category	BMP 1a Residential Audits	BMP 1a Residential Audits	BMP 1b Residential Audits	BMP 1b Residential Audits	BMP 1b Residential Audits	BMP 2 Plumbing Retrofits
	RSF	RMF	RSF	RMF	RSF / RMF	Toilets, Faucets, Showers
Affected End Uses	Internal	Internal	External	External	5%/5%/21%	
Percent Reduction in Water Use	5%	5%	10%	10%	1999	
CUWCC MOU Sign-on Year	1999	1999	1999	1999	2005	
Evaluation Start Year	2005	2005	2005	2005	2005	
Required Interventions Starting in 2005 (Accounts)	935	9	935	9	1309/11	
Market Penetration by End Of Program,%	15	15	15	15	75	
Measure Life (years)	7	7	7	7	Permanent	
Initial Cost	\$ -	\$ -	\$ -	\$ -	\$ -	
Utility Unit Cost, per site one time cost	\$40.00	\$80.00	\$40.00	\$50.00	\$30.00	
Customer Unit Cost to achieve savings	\$10.00	\$30.00	\$5.00	\$20.00	\$0	
Administration Cost, percent of unit cost	25%	25%	25%	25%	10%	
Affected Units	dwelling unit	dwelling unit	dwelling unit	dwelling unit	1992 and older dwelling units	
Comments	Audits are repeated every 7 years to maintain water savings					

Notes:

- RSF = Residential Single Family
- RMF = Residential Multi Family
- BUS/COM= Commercial
- IND = Industrial
- IRR = Dedicated irrigation meters
- INS = Institutional/Public, buildings / grounds owned by the Water Utility or City
- NRSF = New Single Family Homes
- GOV = Government

	BMP 5a Water Budgets	BMP 5b Water Audits	BMP 6 Washer Rebates	BMP 7 Public Education	BMP 9 CII Audits	BMP 14 Toilet Rebates
Account Category	IRR	COM/INS	RSF	RSF/RMF	COM/INS	RSF/RMF
Affected End Uses	Irrigation	Irrigation	Laundry	All	All	Internal
Percent Reduction in Water Use	15%	15%	34%	1%	12%	60%
CUWCC MOU Sign-on Year	1999	1999	1999	1999	1999	1999
Evaluation Start Year	2005	2005	2005	2005	2005	2005
Required Interventions Starting in 2005 (Accounts)	289	48	0	0	6,321	361/5
Market Penetration by End Of Program, %	90	15	4.8	100	10	Match resale rate
Measure Life (years)	10	10	Permanent	2	Permanent	Permanent
Initial Cost	\$ -	\$ -	\$ -	\$ -	\$ -	NA
Utility Unit Cost, per site one time cost	\$400.00	\$1,500.00	\$75.00	\$2.50	\$4,000.00	\$50
Customer Unit Cost to achieve savings	\$ -	\$1,000.00	\$200.00	\$ -	\$2,000.00	\$75
Administration Cost, percent of unit cost	15%	30%	30%	25%	50%	included
Affected Units	Irrigation accounts	large landscape accounts	per dwelling unit	per dwelling unit	CII accounts	per toilet
Comments	Audits are repeated every 10 years to maintain water savings		BMP 6 complete			

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Measure	T2 - 1	T2 - 2	T2 - 3	T2 - 4	T2 - 5a	T2 - 5b	T2 - 6
	Rain-sensor (shut off device) retrofit on irrigation controllers	Cash for Grass (turf removal program)	Financial Incentives for Being Below Water Budget	Financial Rebates for Irrigation Meters	Smart Irrigation Controller Rebates	Smart Irrigation Controller Rebates	Financial Incentives/ Rebates for Irrigation Upgrades
Applicable Customer Classes	SF	Existing Customers SF, MF, CII	IRR	Existing CII Customers with mixed water use (indoor and outdoor)	SF	Existing Customers MF, CII, IRR	Existing Customers MF, CII, IRR
Applicable End Uses	Irrigation	Irrigation	Irrigation	Irrigation	Irrigation	Irrigation	Irrigation
Market Penetration by End Of Program	10%	1%	100%	10%	5%	20%	10%
Water Use Reductions For Targeted End Uses	9%	36%	15%	15%	15%	15%	15%
Program Length, years	5	5	10	5	10	10	15
Measure Life, years	10	Permanent	Permanent	Permanent	21	Permanent	Permanent
Utility Unit Cost for SF accounts, \$/unit	\$ 20.00	\$ 500.00	\$ 25,000.00	\$ -	\$ -	\$ -	\$ -
Utility Unit Cost for MF accounts, \$/unit	--	\$ 500.00	\$ -	\$ -	\$ -	\$ 900.00	\$ -
Utility Unit Cost for non-Res accounts, \$/unit	--	\$ 500.00	\$ -	\$ 500.00	\$ -	\$ 900.00	\$ 500.00
Customer Unit Cost, \$/unit	\$ 35.00	\$ 500.00	\$ 10,000.00	\$ 500.00	\$ 100.00	\$ 100.00	\$ 500.00
Annual Utility Admin & Marketing Cost	25%	25%	35%	25%	30%	30%	25%

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Measure	T2 - 7	T2 - 10	T2 - 12	T2 - 13
	Hotel retrofit (w/financial assistance) - CII Existing	High Efficiency Toilet (HET)	CII Rebates - replace inefficient water using equipment	0.5 gal/flush urinals in new buildings
Applicable Customer Classes	Existing Customers: CII	SF, MF	CII	COM New
Applicable End Uses	Indoor uses	Toilet end use	Process end use	COM Urinal
Market Penetration by End Of Program	20%	20%	10%	100%
Water Use Reductions For Targeted End Uses	20%	45 to 55%	10%	65 to 75%
Program Length, years	15	10	15	30
Measure Life, years	Permanent	Permanent	Permanent	Permanent
Utility Unit Cost for SF accounts, \$/unit	\$ -	\$ 150.00		\$ 50.00
Utility Unit Cost for MF accounts, \$/unit	\$ -	\$ 150.00		
Utility Unit Cost for non-Res accounts, \$/unit	\$ 100.00		\$ 500.00	
Customer Unit Cost. \$/unit	\$ 200.00	\$ 150.00	\$ 1,000.00	\$ 500.00
Annual Utility Admin & Marketing Cost	25%	35%	30%	25%

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Measure	ND 1	ND 2	ND 3	ND 4	ND 5	ND 6	ND 7	ND 8
	Rain-sensor shut off device on irrigation controllers	Smart Irrigation Controller	High Efficiency Toilet (HET)	Dishwasher New Efficient	Clothes washing machines requirement for new residential	Hot Water on Demand	High efficiency faucets and showerheads	Landscape and irrigation requirements
Applicable Customer Classes*	Varies	Varies	Varies	Varies	Varies	Varies	Varies	Varies
Applicable End Uses	Irrigation	Irrigation	Toilet end use	Dishwasher end use	Clothes Washer end use	Faucet and shower end use	Faucet and shower end use	Irrigation
Market Penetration by End Of Program	100%	100%	100%	100%	100%	100%	100%	100%
Water Use Reductions For Targeted End Uses	9%	15%	50 to 55%	34%	50%	14.2 gpd per house	15%	10%
Program Length, years	30	30	30	30	30	30	30	30
Measure Life, years	permanent	permanent	permanent	permanent	permanent	permanent	permanent	permanent
Utility Unit Cost for SF accounts, \$/unit	\$ 12.50	\$ 12.50	\$ 12.50	\$ 12.50	\$ 12.50	\$ 12.50	\$ 12.50	\$ 12.50
Utility Unit Cost for MF accounts, \$/unit	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Utility Unit Cost for non-Res accounts, \$/unit	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Customer Unit Cost. \$/unit	\$ 55.00	\$ 500.00	\$ 300.00	\$ 400.00	\$ 500.00	\$ 700.00	\$ 50.00	\$ 3,000.00
Annual Utility Admin & Marketing Cost	10%	10%	10%	10%	10%	10%	10%	10%

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IRR = Dedicated irrigation meters

INS = Institutional/Public, buildings / grounds owned by the Water Utility or City

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*Customer class varies depending upon local ordinances, Cal Green and contractor request of new measure or planned ordinances

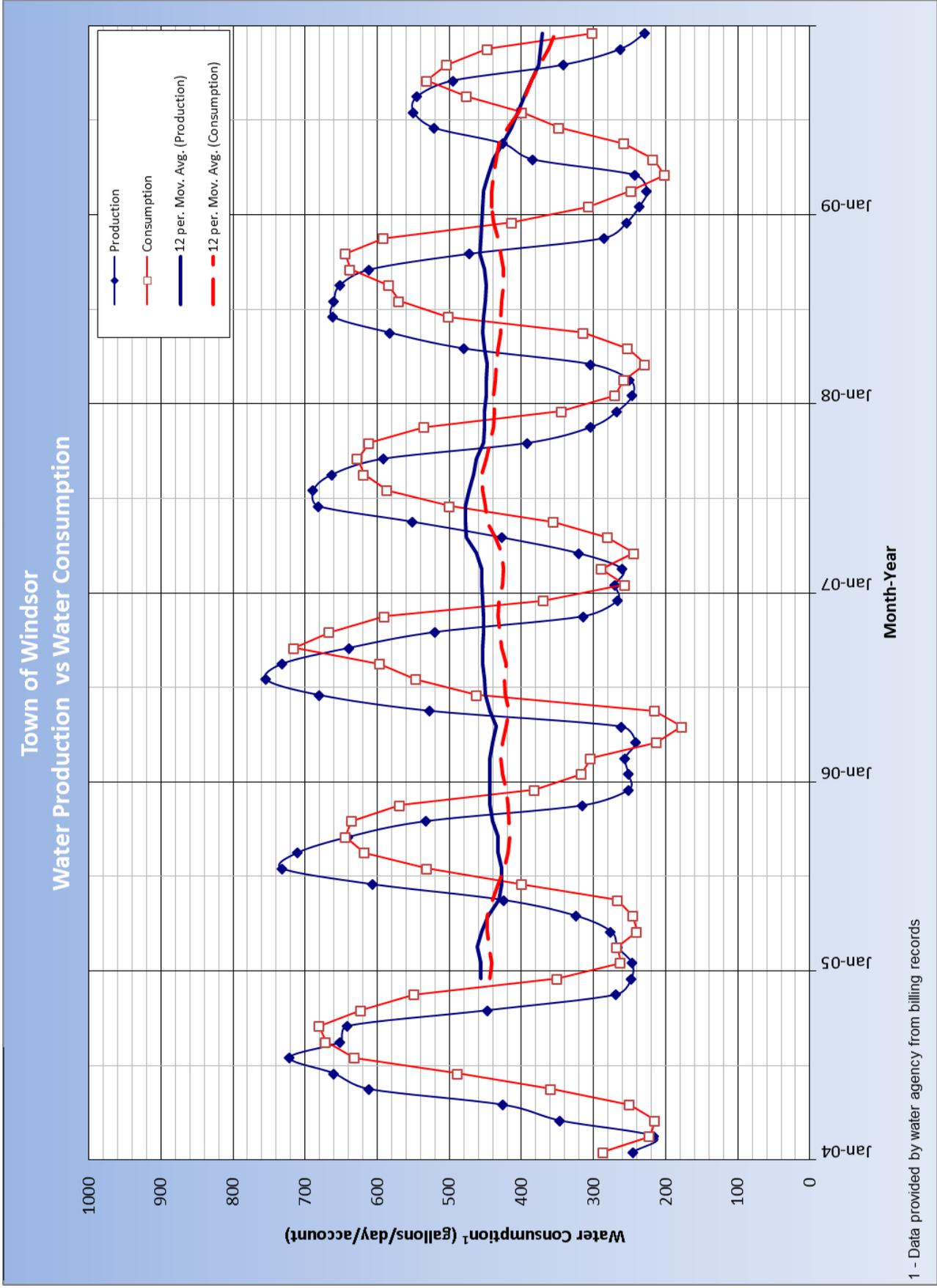
Fixture Replacement SB 407	Cisterns/Rain Catchments	Gray water Retrofit SF
Pre-1994 Existing Accounts	SF, MF	SF

Toilet, urinal, shower, lavatory faucet	Irrigation	Irrigation
4% SF, 2% MF and CII	5%	5%
1% 2017-2020 SF, 1% 2019-2020 MF, 1% CII	0.5%	0.25%
2019-2020	0.0%	40%
Varies	2011	2011
2014	2030	2030
2020	19	19
7	Permanent	Permanent
Permanent	\$	\$
\$	100	500
25	\$	\$
\$	200	-
\$		\$
25	\$	-
Varies	\$	\$
Varies	500	500
Varies	\$	\$
Varies	750	-
Varies	\$	\$
25%	25%	30%
Dwelling unit or CII account	Accounts	Accounts
Measure will start in the year 2017 (SF) and 2019 (CII) to coincide with the California State Law SB 407. Work with the real estate industry to require a certificate of compliance be submitted to the City/Town that the property and efficient fixtures where either already there or were installed at the time of sale, before close of escrow. Consider allowing this certification to be made as a part of the conventional private building inspection report process.	Provide a rebate (\$100) to assist a certain percentage of single family homeowners per year with installation of rain barrels or cisterns.	Provide a rebate (up to \$500) to assist a certain percentage of single family homeowners per year to install gray water systems. Parts cost approx \$200, installation is approx \$400-\$500

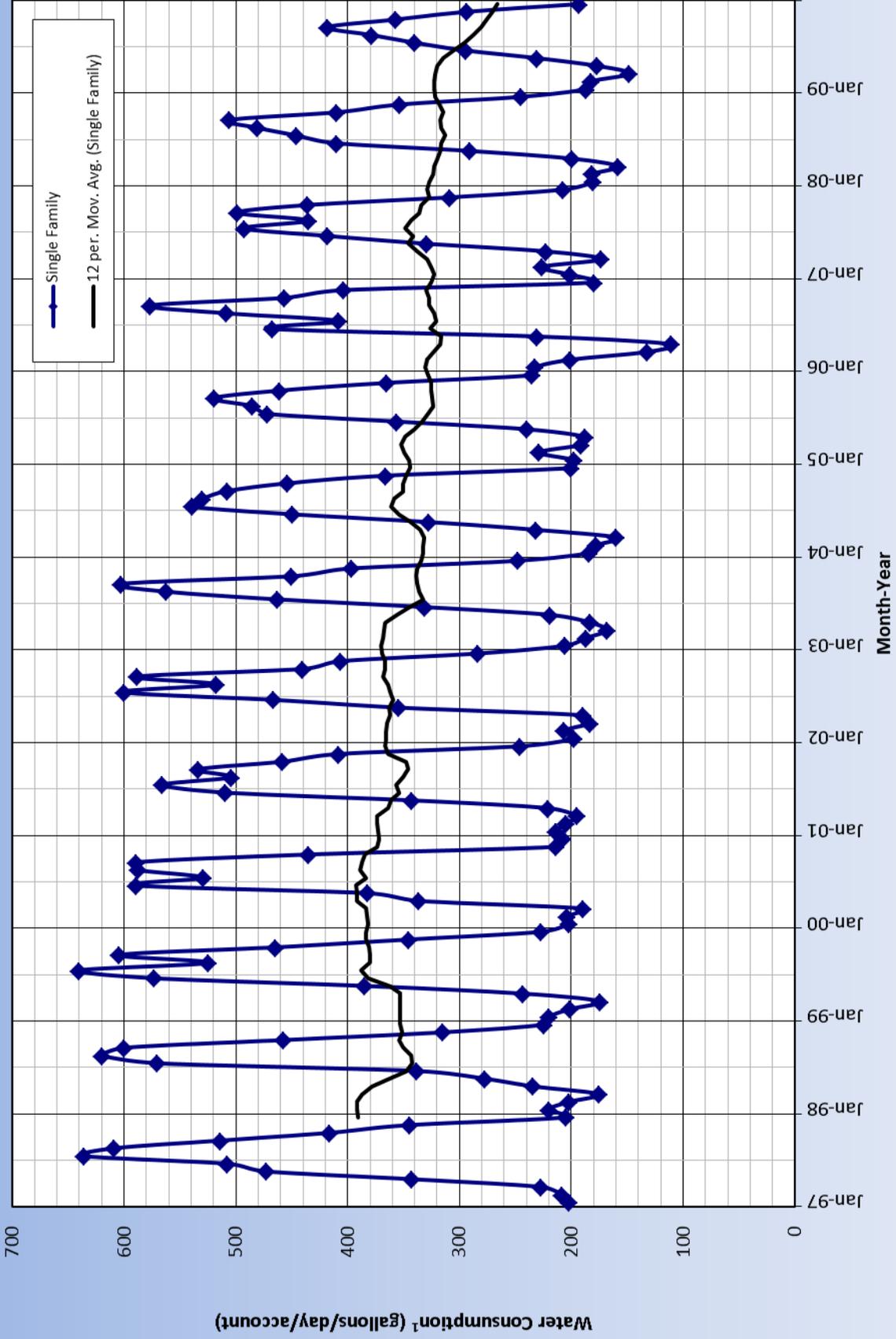
Notes:

RMF = Residential Multi Family
 CII = Commercial, Industrial and Institutional

Appendix B - Water Use Data Graphs for Production and Customer Categories

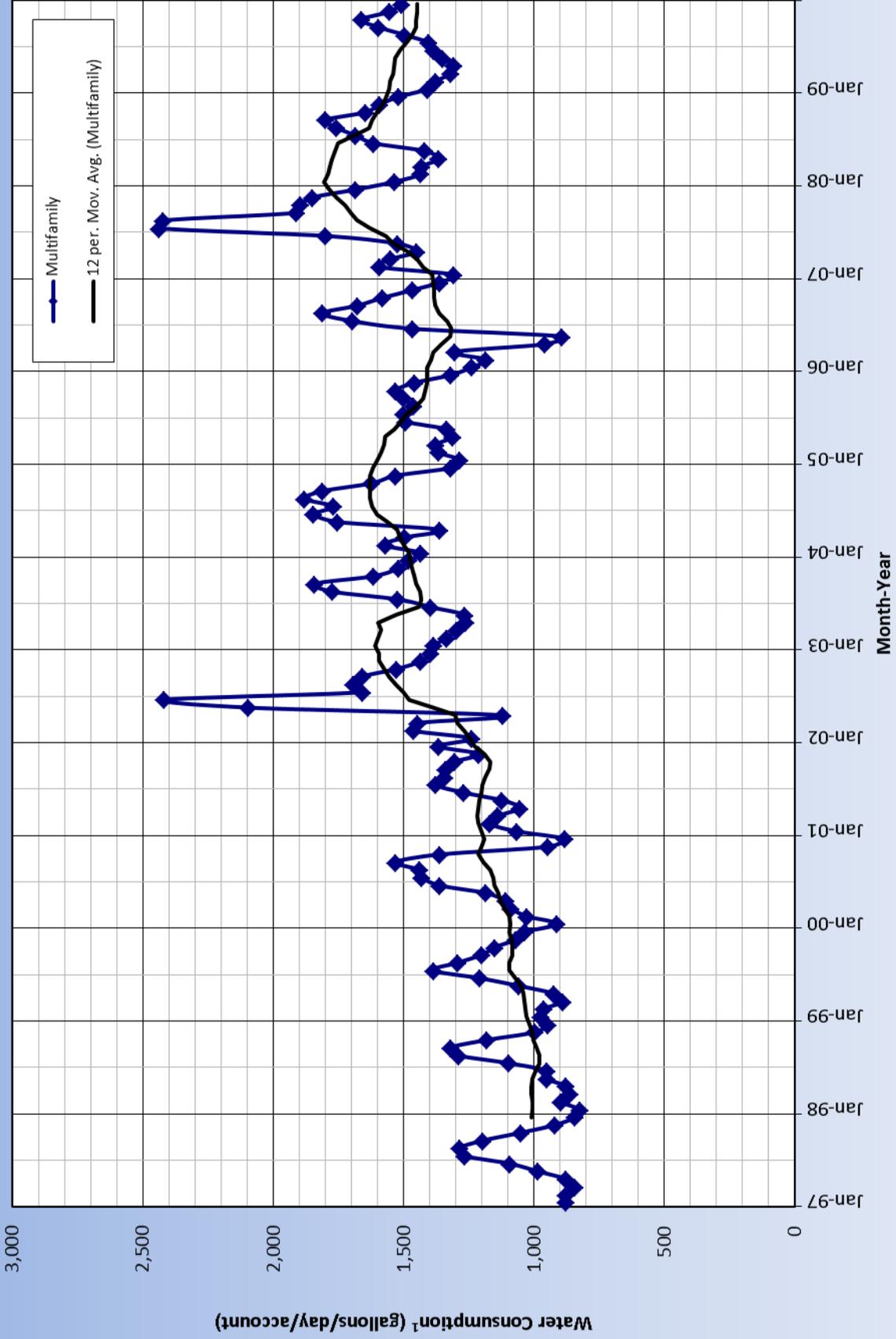


Town of Windsor
 Customer Category : Single Family Residential



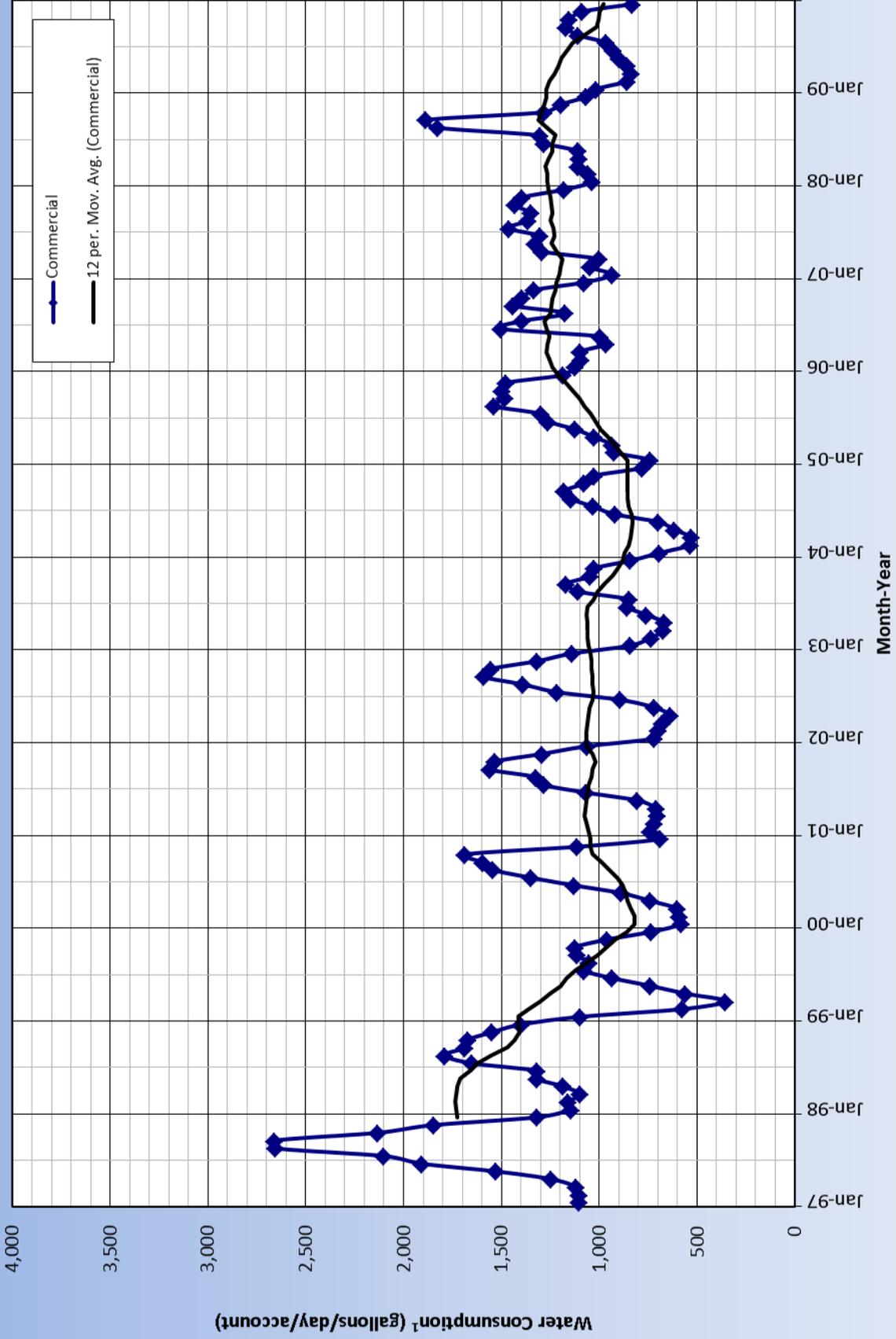
1 - Data provided by water agency from billing records

Town of Windsor
 Customer Category : Multifamily Residential



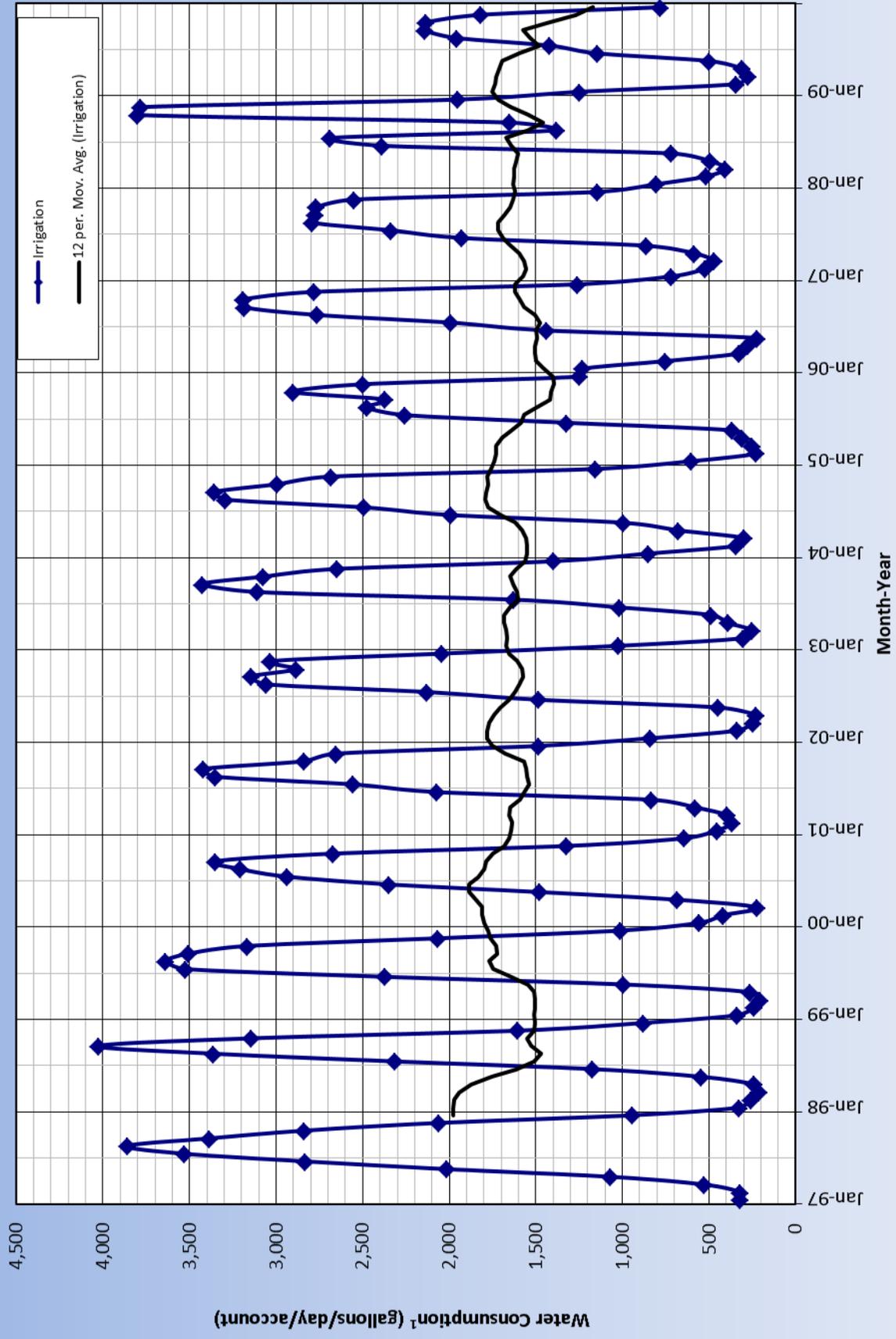
1 - Data provided by water agency from billing records

Town of Windsor
 Customer Category : Commercial



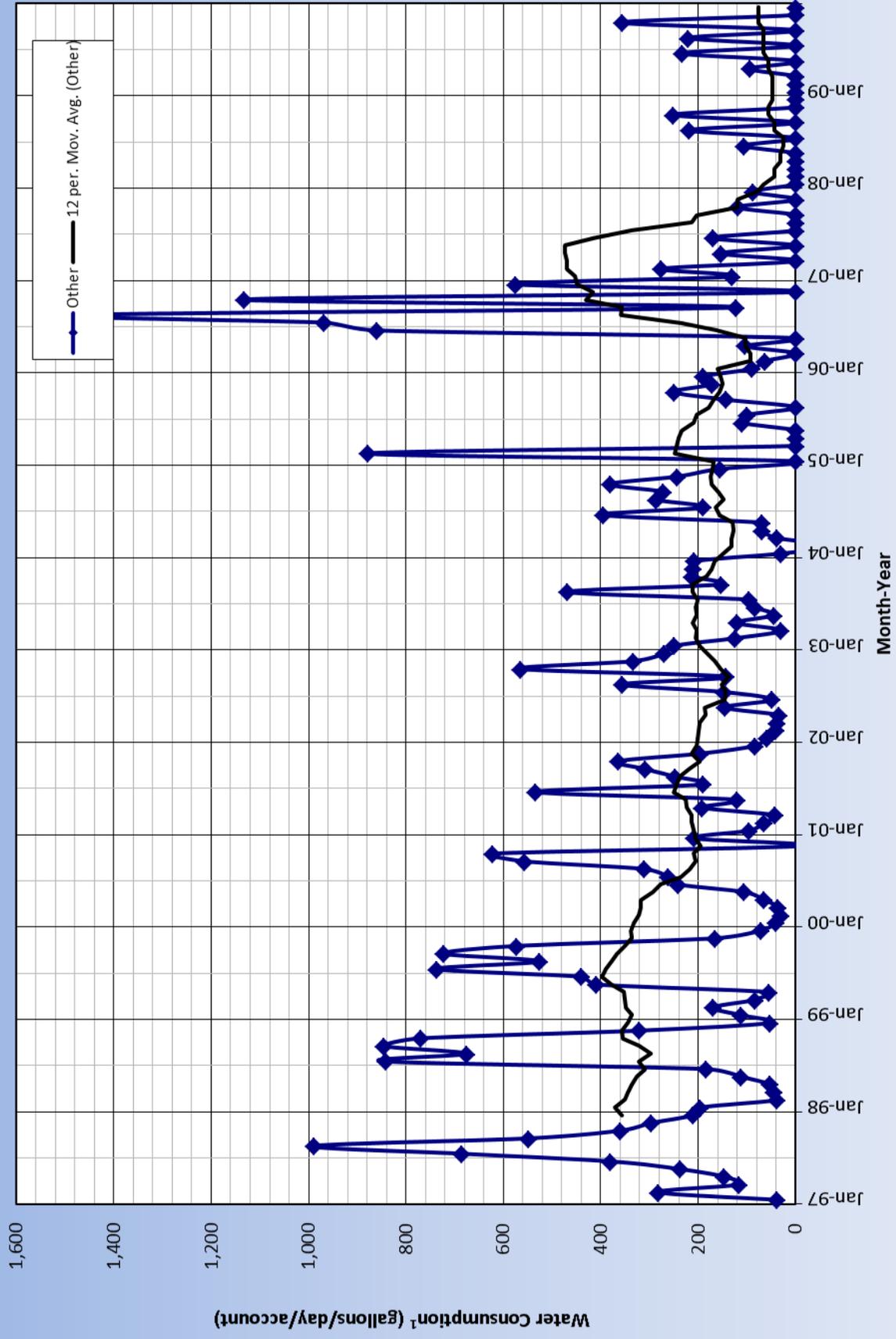
1 - Data provided by water agency from billing records

Town of Windsor Customer Category : Irrigation



1 - Data provided by water agency from billing records

Town of Windsor
Customer Category : Other



1 - Data provided by water agency from billing records