CHAPTER 23C. UTILITY SERVICES.

Article XI. Water Conservation Regulations.

Sec. 23C-11-11. Remedies cumulative.

The remedies provided in this article are cumulative and are in addition to all other remedies provided by law. The enumeration of remedies stated in this article shall not preclude the application of any other remedies not specifically enumerated. (Ord. No. 1186, § 1 (part).)

Appendix E

Detailed Cost Benefit Analysis

The attached pages provide detailed analysis used to prepare the summary information presented in Section 6 for the cost benefit information for DMMs not implemented.

The following pages were included in the City of Woodland 2005 Urban Water Management Plan Update. It is likely that costs of water have increased, probably more that the value of water saved. As a result, the cost benefit ratios would likely stay the same or possibly even reflect a less favorable outlook on the feasibility of implementing DMMs 1, 3, 4, and 5.

Water Demand Management Measures

Law

> 10631 (f) Provide a description of the supplier's water demand management measures. This description shall include all of the following:
> (1) A description of each water demand management measure that is currently being implemented, or scheduled for implementation, including the steps necessary to implement any proposed measures, including, but not limited to, all of the following:

The City is committed to implementing economically feasible programs that promote efficient water use. For the purpose of responding to the Urban Water Management Planning Act, the City estimated the benefits and costs of the 16 Demand Management Measures (DMM). In the benefit-cost analysis, all benefits and costs are considered regardless of whom the recipient is. Alternative perspectives, such as the City's or the customer's can easily be considered in subsequent analysis. The annual benefits and costs are discounted over a 20-year time horizon using a 4.1 percent discount rate.

The discount rate used in this analysis is the discount rate specified by the Office of Management and Budget in Circular A-94, Appendix C. Circular A-94 provides general guidance for conducting benefit-cost analyses and discount rates used in evaluating Federal programs whose benefits and costs are distributed over time. Appendix C "Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses", (Revised January 2000) contains discount rates for constant dollar flows for 10-year and 30-year periods (4.0% and 4.2%). The 4.1 percent discount rate is an interpolation for a 20-year discount period. The programs analyzed in this study represent public investments in future benefits that are comparable to Federal programs.

The benefit-cost analysis is divided into three sections:

- Value of Water Saved.
- Analysis of a model Water Demand Management Program.
- Detailed Economic Analysis of 16 DMM's.

Values of water savings ($ per million gallons saved) were derived from the cumulative costs of supplying water at various points-of-use. The model "Water Demand Management Program" (Program) represents a combination of select DMM's that could maximize water savings in Woodland over the long-term. The Program includes a meter retrofit program with conservation pricing (tiered rates for higher water use) assumptions and a residential plumbing and landscape retrofit element.

Value of Water Saved

The value of water saved is proportional to the cost of supplying water at a specific point of use. Six water cost components were considered in analyzing the value of water saved including the following:

1. Cost of pumping groundwater;
2. Cost of wastewater treatment;
3. Cost of treating (softening) domestic water;
4. Cost of heating domestic water (for shower use);
5. Cost saving in delaying groundwater well development; and
6. Cost saving in delaying wastewater treatment facility construction.

The cost of pumping groundwater includes charges for electricity and chemicals and is proportional to the amount of water pumped. Total City water system O&M costs for 1999 were approximately $2,000,000 of which approximately 35 percent were for electricity and chemicals. The following table summarizes total and variable costs associated with groundwater pumping in Woodland for 1999:

Water Supply Costs

Year	Water System Budget	Water Pumped, gals.	Cost of Water ($/MG)	
			Total Cost $/mg	Variable Cost/mg* 36%
1999	**$2,000,000**	**5,600,000,000**	**$357**	**$129**

*Includes energy and chlorinating costs.

Wastewater treatment costs are provided in the following table. For every million gallons of wastewater not generated (reductions in indoor water use) approximately $136 in variable treatment costs are avoided by the City. It was estimated that approximately 66 percent of total domestic water is used for indoor purposes.

Cost of Treating Wastewater

Year	Total Cost	Annual Flow* (mg)	Cost of Treatment ($/MG)	
			Total Cost $/mg	Variable Cost/mg** 18%
1999	**$1,870,000**	**2,482**	**$753**	**$136**

*Average daily flow: 6.8 mgd

**Chemical and electricity: $338,000

Groundwater in Woodland is very hard and many consumers install and maintain water softeners. It is estimated that 0.008 pounds of salt per gallon are required to adequately soften Woodland groundwater. The cost of salt is approximately $5.25 per 50 pounds. This results in a water softening cost of $840 per million gallons. This cost was applied to all indoor water use.

Cost of Conditioning Water*

Salt use (20 lb./2,500 gal.):	0.0080 lb/gal
Salt cost:	$5.25 /50 lb
Cost per gallon:	$0.00084 /gal
Cost per million gallons:	**$840.00 /mg**

*Indoor water use only, Culligan Water Service, Woodland

The cost of energy to heat one gallon of water from 60 to 100 degrees (F) is $0.0024, or $2,384 per million gallons. The cost of heating water was used to estimate the benefit of retrofitting residential showerheads. Energy calculations are presented in the following table:

Cost of Water heating (shower water use only)

Specific heat of water	1 btu/lb/degF
Temperature change:	40 degree F
Rate of heating:	2 gpm
Cost of natural gas:	$0.50 /therm
Therm/btu:	100,000
Heater efficiency:	70%
Heating rate:	57,222.86 btu/hr
Cost of heating/hour: btu/hr * $/therm / therm/btu:	$0.29 /hr
Cost per gallon:	$0.0024 /gal
Cost per million gallons:	**$2,384.29 /mg**

Reducing water use can delay expansion of the current water supply. Well development depends on population growth. Well output in Woodland is developed to match demand. Wells that will yield 1,800 gallons per minute can be constructed for approximately $500,000, or approximately $38 per million gallons (annualized cost/maximum annual production).

Well Development Costs

Cost of Well (1,800 gallons/minute)	$500,000
Annual Cost (30 years at 6 percent interest rate)	$36,324
Average Cost of Delaying Well Development*	**$38.39 /mg**

Indoor water savings can reduce the amount of flow to wastewater treatment facilities. Average cost of delaying investment in wastewater treatment capacity was estimated by dividing the annual cost of expanding capacity by the additional capacity. This results in a cost of $612 per million gallons.

Wastewater Capital Treatment Costs

Cost of expanding plant by 2.6 mgd:	$8,000,000
Annual cost:	$581,191
Cost per MG (Annual Cost / (2.6 * 365))	$612.42
Average Cost of Delaying Wastewater Treatment Investment	**$612.42 /mg**

Outdoor water use. Reducing outdoor water use reduces water pumping cost and delays future well development. The total value of outdoor water savings is $167 per million gallons.

Reducing indoor water use would reduce groundwater pumping costs, delay well development costs, reduce wastewater treatment costs, delay investment in additional wastewater treatment facilities and reduce indoor water softening costs. These costs savings amount to $1,755 per million gallons. The additional value of reducing hot water use raises the value of certain point-of-use water saved to $4,139 per million gallons.

The following table summarizes water cost components and the value of water savings at various points-of-use:

Water Cost Category	Outdoor Water Use	Indooor Water Use Except Shower	Shower Water Use
Cost of Pumping Water	$128.57	$128.57	$128.57
Average Cost of Delaying Well Development*	$38.39	$38.39	$38.39
Cost of Treating Wastewater		$135.62	$135.62
Average Cost of Delaying Wastewater Treatment Investment		$612.42	$612.42
Cost of Conditioning Water*		$840.00	$840.00
Cost of Water heating (shower water use only)			$2,384.29
Total Water Use Costs	$166.97	$1,755.01	$4,139.29

Water Use

Water use was presented by category in the 1995-96 Woodland Urban Water Management Plan. This past water use pattern was the basis for elements of this Plan and is summarized as follows:

Woodland Water Use by User Category

Category	1996	
	Million Gallons	Percent of Total
Single Family	2,567.2	61%
Multi-Family	329.6	8%
Commercial	346.4	8%
Industrial	220.5	5%
Institutional/Governmental	320.3	8%
Irrigation	31.9	1%
Unaccounted Water	424.0	10%
Total Use:	4,239.9	100%

Source: Woodland 1996 UWMP, page 16

Projected water use for the City of Woodland was used in the DMM benefit cost analyses. Water use projections were presented in Table 6.

Population, population projections, household size, and growth rates were used to analyze the Water Management Program and most of the DMM's. The following table includes the percentage of the population that existed prior to 1980 and 1992. This information is used to estimate the number of retrofits that are possible for a particular DMM.

Historical and Projected Population and Household Size

Year	Population				Household Size
	Number	% Change	% Pre '80	% Pre '92	
1980	30,235		100.00%		3.43
1981	30,993	2.51%	97.55%		3.43
1982	31,324	1.07%	96.52%		3.38
1983	31,739	1.32%	95.26%		3.39
1984	32,627	2.80%	92.67%		3.44
1985	33,034	1.25%	91.53%		3.38
1986	33,971	2.84%	89.00%		3.43
1987	34,862	2.62%	86.73%		3.42
1988	36,941	5.96%	81.85%		3.53
1989	38,980	5.52%	77.57%		3.51
1990	39,802	2.11%	75.96%		3.38
1991	41,184	3.47%	73.41%		3.48
1992	41,615	1.05%	72.65%	100.00%	3.50
1993	42,051	1.05%	71.90%	98.96%	3.53
1994	42,474	1.01%	71.18%	97.98%	3.54
1995	43,402	2.18%	69.66%	95.88%	3.61
1996	44,302	2.07%	68.25%	93.94%	3.61
1997	45,201	2.03%	66.89%	92.07%	3.61
1998	46,101	1.99%	65.58%	90.27%	3.61
1999	46,000	-0.22%	65.73%	90.47%	3.53
2000	47,900	4.13%	63.12%	86.88%	3.61
2001	48,320	0.88%	62.57%	86.12%	3.59
2002	48,740	0.87%	62.03%	85.38%	3.56
2003	49,160	0.86%	61.50%	84.65%	3.53
2004	49,580	0.85%	60.98%	83.94%	3.51
2005	50,000	0.85%	60.47%	83.23%	3.49
2006	51,000	2.00%	59.28%	81.60%	3.50
2007	52,000	1.96%	58.14%	80.03%	3.51
2008	53,000	1.92%	57.05%	78.52%	3.52
2009	54,000	1.89%	55.99%	77.06%	3.53
2010	55,000	1.85%	54.97%	75.66%	3.54
2011	56,000	1.82%	53.99%	74.31%	3.55
2012	57,000	1.79%	53.04%	73.01%	3.56
2013	58,000	1.75%	52.13%	71.75%	3.56
2014	59,000	1.72%	51.25%	70.53%	3.57
2015	60,000	1.69%	50.39%	69.36%	3.57
2016	61,200	2.00%	49.40%	68.00%	3.59
2017	62,400	1.96%	48.45%	66.69%	3.60
2018	63,600	1.92%	47.54%	65.43%	3.61
2019	64,800	1.89%	46.66%	64.22%	3.62
2020	66,000	1.85%	45.81%	63.05%	3.63
2021	67,222	1.85%	44.98%	61.91%	3.63

This concludes the presentation of the data needed to estimate the economic feasibility of water savings. The next section presents the results of the economic analysis of a demand management program measures.

Analysis of the "Water Demand Management Program"

The Water Demand Management Program formulated for this study incorporates the DMM features of retrofitting water meters, establishing conservation pricing, and retrofitting residential indoor water use plumbing fixtures and landscapes.

If implemented, the Program could save 1.3 billion gallons of water annually by the 20th year of operation. Savings would result from the use of the most water efficient devices and procedures, and includes a new price system as an incentive to keep indiscriminate water use to a minimum.

Water Costs

The Program features four components including: (1) retrofitting residences with meters and billing use by a conservation pricing schedule; (2) retrofitting residences with ultra-low-flow toilets; (3) retrofitting residences with low-flow showerheads; and (4) replacing sod in front-yards with xeriscape. Each component saves water that has different values as noted previously. Meters and conservation pricing will largely affect outdoor water use such as landscape watering, washing cars, houses and driveways.

Water savings resulting from more efficient toilets reduces City wastewater treatment and residential water softening costs. More efficient showerheads will save heating water costs. The maximum value of each million gallons of water saved is $4,139. The minimum value is $167 per million gallons.

Economic Feasibility:

Program summary. The Program as structured for this analysis is not economically feasible as costs exceed benefits by a 5 to 1 margin. The present value of Program benefits was found to be $6.5 million as compared with the present value of costs of $31 million resulting in a benefit cost ratio of 0.21. However, on an individual basis some components are economically feasible such as the showerhead element because the value of water saved is high and the cost of showerheads is relatively low. The following table summarizes program benefit to cost ratios by component and overall:

Program Components:	Benefits	Costs	Net Present Value	Benefit Cost Ratio
1. Install single family residential meters with conservation pricing	$1,218,795	$5,641,229	($4,422,433)	0.22
2. Retrofit residential toilets	$1,125,067	$4,883,888	($3,758,821)	0.23
3. Retrofit residential showerheads	$3,980,310	$355,192	$3,625,118	11.21
4. Retrofit residential landscape	$215,062	$20,127,614	($19,912,552)	0.01
Program Total	**$6,539,234**	**$31,007,922**	**($24,468,689)**	**0.21**

The results of the economic analysis for the Program are presented in the following table:

Program Analysis

Program Benefit Cost Analysis Results for:
Individual Program Components:

1. **Install single family residential meters with conservation pricing**
2. **Retrofit residential toilets**
3. **Retrofit residential showerheads**
4. **Retrofit residential landscape**

		Benefits					
		Water Use (mg)			Average		
Year	Total Annual Costs	Without Project	Percent Reduction	Reduction (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$16,131	3,826	2%	86.3	$166.97	$14,413	-$1,717
1	$2,835,472	3,840	5%	174.8	$514.57	$89,944	-$2,745,528
2	$2,846,590	3,853	7%	261.7	$631.28	$165,217	-$2,681,374
3	$2,857,709	3,867	9%	347.2	$692.00	$240,245	-$2,617,464
4	$2,868,828	3,881	11%	431.2	$730.54	$315,040	-$2,553,788
5	$2,880,142	3,894	13%	515.0	$756.91	$389,777	-$2,490,365
6	$2,891,456	3,955	15%	601.7	$772.81	$465,024	-$2,426,432
7	$2,902,770	4,015	17%	688.3	$784.89	$540,238	-$2,362,532
8	$2,914,085	4,076	19%	774.7	$794.42	$615,421	-$2,298,664
9	$2,111,997	4,136	20%	840.8	$745.11	$626,453	-$1,485,544
10	$2,123,524	4,196	22%	907.7	$702.46	$637,633	-$1,485,891
11	$2,135,052	4,283	23%	977.8	$664.05	$649,342	-$1,485,709
12	$2,146,579	4,370	24%	1,048.2	$630.67	$661,097	-$1,485,482
13	$2,158,106	4,457	25%	1,118.9	$601.38	$672,895	-$1,485,211
14	$1,721,375	4,544	25%	1,145.3	$591.36	$677,306	-$1,044,069
15	$1,724,283	4,630	25%	1,173.0	$581.35	$681,925	-$1,042,358
16	$1,727,191	4,715	25%	1,199.0	$572.38	$686,261	-$1,040,931
17	$1,730,100	4,800	26%	1,224.9	$563.79	$690,596	-$1,039,503
18	$1,733,008	4,884	26%	1,250.9	$555.55	$694,932	-$1,038,076
19	$1,735,916	4,969	26%	1,276.9	$547.65	$699,267	-$1,036,649
20	$1,739,258	5,053	26%	1,305.0	$539.43	$703,968	-$1,035,290
Present Value of Total Annual Benefits:				**$31,007,922**			
Present Value of Total Annual Costs:				**$6,539,234**			
Net Present Value:				**($24,468,689)**			
Benefit Cost Ratio:				**0.21**			

The next four tables present the data used in analyzing the four components of the Program. Tables also list important assumptions.

Component: Install residential water meters. The analysis determined that this component would result in a benefit to cost ratio of 0.22. Therefore, installing meters with conservation pricing is not economically feasible. Total benefits were derived under the assumption that total residential water use will be reduced by 20 percent by a conservation pricing schedule. The value of water savings ($167 per million gallons saved) is based on reduced groundwater pumping and well development costs.

Program Analysis

Individual Component Benefit Cost Analysis Results for:

1. Install single family residential meters with conservation pricing

	Costs					Benefits					
						Water Use					
Year	Meters Installed	Installation Costs*	Total Accounts Metered	Cost of Meter Reading**	Total Costs	Without (mg)	% Water Saved	Reduction*** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	1,453	$16,131	$16,131	3,826	2%	86.32	$166.97	$14,413	($1,717)
1	799	$439,391	2,455	$27,249	$466,640	3,840	4%	143.82	$166.97	$24,013	($442,627)
2	799	$439,391	3,457	$38,368	$477,759	3,853	5%	199.77	$166.97	$33,355	($444,404)
3	799	$439,391	4,458	$49,487	$488,878	3,867	7%	254.26	$166.97	$42,452	($446,426)
4	799	$439,391	5,460	$60,606	$499,996	3,881	8%	307.35	$166.97	$51,317	($448,680)
5	799	$439,391	6,479	$71,920	$511,311	3,894	9%	360.09	$166.97	$60,123	($451,187)
6	799	$439,391	7,499	$83,234	$522,625	3,955	11%	415.89	$166.97	$69,439	($453,186)
7	799	$439,391	8,518	$94,548	$533,939	4,015	12%	471.49	$166.97	$78,722	($455,217)
8	799	$439,391	9,537	$105,862	$545,253	4,076	13%	526.89	$166.97	$87,973	($457,280)
9	799	$439,391	10,556	$117,176	$556,567	4,136	14%	582.12	$166.97	$97,195	($459,372)
10	799	$439,391	11,595	$128,704	$568,094	4,196	15%	638.24	$166.97	$106,564	($461,530)
11	799	$439,391	12,633	$140,231	$579,622	4,283	16%	697.52	$166.97	$116,463	($463,159)
12	799	$439,391	13,672	$151,758	$591,149	4,370	17%	757.08	$166.97	$126,407	($464,742)
13	799	$439,391	14,710	$163,285	$602,676	4,457	18%	816.89	$166.97	$136,394	($466,282)
14	0	$0	14,950	$165,945	$165,945	4,544	18%	832.47	$166.97	$138,994	($26,951)
15	0	$0	15,212	$168,853	$168,853	4,630	18%	849.29	$166.97	$141,803	($27,050)
16	0	$0	15,474	$171,761	$171,761	4,715	18%	864.41	$166.97	$144,328	($27,434)
17	0	$0	15,736	$174,670	$174,670	4,800	18%	879.53	$166.97	$146,852	($27,817)
18	0	$0	15,998	$177,578	$177,578	4,884	18%	894.65	$166.97	$149,377	($28,201)
19	0	$0	16,260	$180,486	$180,486	4,969	18%	909.77	$166.97	$151,902	($28,584)
20	0	$0	16,561	$183,828	$183,828	5,053	18%	927.08	$166.97	$154,792	($29,037)

Present Value of Total Annual Benefits:	**$1,218,795**
Present Value of Total Annual Costs:	**$5,641,229**
Net Present Value:	**($4,422,433)**
Benefit Cost Ratio:	**0.22**

*Installation costs: # retrofited annually x meter installation costs

Installation: $550 per meter. ($500 adjusted for inflation. Bob Shay, City of Davis, 10/31/00.)

Total unmetered: 10,386 accounts

Years to retrofit: 13 799 retrofitted annually

**Meter reading costs: Cost of reading meter x # of meters

Time to read residential meter: 40 per hour

Time to read C&I meter: 20 per hour

Cost per hour: $37.00 City of Woodland wage rate.

Meter reading freqency: 12 times per year

Cost to read residential meter: $11.10 per meter per year.

Cost to read C&I meter: $22.20 per meter per year.

***Water Reduction: # of metered accounts x average annual water use/account x % water saving

Annual water saved per account: 20%

Component: Retrofitting residential toilets. The analysis determined that this component would result in a benefit to cost ratio of 0.23. Therefore, retrofitting toilets is not economically feasible even though the component could save up to 64 million gallons of water per year. The value of water savings of $1,755 per million gallons saved includes all costs of supplying water except heating.

Program Analysis

Individual Component Benefit Cost Analysis Results for:

2. Retrofit residential toilets

	Costs		Benefits					
			Water Use					
Year	Devices Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	3,826	0%	0.00	$1,755.01	$0	$0
1	2,757	$758,256	3,840	0%	8.05	$1,755.01	$14,130	($744,126)
2	2,757	$758,256	3,853	0%	16.10	$1,755.01	$28,260	($729,995)
3	2,757	$758,256	3,867	1%	24.15	$1,755.01	$42,390	($715,865)
4	2,757	$758,256	3,881	1%	32.21	$1,755.01	$56,520	($701,735)
5	2,757	$758,256	3,894	1%	40.26	$1,755.01	$70,650	($687,605)
6	2,757	$758,256	3,955	1%	48.31	$1,755.01	$84,781	($673,475)
7	2,757	$758,256	4,015	1%	56.36	$1,755.01	$98,911	($659,345)
8	2,757	$758,256	4,076	2%	64.41	$1,755.01	$113,041	($645,215)
9	0	$0	4,136	2%	64.41	$1,755.01	$113,041	$113,041
10	0	$0	4,196	2%	64.41	$1,755.01	$113,041	$113,041
11	0	$0	4,283	2%	64.41	$1,755.01	$113,041	$113,041
12	0	$0	4,370	1%	64.41	$1,755.01	$113,041	$113,041
13	0	$0	4,457	1%	64.41	$1,755.01	$113,041	$113,041
14	0	$0	4,544	1%	64.41	$1,755.01	$113,041	$113,041
15	0	$0	4,630	1%	64.41	$1,755.01	$113,041	$113,041
16	0	$0	4,715	1%	64.41	$1,755.01	$113,041	$113,041
17	0	$0	4,800	1%	64.41	$1,755.01	$113,041	$113,041
18	0	$0	4,884	1%	64.41	$1,755.01	$113,041	$113,041
19	0	$0	4,969	1%	64.41	$1,755.01	$113,041	$113,041
20	0	$0	5,053	1%	64.41	$1,755.01	$113,041	$113,041
Present Value of Total Annual Benefits:					**$1,125,067**			
Present Value of Total Annual Costs:					**$4,883,888**			
Net Present Value:					**($3,758,821)**			
Benefit Cost Ratio:					**0.23**			

*Installation costs: # retrofited annually x installation costs

Installation: $275 Ace Plumbing, Sacramento: Toilet/showerhead retrofit $295. Split $275 toilet - $20 showerhead.

High flow toilets: 22,058 toilets installed prior to 1992

2 toilets per single family unit

8.4 toilets per multi-family unit

Years to retrofit: 8 2,757 Toilets retrofitted annually

**Water Reduction: # of retrofitted toilets x water saved/flush x # flushes/day x 365 / 1000000

Water saved per flush: 2.00 gallons

Type	ga/flush
Low-flow	2.00
High-flow	4.00

Source: GAO, Aug. 2000

Assumed flushes per day: 4

Component: Retrofit residential showerheads. The analysis determined that this component would result in a benefit to cost ratio of 11 to 1. Therefore, retrofitting showerheads is economically feasible with water savings of up to 96 million gallons of water annually. Retrofitting residential showerheads presents the greatest potential for water conservation due to the relative high value of water savings of $4,139 per million gallons and the amount of water used.

The showerhead retrofit program would still be advantageous for the City if just the direct costs to the City were considered. Direct City costs include energy for pumping water, wastewater treatment, and investment in new wells and treatment facilities. The value of water saved would be reduced from $4,139 to $915 per million gallons and the benefit cost ratio would be reduced from 11 to 1 to 2.8 to 1 (feasible).

Program Analysis

Individual Component Benefit Cost Analysis Results for:

3. Retrofit residential showerheads

	Costs		Benefits					
			Water Use					
Year	Devices Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	3,826	0%	0	$4,139.29	$0	$0
1	2,757	$55,146	3,840	0%	12.08	$4,139.29	$49,990	($5,156)
2	2,757	$55,146	3,853	1%	24.15	$4,139.29	$99,980	$44,834
3	2,757	$55,146	3,867	1%	36.23	$4,139.29	$149,970	$94,824
4	2,757	$55,146	3,881	1%	48.31	$4,139.29	$199,960	$144,814
5	2,757	$55,146	3,894	2%	60.38	$4,139.29	$249,950	$194,804
6	2,757	$55,146	3,955	2%	72.46	$4,139.29	$299,940	$244,794
7	2,757	$55,146	4,015	2%	84.54	$4,139.29	$349,930	$294,784
8	2,757	$55,146	4,076	2%	96.62	$4,139.29	$399,920	$344,774
9	0	$0	4,136	2%	96.62	$4,139.29	$399,920	$399,920
10	0	$0	4,196	2%	96.62	$4,139.29	$399,920	$399,920
11	0	$0	4,283	2%	96.62	$4,139.29	$399,920	$399,920
12	0	$0	4,370	2%	96.62	$4,139.29	$399,920	$399,920
13	0	$0	4,457	2%	96.62	$4,139.29	$399,920	$399,920
14	0	$0	4,544	2%	96.62	$4,139.29	$399,920	$399,920
15	0	$0	4,630	2%	96.62	$4,139.29	$399,920	$399,920
16	0	$0	4,715	2%	96.62	$4,139.29	$399,920	$399,920
17	0	$0	4,800	2%	96.62	$4,139.29	$399,920	$399,920
18	0	$0	4,884	2%	96.62	$4,139.29	$399,920	$399,920
19	0	$0	4,969	2%	96.62	$4,139.29	$399,920	$399,920
20	0	$0	5,053	2%	96.62	$4,139.29	$399,920	$399,920
Present Value of Total Annual Benefits:					**$3,980,310**			
Present Value of Total Annual Costs:					**$355,192**			
Net Present Value:					**$3,625,118**			
Benefit Cost Ratio:					**11.21**			

*Installation costs: # retrofited annually x installation costs

Installation: $20

High flow showers: 22,058 showers installed prior to 1992

2 showers per single family unit

8.4 showers per multi-family unit

Years to retrofit: 8 2,757 Showers retrofitted annually

**Water Reduction: # of retrofitted showers x water saved/shower x # showers/day x 365 / 1,000,000

Water saved per shower: 6.00 gallons

Type	ga/shower
Low-flow	7.00
High-flow	13.00

Source: GAO, Aug. 2000

Assumed number of showers per day per shower: 2

Component: Retrofitting residential landscapes. Retrofitting front-yard sod with xeriscape is an ambitious program that would require active customer participation. The economic analysis on this component of the Program assumes that 100 percent of household water users will participate in the program. Adoption of more efficient landscapes has the potential for saving 217 million gallons of water annually. Unfortunately the cost retrofitting residential landscapes is approximately $2,725 and the practice is economically infeasible with a benefit to cost ratio of 0.01.

Program Analysis

Individual Component Benefit Cost Analysis Results for:

4. Retrofit residential landscape

	Costs		Benefits					
			Water Use					
Year	Number of Landscapes Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	3,391	0%	0.00	$166.97	$0	$0
1	571	$1,555,430	3,403	0%	10.85	$166.97	$1,811	($1,553,619)
2	571	$1,555,430	3,415	1%	21.69	$166.97	$3,622	($1,551,808)
3	571	$1,555,430	3,427	1%	32.54	$166.97	$5,432	($1,549,998)
4	571	$1,555,430	3,439	1%	43.38	$166.97	$7,243	($1,548,187)
5	571	$1,555,430	3,451	2%	54.23	$166.97	$9,054	($1,546,376)
6	571	$1,555,430	3,505	2%	65.07	$166.97	$10,865	($1,544,565)
7	571	$1,555,430	3,558	2%	75.92	$166.97	$12,675	($1,542,755)
8	571	$1,555,430	3,612	2%	86.76	$166.97	$14,486	($1,540,944)
9	571	$1,555,430	3,665	3%	97.61	$166.97	$16,297	($1,539,133)
10	571	$1,555,430	3,719	3%	108.45	$166.97	$18,108	($1,537,322)
11	571	$1,555,430	3,796	3%	119.30	$166.97	$19,919	($1,535,511)
12	571	$1,555,430	3,873	3%	130.14	$166.97	$21,729	($1,533,701)
13	571	$1,555,430	3,950	4%	140.99	$166.97	$23,540	($1,531,890)
14	571	$1,555,430	4,027	4%	151.83	$166.97	$25,351	($1,530,079)
15	571	$1,555,430	4,104	4%	162.68	$166.97	$27,162	($1,528,268)
16	571	$1,555,430	4,178	4%	173.52	$166.97	$28,972	($1,526,458)
17	571	$1,555,430	4,253	4%	184.37	$166.97	$30,783	($1,524,647)
18	571	$1,555,430	4,328	5%	195.21	$166.97	$32,594	($1,522,836)
19	571	$1,555,430	4,403	5%	206.06	$166.97	$34,405	($1,521,025)
20	571	$1,555,430	4,478	5%	216.90	$166.97	$36,216	($1,519,214)
Present Value of Total Annual Benefits:					**$215,062**			
Present Value of Total Annual Costs:					**$20,127,614**			
Net Present Value:					**($19,912,552)**			
Benefit Cost Ratio:					**0.01**			

*Installation costs: # retrofited annually x installation costs

Installation: $2,725 (Dumars Inc., $2,725 for 927sf = $2.94/sf)

Conventional Landscapes: 11,416

Years to retrofit: 20 571 Landscapes retrofitted annually

**Water Reduction: Annual water savings / 1,000,000

Water saved per year: 19,000 gallons

Source: Dumars Inc. October, 2000

Economic Analysis of Individual Demand Management Measures Section

DMM-1—Interior and Exterior Water Audits for Single-family and Multi-family Housing

There are four components to DMM-1.

1. Check water meter, toilets and faucets for leaks,
2. Check toilet flow rates and recommend ULFT if needed,
3. Check showerhead flow rates and recommend low-flow showerheads if needed, and
4. Check irrigation system for leaks and efficiency, and recommend an irrigation schedule

Assumptions: These items can be audited and corrective actions recommended by 2 persons in one hour at a cost of $100. Twenty percent of the residential accounts would be audited in a year. Water savings cannot be determined for the City of Woodland but the assumed water savings from the audit was 1/2 gallon per capita per day.

The audit can result in recommendations to retrofit toilets and showerheads. Evaluation of the audit requires the number of customers acting on the recommendation and this could only be determined for the City of Woodland by a post audit survey. For the purposes this analysis, a 10 percent participation rate is assumed.

Toilets can be installed for $275 per unit that save an estimated 2 gallons per flush (GAO). (Studies indicate that the number of flushes for high-flow and low-flow toilets are not significantly different.) Showerheads can be replaced for $20 per unit that save approximately 6 gallons per shower (GAO). Irrigation schedules are available through the California Irrigation Management Information System (see California Department of Water Resources web site http://wwwdpla.water.ca.gov/cgi-bin/cimis/cimis/data/input_form or call toll-free at (800)322-4647. Implementing and maintaining the schedule is assumed to cost $250 per year per customer. A 10 percent participation rate is assumed for these practices.

Economic Feasibility

DMM-1 is effective in saving water after the audits are completed and the low-flow devices have been installed. Total water savings is expected to be about 77 million gallons annually in the 9th year of operation.

Results of the benefit cost analysis for DMM-1 and each component are presented in the following table. The present value of benefits over the 20-year time horizon is $695,000 and the present value of costs is $7 million resulting in a negative net present value of $6.3 million and a benefit to cost ratio of 0.10. The components of DMM-1 are not economically feasible with the exception of the showerheads.

Program Components:	Benefits	Costs	Net Present Value	Benefit Cost Ratio
1. Check meter, toilets and faucets for leaks	$89,589	$4,238,150	($4,148,561)	0.021
2. Check toilet flow rates & recommend ULFT if needed.	$112,507	$488,389	($375,882)	0.230
3. Check showerhead flow rates and recommend low-flow showerheads if needed.	$398,031	$35,519	$362,512	11.206
4. Check irrigation system and recommend an irrigation schedule	$94,854	$2,297,809	($2,202,955)	0.041
DMM Total	$694,981	$7,059,867	($6,364,886)	0.098

Detailed information such as the schedule of DMM-1 Implementation, water savings, program costs, benefits and detailed assumption of the analysis of the various DMM-1 components and the total DMM follow.

DMM 1: Water Audits and Incentives

Benefit Cost Analysis Results

1. **Check meter, toilets and faucets for leaks**
2. **Check toilet flow rates & recommend ULFT if needed.**
3. **Check showerhead flow rates and recommend low-flow showerheads if needed.**
4. **Check irrigation system and recommend an irrigation schedule**

		Benefits					
		Water Use (mg)			Average		
Year	Total Annual Costs	Without Project	Percent Reduction	Reduction (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$265,157	3,826	0%	1.7	$1,755.01	$3,068	-$262,088
1	$707,598	3,826	0%	11.8	$1,037.94	$12,233	-$695,365
2	$711,949	3,840	1%	21.4	$964.94	$20,644	-$691,305
3	$716,300	3,853	1%	30.8	$931.49	$28,677	-$687,622
4	$720,651	3,867	1%	40.1	$911.42	$36,523	-$684,128
5	$725,001	3,881	1%	49.3	$897.97	$44,274	-$680,727
6	$729,704	3,894	2%	58.5	$888.68	$52,016	-$677,689
7	$734,407	3,955	2%	67.8	$881.89	$59,752	-$674,655
8	$739,110	4,015	2%	77.0	$876.70	$67,486	-$671,624
9	$305,723	4,076	2%	77.1	$877.54	$67,615	-$238,107
10	$310,426	4,136	2%	77.1	$878.38	$67,744	-$242,682
11	$315,513	4,196	2%	77.2	$879.21	$67,873	-$247,640
12	$320,599	4,283	2%	77.3	$880.04	$68,001	-$252,599
13	$325,686	4,370	2%	77.3	$880.86	$68,129	-$257,557
14	$330,773	4,457	2%	77.4	$881.69	$68,257	-$262,516
15	$335,860	4,544	2%	77.5	$882.51	$68,385	-$267,475
16	$341,395	4,630	2%	77.6	$883.41	$68,526	-$272,869
17	$346,930	4,715	2%	77.7	$884.36	$68,674	-$278,256
18	$352,465	4,800	2%	77.7	$885.32	$68,824	-$283,641
19	$358,000	4,884	2%	77.8	$886.28	$68,976	-$289,023
20	$363,534	4,969	2%	77.9	$887.26	$69,129	-$294,405

The following four tables present benefit to cost analysis results for individual DMM-1 components.

DMM 1: Water Audits and Incentives

Individual Component Benefit Cost Analysis Results:

1. Check meter, toilets and faucets for leaks

	Costs			Benefits					
				Water Use					
Year	Number of Households*	Number of Surveys	Total Costs**	Without* (mg)	% Water Saved	Reduction*** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	13,258	2,652	$265,157	3,826	0.05%	1.7484	$1,755.01	$3,068	($262,088)
1	13,475	2,695	$269,508	3,840	0.07%	2.6379	$1,755.01	$4,629	($264,878)
2	13,693	2,739	$273,859	3,853	0.08%	3.0979	$1,755.01	$5,437	($268,422)
3	13,910	2,782	$278,210	3,867	0.09%	3.3433	$1,755.01	$5,868	($272,342)
4	14,128	2,826	$282,560	3,881	0.09%	3.4813	$1,755.01	$6,110	($276,451)
5	14,346	2,869	$286,911	3,894	0.09%	3.5657	$1,755.01	$6,258	($280,653)
6	14,581	2,916	$291,614	3,955	0.09%	3.6443	$1,755.01	$6,396	($285,218)
7	14,816	2,963	$296,317	4,015	0.09%	3.7202	$1,755.01	$6,529	($289,788)
8	15,051	3,010	$301,020	4,076	0.09%	3.7946	$1,755.01	$6,660	($294,360)
9	15,286	3,057	$305,723	4,136	0.09%	3.8683	$1,755.01	$6,789	($298,934)
10	15,521	3,104	$310,426	4,196	0.09%	3.9416	$1,755.01	$6,918	($303,508)
11	15,776	3,155	$315,513	4,283	0.09%	4.0148	$1,755.01	$7,046	($308,467)
12	16,030	3,206	$320,599	4,370	0.09%	4.0879	$1,755.01	$7,174	($313,425)
13	16,284	3,257	$325,686	4,457	0.09%	4.1610	$1,755.01	$7,303	($318,384)
14	16,539	3,308	$330,773	4,544	0.09%	4.2340	$1,755.01	$7,431	($323,343)
15	16,793	3,359	$335,860	4,630	0.09%	4.3070	$1,755.01	$7,559	($328,301)
16	17,070	3,414	$341,395	4,715	0.09%	4.3873	$1,755.01	$7,700	($333,695)
17	17,346	3,469	$346,930	4,800	0.09%	4.4712	$1,755.01	$7,847	($339,083)
18	17,623	3,525	$352,465	4,884	0.09%	4.5570	$1,755.01	$7,998	($344,467)
19	17,900	3,580	$358,000	4,969	0.09%	4.6437	$1,755.01	$8,150	($349,850)
20	18,177	3,635	$363,534	5,053	0.09%	4.7309	$1,755.01	$8,303	($355,232)

Present Value of Total Annual Benefits:	**$89,589**
Present Value of Total Annual Costs:	**$4,238,150**
Net Present Value:	**($4,148,561)**
Benefit Cost Ratio:	**0.02**

*Number of households = number of single family dwelling units + number of multi-family dwelling units

**Survey costs: # surveys annually x survey cost

Survey Cost: $100
% Surveyed: 20%
Water saved: 0.5 gallons/capita/day

***Water Saved: Number of households surveyed x average household size x water saved (gcd) + (survey effectiveness x last years savings)

Survey Effectiveness: 50% carryover of last year's water reduction

DMM 1: Water Audits and Incentives

Individual Component Benefit Cost Analysis Results:

3. Check showerhead flow rates and recommend low-flow showerheads if needed.

	Costs		Benefits					
			Water Use					
Year	Devices Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	3,826	0.00%	0.00	$4,139.29	$0	$0
1	276	$5,515	3,826	0.03%	1.21	$4,139.29	$4,999	($516)
2	276	$5,515	3,840	0.06%	2.42	$4,139.29	$9,998	$4,483
3	276	$5,515	3,853	0.09%	3.62	$4,139.29	$14,997	$9,482
4	276	$5,515	3,867	0.12%	4.83	$4,139.29	$19,996	$14,481
5	276	$5,515	3,881	0.16%	6.04	$4,139.29	$24,995	$19,480
6	276	$5,515	3,894	0.19%	7.25	$4,139.29	$29,994	$24,479
7	276	$5,515	3,955	0.21%	8.45	$4,139.29	$34,993	$29,478
8	276	$5,515	4,015	0.24%	9.66	$4,139.29	$39,992	$34,477
9	0	$0	4,076	0.24%	9.66	$4,139.29	$39,992	$39,992
10	0	$0	4,136	0.23%	9.66	$4,139.29	$39,992	$39,992
11	0	$0	4,196	0.23%	9.66	$4,139.29	$39,992	$39,992
12	0	$0	4,283	0.23%	9.66	$4,139.29	$39,992	$39,992
13	0	$0	4,370	0.22%	9.66	$4,139.29	$39,992	$39,992
14	0	$0	4,457	0.22%	9.66	$4,139.29	$39,992	$39,992
15	0	$0	4,544	0.21%	9.66	$4,139.29	$39,992	$39,992
16	0	$0	4,630	0.21%	9.66	$4,139.29	$39,992	$39,992
17	0	$0	4,715	0.20%	9.66	$4,139.29	$39,992	$39,992
18	0	$0	4,800	0.20%	9.66	$4,139.29	$39,992	$39,992
19	0	$0	4,884	0.20%	9.66	$4,139.29	$39,992	$39,992
20	0	$0	4,969	0.19%	9.66	$4,139.29	$39,992	$39,992

Present Value of Total Annual Benefits:	**$398,031**
Present Value of Total Annual Costs:	**$35,519**
Net Present Value:	**$362,512**
Benefit Cost Ratio:	**11.21**

*Installation costs: # retrofited annually x installation costs x participation rate

Installation: $20 Ace Plumbing, Sacramento: Toilet/showerhead retrofit $295. Split $275 toilet - $20 showerhead.

High flow showerheads: 22,058 showerheads installed prior to 1992
2 showerheads per single family unit
8.4 showerheads per multi-family unit

Years to survey 8 2,757 showerheads retrofitted annually

Percent participation: 10%

**Water Reduction: # of retrofitted showerheads x water saved/shower x # showers/day x 365 / 1000000

Water saved per shower: 6.00 gallons

Type	ga/shower
Low-flow	7.00
High-flow	13.00

Source: GAO, Aug. 2000

Assumed number of showers per day per shower: 2

DMM 1: Water Audits and Incentives

Individual Component Benefit Cost Analysis Results:

2. Check toilet flow rates & recommend ULFT if needed.

	Costs		Benefits					
			Water Use					
Year	Devices Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	3,826	0.00%	0.00	$1,755.01	$0	$0
1	276	$75,826	3,826	0.02%	0.81	$1,755.01	$1,413	($74,413)
2	276	$75,826	3,840	0.04%	1.61	$1,755.01	$2,826	($73,000)
3	276	$75,826	3,853	0.06%	2.42	$1,755.01	$4,239	($71,587)
4	276	$75,826	3,867	0.08%	3.22	$1,755.01	$5,652	($70,174)
5	276	$75,826	3,881	0.10%	4.03	$1,755.01	$7,065	($68,761)
6	276	$75,826	3,894	0.12%	4.83	$1,755.01	$8,478	($67,348)
7	276	$75,826	3,955	0.14%	5.64	$1,755.01	$9,891	($65,935)
8	276	$75,826	4,015	0.16%	6.44	$1,755.01	$11,304	($64,521)
9	0	$0	4,076	0.16%	6.44	$1,755.01	$11,304	$11,304
10	0	$0	4,136	0.16%	6.44	$1,755.01	$11,304	$11,304
11	0	$0	4,196	0.15%	6.44	$1,755.01	$11,304	$11,304
12	0	$0	4,283	0.15%	6.44	$1,755.01	$11,304	$11,304
13	0	$0	4,370	0.15%	6.44	$1,755.01	$11,304	$11,304
14	0	$0	4,457	0.14%	6.44	$1,755.01	$11,304	$11,304
15	0	$0	4,544	0.14%	6.44	$1,755.01	$11,304	$11,304
16	0	$0	4,630	0.14%	6.44	$1,755.01	$11,304	$11,304
17	0	$0	4,715	0.14%	6.44	$1,755.01	$11,304	$11,304
18	0	$0	4,800	0.13%	6.44	$1,755.01	$11,304	$11,304
19	0	$0	4,884	0.13%	6.44	$1,755.01	$11,304	$11,304
20	0	$0	4,969	0.13%	6.44	$1,755.01	$11,304	$11,304
Present Value of Total Annual Benefits:					**$112,507**			
Present Value of Total Annual Costs:					**$488,389**			
Net Present Value:					**($375,882)**			
Benefit Cost Ratio:					**0.23**			

*Installation costs: # retrofited annually x installation costs x participation rate

Installation: $275 Ace Plumbing, Sacramento: Toilet/showerhead retrofit $295. Split $275 toilet - $20 showerhead.

High flow toilets: 22,058 toilets installed prior to 1992
2 toilets per single family unit
8.4 toilets per multi-family unit

Years to survey 8 2,757 toilets retrofitted annually

Percent participation: 10%

**Water Reduction: # of retrofitted toilets x water saved/flush x # flushes/day x 365 / 1000000

Water saved per flush: 2.00 gallons

Type	ga/flush
Low-flow	2.00
High-flow	4.00

Source: GAO, Aug. 2000

Assumed flushes per day: 4.00

DMM 1: Water Audits and Incentives

Individual Component Benefit Cost Analysis Results:

4. Check irrigation system and recommend an irrigation schedule

	Costs		Benefits					
			Water Use					
Year	Number of Landscapes Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	3,391	0.00%	0.00	$166.97	$0	$0
1	1,427	$356,750	3,391	0.21%	7.14	$166.97	$1,191	($355,559)
2	1,427	$356,750	3,403	0.42%	14.27	$166.97	$2,383	($354,367)
3	1,427	$356,750	3,415	0.63%	21.41	$166.97	$3,574	($353,176)
4	1,427	$356,750	3,427	0.83%	28.54	$166.97	$4,765	($351,985)
5	1,427	$356,750	3,439	1.04%	35.68	$166.97	$5,957	($350,793)
6	1,427	$356,750	3,451	1.24%	42.81	$166.97	$7,148	($349,602)
7	1,427	$356,750	3,505	1.43%	49.95	$166.97	$8,339	($348,411)
8	1,427	$356,750	3,558	1.60%	57.08	$166.97	$9,530	($347,220)
9	0	$0	3,612	1.58%	57.08	$166.97	$9,530	$9,530
10	0	$0	3,665	1.56%	57.08	$166.97	$9,530	$9,530
11	0	$0	3,719	1.53%	57.08	$166.97	$9,530	$9,530
12	0	$0	3,796	1.50%	57.08	$166.97	$9,530	$9,530
13	0	$0	3,873	1.47%	57.08	$166.97	$9,530	$9,530
14	0	$0	3,950	1.45%	57.08	$166.97	$9,530	$9,530
15	0	$0	4,027	1.42%	57.08	$166.97	$9,530	$9,530
16	0	$0	4,104	1.39%	57.08	$166.97	$9,530	$9,530
17	0	$0	4,178	1.37%	57.08	$166.97	$9,530	$9,530
18	0	$0	4,253	1.34%	57.08	$166.97	$9,530	$9,530
19	0	$0	4,328	1.32%	57.08	$166.97	$9,530	$9,530
20	0	$0	4,403	1.30%	57.08	$166.97	$9,530	$9,530

Present Value of Total Annual Benefits:	**$94,854**
Present Value of Total Annual Costs:	**$2,297,809**
Net Present Value:	**($2,202,955)**
Benefit Cost Ratio:	**0.04**

*Schedule costs: # scheduled x schedule cost/year x participation rate

Annual scheduling cost $250

Irrigated Landscapes 11,416

Years to survey 8 1,427 Landscapes surveyed annually

**Water Reduction: Annual water savings / 1,000,000

Water saved per year: 5,000 gallons

Participation rate: 10%

DMM-2—Plumbing Retrofit

DMM-2 requires that low-flow fixtures be installed to replace non low-flow plumbing fixtures.

There are two components to DMM-2 to account for different values of water saved.

1. Check toilet flow rates and install ULFT as required, and
2. Check showerhead flow rates and install low-flow showerheads as required.

Installation costs were summarized under DMM-1 and apply equally to DMM-2. Toilets that save an estimated 2 gallons per flush (GAO) can be installed for $275 per unit. Showerheads can be replaced for $20 per unit that save approximately 6 gallons per shower (GAO). "Who pays for the retrofit?" is not specified since the benefit to cost analysis accounts for all benefits and costs regardless of incidence.

Economic Feasibility

DMM-2 is effective in saving water once the low-flow devices have been installed as indicated by the 0.97 benefit cost ratio (approximately 1). Total water savings are expected to be about 156 million gallons annually by the 8th year of operation.

Results from the benefit to cost analysis for DMM-2 and each component are presented in the following table. The present value of benefits over the 20-year time horizon is $5.1 million and the present value of costs is $5.2 million resulting in a positive net present value of $134,000. The individual components of DMM-2 have the same benefit cost ratio as they did in DMM-1 but the water savings, benefits and costs are much higher since the retrofits are required, not recommended.

Program Components:	Benefits	Costs	Net Present Value	Benefit Cost Ratio
1. Check toilet flow rates and install ULFT as requested.	$1,125,067	$4,883,888	($3,758,821)	0.23
2. Check showerhead flow rates and install low-flow device as requested.	$3,980,310	$355,192	$3,625,118	11.21
Program Total	**$5,105,377**	**$5,239,080**	**($133,703)**	**0.97**

Detailed information such as the schedule of DMM-2 Implementation, water savings, program costs, benefits and detailed assumption of the analysis of the various DMM-2 components and the total DMM are presented in the following subsection.

The following table contains the overall economic evaluation of DMM-2.

DMM 2: Plumbing Standards and Retrofit

Program Benefit Cost Analysis Results for:

1. Check toilet flow rates and install ULFT as requested.

2. Check showerhead flow rates and install low-flow device as requested.

		Benefits					
		Water Use (mg)			Average		
Year	Total Annual Costs	Without Project	Percent Reduction	Reduction (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$0	3,826	0%	0.0	$0.00	$0	$0
1	$813,402	3,826	1%	20.1	$3,185.58	$64,120	-$749,281
2	$813,402	3,840	1%	40.3	$3,185.58	$128,240	-$685,161
3	$813,402	3,853	2%	60.4	$3,185.58	$192,360	-$621,041
4	$813,402	3,867	2%	80.5	$3,185.58	$256,480	-$556,921
5	$813,402	3,881	3%	100.6	$3,185.58	$320,601	-$492,801
6	$813,402	3,894	3%	120.8	$3,185.58	$384,721	-$428,681
7	$813,402	3,955	4%	140.9	$3,185.58	$448,841	-$364,561
8	$813,402	4,015	4%	161.0	$3,185.58	$512,961	-$300,441
9	$0	4,076	4%	161.0	$3,185.58	$512,961	$512,961
10	$0	4,136	4%	161.0	$3,185.58	$512,961	$512,961
11	$0	4,196	4%	161.0	$3,185.58	$512,961	$512,961
12	$0	4,283	4%	161.0	$3,185.58	$512,961	$512,961
13	$0	4,370	4%	161.0	$3,185.58	$512,961	$512,961
14	$0	4,457	4%	161.0	$3,185.58	$512,961	$512,961
15	$0	4,544	4%	161.0	$3,185.58	$512,961	$512,961
16	$0	4,630	3%	161.0	$3,185.58	$512,961	$512,961
17	$0	4,715	3%	161.0	$3,185.58	$512,961	$512,961
18	$0	4,800	3%	161.0	$3,185.58	$512,961	$512,961
19	$0	4,884	3%	161.0	$3,185.58	$512,961	$512,961
20	$0	4,969	3%	161.0	$3,185.58	$512,961	$512,961

*Total residential water use.

The following two tables contain economic evaluations of DMM-2 components.

DMM 2: Plumbing Standards and Retrofit

Individual Component Benefit Cost Analysis Results for:

2. Check showerhead flow rates and install low-flow device as requested.

	Costs		Benefits					
			Water Use					
Year	Devices Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	3,826	0%	0.00	$4,139.29	$0	$0
1	2,757	$55,146	3,826	0%	12.08	$4,139.29	$49,990	($5,156)
2	2,757	$55,146	3,840	1%	24.15	$4,139.29	$99,980	$44,834
3	2,757	$55,146	3,853	1%	36.23	$4,139.29	$149,970	$94,824
4	2,757	$55,146	3,867	1%	48.31	$4,139.29	$199,960	$144,814
5	2,757	$55,146	3,881	2%	60.38	$4,139.29	$249,950	$194,804
6	2,757	$55,146	3,894	2%	72.46	$4,139.29	$299,940	$244,794
7	2,757	$55,146	3,955	2%	84.54	$4,139.29	$349,930	$294,784
8	2,757	$55,146	4,015	2%	96.62	$4,139.29	$399,920	$344,774
9	0	$0	4,076	2%	96.62	$4,139.29	$399,920	$399,920
10	0	$0	4,136	2%	96.62	$4,139.29	$399,920	$399,920
11	0	$0	4,196	2%	96.62	$4,139.29	$399,920	$399,920
12	0	$0	4,283	2%	96.62	$4,139.29	$399,920	$399,920
13	0	$0	4,370	2%	96.62	$4,139.29	$399,920	$399,920
14	0	$0	4,457	2%	96.62	$4,139.29	$399,920	$399,920
15	0	$0	4,544	2%	96.62	$4,139.29	$399,920	$399,920
16	0	$0	4,630	2%	96.62	$4,139.29	$399,920	$399,920
17	0	$0	4,715	2%	96.62	$4,139.29	$399,920	$399,920
18	0	$0	4,800	2%	96.62	$4,139.29	$399,920	$399,920
19	0	$0	4,884	2%	96.62	$4,139.29	$399,920	$399,920
20	0	$0	4,969	2%	96.62	$4,139.29	$399,920	$399,920
Present Value of Total Annual Benefits:					**$3,980,310**			
Present Value of Total Annual Costs:					**$355,192**			
Net Present Value:					**$3,625,118**			
Benefit Cost Ratio:					**11.21**			

*Installation costs: # retrofited annually x installation costs

Installation: $20

High flow showerheads: 22,058 showerheads installed prior to 1992

2 showerheads per single family unit

8.4 showerheads per multi-family unit

Years to survey 8 2,757 Showers retrofitted annually

**Water Reduction: # of retrofitted showers x water saved/shower x # showers/day x 365 / 1,000,000

Water saved per shower: 6.00 gallons

Type	ga/shower
Low-flow	7.00
High-flow	13.00

Source: GAO, Aug. 2000

Assumed showers per day per shower: 2.00

DMM 2: Plumbing Standards and Retrofit

Individual Component Benefit Cost Analysis Results for:

2. Check showerhead flow rates and install low-flow device as requested.

	Costs		Benefits					
			Water Use					
Year	Devices Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	3,826	0%	0.00	$4,139.29	$0	$0
1	2,757	$55,146	3,826	0%	12.08	$4,139.29	$49,990	($5,156)
2	2,757	$55,146	3,840	1%	24.15	$4,139.29	$99,980	$44,834
3	2,757	$55,146	3,853	1%	36.23	$4,139.29	$149,970	$94,824
4	2,757	$55,146	3,867	1%	48.31	$4,139.29	$199,960	$144,814
5	2,757	$55,146	3,881	2%	60.38	$4,139.29	$249,950	$194,804
6	2,757	$55,146	3,894	2%	72.46	$4,139.29	$299,940	$244,794
7	2,757	$55,146	3,955	2%	84.54	$4,139.29	$349,930	$294,784
8	2,757	$55,146	4,015	2%	96.62	$4,139.29	$399,920	$344,774
9	0	$0	4,076	2%	96.62	$4,139.29	$399,920	$399,920
10	0	$0	4,136	2%	96.62	$4,139.29	$399,920	$399,920
11	0	$0	4,196	2%	96.62	$4,139.29	$399,920	$399,920
12	0	$0	4,283	2%	96.62	$4,139.29	$399,920	$399,920
13	0	$0	4,370	2%	96.62	$4,139.29	$399,920	$399,920
14	0	$0	4,457	2%	96.62	$4,139.29	$399,920	$399,920
15	0	$0	4,544	2%	96.62	$4,139.29	$399,920	$399,920
16	0	$0	4,630	2%	96.62	$4,139.29	$399,920	$399,920
17	0	$0	4,715	2%	96.62	$4,139.29	$399,920	$399,920
18	0	$0	4,800	2%	96.62	$4,139.29	$399,920	$399,920
19	0	$0	4,884	2%	96.62	$4,139.29	$399,920	$399,920
20	0	$0	4,969	2%	96.62	$4,139.29	$399,920	$399,920
Present Value of Total Annual Benefits:					**$3,980,310**			
Present Value of Total Annual Costs:					**$355,192**			
Net Present Value:					**$3,625,118**			
Benefit Cost Ratio:					**11.21**			

*Installation costs: # retrofited annually x installation costs

Installation: $20

High flow showerheads: 22,058 showerheads installed prior to 1992

2 showerheads per single family unit

8.4 showerheads per multi-family unit

Years to survey 8 2,757 Showers retrofitted annually

**Water Reduction: # of retrofitted showers x water saved/shower x # showers/day x 365 / 1,000,000

Water saved per shower: 6.00 gallons

Type	ga/shower
Low-flow	7.00
High-flow	13.00

Source: GAO, Aug. 2000

Assumed showers per day per shower: 2.00

DMM-3—Distribution System Water Audits, Leak Detection and Repair

DMM-3 would involve auditing the City's water distribution system to detect major leaks. An audit could be incorporated into the routine maintenance schedule or contracted out. An increase of $20,000 per year in the maintenance budget and a water savings of 20 percent of the unaccounted water is assumed for the purposes of conducting the economic analysis. The amount of water saving from DMM-3 is dependent on the condition of the system.

Economic Feasibility

Total water savings from DMM-3 is expected to be about 145 million gallons annually in the 20th year of operation. The benefit to cost ratio for DMM-3 is 0.81. Additional, but undetermined program value could result from reductions damage to roadway sub-base that might be induced by large water leaks that go unrepaired. The following table contains the schedule of DMM-3 costs, benefits and water savings.

DMM 3: Distribution System Water Audits, Leak Detection and Repair

Individual Component Benefit Cost Analysis Results:

		Benefits					
		Water Use					
Year	Total Costs	Without* (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$25,000	560	20%	112	$166.97	$18,701	($6,299)
1	$25,000	560	20%	112	$166.97	$18,701	($6,299)
2	$25,000	562	20%	112	$166.97	$18,767	($6,233)
3	$25,000	564	20%	113	$166.97	$18,834	($6,166)
4	$25,000	566	20%	113	$166.97	$18,901	($6,099)
5	$25,000	568	20%	114	$166.97	$18,968	($6,032)
6	$25,000	570	20%	114	$166.97	$19,035	($5,965)
7	$25,000	579	20%	116	$166.97	$19,330	($5,670)
8	$25,000	588	20%	118	$166.97	$19,625	($5,375)
9	$25,000	597	20%	119	$166.97	$19,920	($5,080)
10	$25,000	605	20%	121	$166.97	$20,215	($4,785)
11	$25,000	614	20%	123	$166.97	$20,510	($4,490)
12	$25,000	627	20%	125	$166.97	$20,935	($4,065)
13	$25,000	640	20%	128	$166.97	$21,359	($3,641)
14	$25,000	652	20%	130	$166.97	$21,783	($3,217)
15	$25,000	665	20%	133	$166.97	$22,208	($2,792)
16	$25,000	678	20%	136	$166.97	$22,632	($2,368)
17	$25,000	690	20%	138	$166.97	$23,045	($1,955)
18	$25,000	703	20%	141	$166.97	$23,459	($1,541)
19	$25,000	715	20%	143	$166.97	$23,872	($1,128)
20	$25,000	727	20%	145	$166.97	$24,286	($714)
Present Value of Total Annual Benefits:					**$282,159**		
Present Value of Total Annual Costs:					**$347,521**		
Net Present Value:					**($65,362)**		
Benefit Cost Ratio:					**0.81**		

*Unaccounted for water.

**Water reduction: 20% reduction in unaccounted for water.

DMM-4—Metering with Commodity Rates

Description

DMM-4 requires that all non-metered accounts be retrofitted and that a pricing schedule based on the amount of water use be instituted. The City is fully metered for all nonresidential sectors and meters have been installed in new residential construction since 1992. Currently about 10,300 residential accounts are not metered. In addition, commercial, institutional and governmental accounts that have substantial landscaping areas will have separate meters.

The cost of retrofitting water meters was assumed to be $550 per meter based on City of Davis program costs ($500) plus $50 for inflation. Additional costs for DMM-4 are the costs of reading the meters and billing based on water use, which is estimated at approximately $11.10 per meter per year.

Effectiveness of this program is not known because each pricing system depends on the rate imposed. Since the cost of water in Woodland is relatively low it would be difficult to impose water rates that did more than cover system costs. This implies that rates based on the cost of water would not have a significant effect on the amount of water use. To facilitate the economic evaluation of DMM-4, a metered account with a pricing schedule based on the amount of water use is assumed to save 10 percent of total water use. This would probably come from reduced outdoor water use for landscaping and outdoor washing.

Separating landscaping from commercial, institutional and government indoor use is assumed to save approximately 5,000 gallons per year per account.

Economic Feasibility

Although DMM-4 can potentially save 457 million gallons per year, it is not economically feasible. Estimates of the costs of implementing DMM-4 and the value of water saved are well known but the effectiveness of the program needs to be quantified. This can only be assessed by a post-DMM survey.

Program Components:	Benefits	Costs	Net Present Value	Benefit Cost Ratio
1. Install single family residential meters and bill by volume of use	$601,427	$5,641,229	($5,039,802)	0.11
2. Switch mixed use to dedicated landscape use and other use	$6,502	$361,164	($354,662)	0.02
Program Total	**$607,929**	**$6,002,393**	**($5,394,465)**	**0.10**

Detailed results on the two components of DMM-4 are presented in the following tables. The first table contains the economic analysis of the entire DMM. Two additional tables provide information on each DMM-4 component.

DMM 4: Install meters and adopt commodity rates

Program Benefit Cost Analysis Results

1. Install single family residential meters and bill by volume of use

2. Switch mixed use to dedicated landscape use and other use

	Costs	Benefits					
		Water Use (mg)			Unit Cost	Value of	Net
Year	Total	Without*	% Reduction	Reduction (mg)	($/mg)	Water Saved	Benefits
0	$16,131	3,826	1%	43.1	$166.97	$7,191	-$8,940
1	$513,225	3,826	2%	70.3	$166.97	$11,736	-$501,489
2	$524,344	3,840	3%	98.7	$166.97	$16,482	-$507,862
3	$535,463	3,853	3%	126.9	$166.97	$21,181	-$514,282
4	$546,581	3,867	4%	154.7	$166.97	$25,834	-$520,748
5	$557,896	3,881	5%	182.8	$166.97	$30,524	-$527,372
6	$569,210	3,894	5%	210.6	$166.97	$35,169	-$534,040
7	$580,524	3,955	6%	238.3	$166.97	$39,789	-$540,735
8	$591,838	4,015	7%	265.8	$166.97	$44,375	-$547,463
9	$603,152	4,076	7%	293.0	$166.97	$48,928	-$554,224
10	$614,679	4,136	8%	320.7	$166.97	$53,538	-$561,141
11	$579,622	4,196	8%	347.7	$166.97	$58,049	-$521,573
12	$591,149	4,283	9%	376.8	$166.97	$62,915	-$528,234
13	$602,676	4,370	9%	406.1	$166.97	$67,799	-$534,877
14	$165,945	4,457	9%	413.5	$166.97	$69,047	-$96,898
15	$168,853	4,544	9%	421.6	$166.97	$70,398	-$98,455
16	$171,761	4,630	9%	429.7	$166.97	$71,749	-$100,012
17	$174,670	4,715	9%	436.2	$166.97	$72,829	-$101,840
18	$177,578	4,800	9%	442.7	$166.97	$73,910	-$103,668
19	$180,486	4,884	9%	449.1	$166.97	$74,992	-$105,494
20	$183,828	4,969	9%	456.7	$166.97	$76,253	-$107,576

DMM 4: Install meters and adopt commodity rates

Individual Component Benefit Cost Analysis Results:

1. Install single family residential meters and bill by volume of use

	Costs					Benefits					
						Water Use					
Year	Meters Installed	Installation Costs*	Total Accounts	Cost of Meter Reading**	Total Costs	Without (mg)	% Water Saved	Reduction*** (mg)	Unit Cost ($/mg)	Value of Water	Net Benefits
0	0	$0	1,453	$16,131	$16,131	3,826	1%	43.07	$166.97	$7,191	($8,940)
1	799	$439,391	2,455	$27,249	$466,640	3,826	2%	69.87	$166.97	$11,665	($454,975)
2	799	$439,391	3,457	$38,368	$477,759	3,840	3%	97.87	$166.97	$16,341	($461,418)
3	799	$439,391	4,458	$49,487	$488,878	3,853	3%	125.59	$166.97	$20,969	($467,909)
4	799	$439,391	5,460	$60,606	$499,996	3,867	4%	153.03	$166.97	$25,551	($474,446)
5	799	$439,391	6,479	$71,920	$511,311	3,881	5%	180.70	$166.97	$30,170	($481,140)
6	799	$439,391	7,499	$83,234	$522,625	3,894	5%	208.10	$166.97	$34,745	($487,880)
7	799	$439,391	8,518	$94,548	$533,939	3,955	6%	235.34	$166.97	$39,294	($494,645)
8	799	$439,391	9,537	$105,862	$545,253	4,015	7%	262.38	$166.97	$43,809	($501,444)
9	799	$439,391	10,556	$117,176	$556,567	4,076	7%	289.23	$166.97	$48,291	($508,276)
10	799	$439,391	11,595	$128,704	$568,094	4,136	8%	316.42	$166.97	$52,831	($515,263)
11	799	$439,391	12,633	$140,231	$579,622	4,196	8%	343.43	$166.97	$57,341	($522,280)
12	799	$439,391	13,672	$151,758	$591,149	4,283	9%	372.58	$166.97	$62,208	($528,941)
13	799	$439,391	14,710	$163,285	$602,676	4,370	9%	401.83	$166.97	$67,092	($535,584)
14	0	$0	14,950	$165,945	$165,945	4,457	9%	409.31	$166.97	$68,340	($97,605)
15	0	$0	15,212	$168,853	$168,853	4,544	9%	417.40	$166.97	$69,691	($99,162)
16	0	$0	15,474	$171,761	$171,761	4,630	9%	425.49	$166.97	$71,042	($100,720)
17	0	$0	15,736	$174,670	$174,670	4,715	9%	431.96	$166.97	$72,122	($102,548)
18	0	$0	15,998	$177,578	$177,578	4,800	9%	438.43	$166.97	$73,203	($104,375)
19	0	$0	16,260	$180,486	$180,486	4,884	9%	444.91	$166.97	$74,285	($106,201)
20	0	$0	16,561	$183,828	$183,828	4,969	9%	452.46	$166.97	$75,545	($108,283)

Present Value of Total Annual Benefits:	**$601,427**
Present Value of Total Annual Costs:	**$5,641,229**
Net Present Value:	**($5,039,802)**
Benefit Cost Ratio:	**0.11**

*Installation costs: # retrofited annually x meter installation costs

Installation: $550 per meter. ($500 adjusted for inflation. Bob Shay, City of Davis, personal communication. 10/31/00.)

Total unmetered: 10,386

Years to retrofit: 13 799 retrofitted annually

**Meter reading costs: Cost of reading meter x # of meters

Time to read residential meter: 40 per hour

Time to read C&I meter: 20 per hour

Cost per hour: $37.00 City of Woodland wage rate.

Meter reading freqency: 12 times per year

Cost to read residential meter: $11.10 per meter per year.

Cost to read C&I meter: $22.20 per meter per year.

***Water Reduction: # of metered accounts x average annual water use/account x % water saving

Annual water saved per account: 10.00%

DMM 4: Install meters and adopt commodity rates

Individual Component Benefit Cost Analysis Results:

2. Switch mixed use to dedicated landscape use and other use

	Costs		Benefits					
			Water Use			Unit Cost	Value of	Net
Year	Meters Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	($/mg)	Water Saved	Benefits
0	0	$0	458	0%	0.00	$166.97	$0	$0
1	85	$46,585	458	0%	0.42	$166.97	$71	($46,514)
2	85	$46,585	459	0%	0.85	$166.97	$141	($46,444)
3	85	$46,585	461	0%	1.27	$166.97	$212	($46,373)
4	85	$46,585	462	0%	1.69	$166.97	$283	($46,302)
5	85	$46,585	464	0%	2.12	$166.97	$354	($46,231)
6	85	$46,585	466	1%	2.54	$166.97	$424	($46,161)
7	85	$46,585	473	1%	2.96	$166.97	$495	($46,090)
8	85	$46,585	480	1%	3.39	$166.97	$566	($46,019)
9	85	$46,585	487	1%	3.81	$166.97	$636	($45,949)
10	85	$46,585	495	1%	4.24	$166.97	$707	($45,878)
11	0	$0	502	1%	4.24	$166.97	$707	$707
12	0	$0	512	1%	4.24	$166.97	$707	$707
13	0	$0	523	1%	4.24	$166.97	$707	$707
14	0	$0	533	1%	4.24	$166.97	$707	$707
15	0	$0	543	1%	4.24	$166.97	$707	$707
16	0	$0	554	1%	4.24	$166.97	$707	$707
17	0	$0	564	1%	4.24	$166.97	$707	$707
18	0	$0	574	1%	4.24	$166.97	$707	$707
19	0	$0	584	1%	4.24	$166.97	$707	$707
20	0	$0	594	1%	4.24	$166.97	$707	$707
Present Value of Total Annual Benefits:					**$6,502**			
Present Value of Total Annual Costs:					**$361,164**			
Net Present Value:					**($354,662)**			
Benefit Cost Ratio:					**0.02**			

*Installation costs: # retrofited annually x installation costs

Installation:	$550	per meter. ($500 adjusted for inflation. Bob Shay, City of Davis 10/31/00.)
Mixed use Acct.	847	
Years to retrofit	10	85 meters installed annually
Water saved:	5,000	gallons per year per account

DMM-5—Large Landscape Water Audits and Incentives

Description

The City currently utilizes weekly climatological data to support the weekly adjustment of City park sprinkler timers. Timers are adjusted to allow replenishment of water storage lost during the previous week.

Economic Feasibility

Woodland maintains 30 major landscaped recreation facilities totalling 165 acres (estimated 60 percent of which is irrigated). 18 of these 30 sites are equipped with automatic water systems that are adjusted weekly to correct for changing plant evapotranspiration as noted above. Annual adjustment costs (labor) are estimated at $10,000. Water conservation is estimated to be 69 acre-feet (23 million gallons) per year. This current program is not cost effective if the labor cost estimate is correct even though water is saved. The benefit to cost ratio for DMM-5 is 0.38 to 1.

DMM 5: Large Landscape Water Audits and Incentives

Individual Component Benefit Cost Analysis Results:

1. Audit and schedule large irrigations

			Benefits					
			Water Use					
Year	Number of Accounts	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
1	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
2	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
3	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
4	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
5	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
6	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
7	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
8	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
9	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
10	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
11	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
12	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
13	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
14	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
15	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
16	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
17	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
18	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
19	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
20	18	$10,000	189	12%	23.00	$166.97	$3,840	($6,160)
Present Value of Total Annual Benefits:					**$53,382**			
Present Value of Total Annual Costs:					**$139,008**			
Net Present Value:					**($85,626)**			
Benefit Cost Ratio:					**0.38**			

*Annual scheduling costs:

**Observed by City Staff in current operations

DMM-6—Landscape Water Conservation Requirements

Description

In 1991, motivated by the drought, the City established a no-waste ordinance. It conforms with California Water Code Section 65590 et seq. (AB325), which covers new and existing commercial, industrial, institutional/ governmental, and multi-family customers, and includes new single-family homes. Other components suggested for DMM-6 are the promotion of more efficient landscapes and the implementation of irrigation scheduling. Irrigation scheduling has been analyzed previously in DMM-5.

Economic Feasibility

DMM-6 netted a benefit to cost ratio of 0.17 based on a voluntary program and an assumed participation rate of 30 percent. The program was budgeted at $50,000 per year. Water use reductions assumed to be about 10 percent per year resulting in approximately 60 million gallons of savings per year.

Program costs, water savings, and benefits for this DMM are presented in the following table.

DMM 6: Landscape Water Conservation Requirements

Individual Component Benefit Cost Analysis Results:

1. Promote more water efficient landscapes and practices

		Benefits					
		Water Use					
Year	Costs	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$50,000	1,512	3%	45.36	$166.97	$7,574	($42,426)
1	$50,000	1,517	3%	45.52	$166.97	$7,601	($42,399)
2	$50,000	1,523	3%	45.68	$166.97	$7,628	($42,372)
3	$50,000	1,528	3%	45.85	$166.97	$7,655	($42,345)
4	$50,000	1,534	3%	46.01	$166.97	$7,682	($42,318)
5	$50,000	1,539	3%	46.17	$166.97	$7,709	($42,291)
6	$50,000	1,565	3%	46.94	$166.97	$7,837	($42,163)
7	$50,000	1,590	3%	47.71	$166.97	$7,965	($42,035)
8	$50,000	1,616	3%	48.48	$166.97	$8,094	($41,906)
9	$50,000	1,641	3%	49.24	$166.97	$8,222	($41,778)
10	$50,000	1,667	3%	50.01	$166.97	$8,350	($41,650)
11	$50,000	1,691	3%	50.74	$166.97	$8,472	($41,528)
12	$50,000	1,715	3%	51.46	$166.97	$8,593	($41,407)
13	$50,000	1,740	3%	52.19	$166.97	$8,714	($41,286)
14	$50,000	1,764	3%	52.92	$166.97	$8,835	($41,165)
15	$50,000	1,788	3%	53.64	$166.97	$8,956	($41,044)
16	$50,000	1,824	3%	54.71	$166.97	$9,136	($40,864)
17	$50,000	1,860	3%	55.79	$166.97	$9,315	($40,685)
18	$50,000	1,895	3%	56.86	$166.97	$9,494	($40,506)
19	$50,000	1,931	3%	57.93	$166.97	$9,673	($40,327)
20	$50,000	1,967	3%	59.01	$166.97	$9,852	($40,148)
Present Value of Total Annual Benefits:				**$115,069**			
Present Value of Total Annual Costs:				**$695,042**			
Net Present Value:				**($579,973)**			
Benefit Cost Ratio:				**0.17**			

*Outdoor water use: 30% of total residential water use

**Water Use Reduction: Without project water use x % water savings x participation rate

\ Water Savings: 10%

/ Participation Rate: 30%

DMM-7—Public Information

Description
The City would distribute water use information through bill inserts, brochures, community speakers, paid advertising, and special events. The City would consider changing water bills to show gallons used per day for the last billing period compared to the same period the previous year (bills currently indicate total billing period usage in units of one hundred cubic feet, (ccf).

Economic Feasibility
A benefit to cost ratio of 1 results from a saving of 1 percent of total water use and a program budget of $50,000 per year.

Detailed data on DMM-7 follows.

DMM 7: Public Information

Individual Component Benefit Cost Analysis Results:

1. Public water conservation information program

		Benefits					
		Water Use					
Year	Total Costs	Without (mg)	% Water Saved	Reduction* (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$50,000	5,040	1%	50.40	$915.01	$46,116	($3,884)
1	$50,000	5,040	1%	50.40	$915.01	$46,116	($3,884)
2	$50,000	5,058	1%	50.58	$915.01	$46,281	($3,719)
3	$50,000	5,076	1%	50.76	$915.01	$46,446	($3,554)
4	$50,000	5,094	1%	50.94	$915.01	$46,610	($3,390)
5	$50,000	5,112	1%	51.12	$915.01	$46,775	($3,225)
6	$50,000	5,130	1%	51.30	$915.01	$46,940	($3,060)
7	$50,000	5,210	1%	52.10	$915.01	$47,668	($2,332)
8	$50,000	5,289	1%	52.89	$915.01	$48,395	($1,605)
9	$50,000	5,369	1%	53.69	$915.01	$49,123	($877)
10	$50,000	5,448	1%	54.48	$915.01	$49,851	($149)
11	$50,000	5,528	1%	55.28	$915.01	$50,579	$579
12	$50,000	5,642	1%	56.42	$915.01	$51,625	$1,625
13	$50,000	5,756	1%	57.56	$915.01	$52,672	$2,672
14	$50,000	5,871	1%	58.71	$915.01	$53,718	$3,718
15	$50,000	5,985	1%	59.85	$915.01	$54,764	$4,764
16	$50,000	6,100	1%	61.00	$915.01	$55,811	$5,811
17	$50,000	6,211	1%	62.11	$915.01	$56,831	$6,831
18	$50,000	6,322	1%	63.22	$915.01	$57,850	$7,850
19	$50,000	6,434	1%	64.34	$915.01	$58,870	$8,870
20	$50,000	6,545	1%	65.45	$915.01	$59,889	$9,889

Present Value of Total Annual Benefits:	**$695,810**
Present Value of Total Annual Costs:	**$695,042**
Net Present Value:	**$768**
Benefit Cost Ratio:	**1.00**

*Water savings: 1% of total water use.

DMM-8—School Education

Description
The City would promote water conservation by supplying educational materials to the local school district.

Economic Feasibility
A benefit to cost ratio of 1 results from the assumption that water savings are 1 percent of total residential water use, almost 38 million gallons annually increasing to 50 million gallons after 20 years. The value of water savings is approximately $940 per million gallons. These assumptions justify an annual expenditure of $38,000 for DMM-8. Such a program should include follow-up efforts to determine the extent of changes in water use related behaviors to test the validity of these assumptions.

Detailed data on DMM-8 follows.

DMM 8: School Education Program

Individual Component Benefit Cost Analysis Results:

1. School Education Program

Year	Total Costs	Benefits					
		Water Use			Unit Cost ($/mg)	Value of Water Saved	Net Benefits
		Without (mg)	% Water Saved	Reduction* (mg)			
0	$38,000	3,826	1%	38.26	$915.01	$35,009	($2,991)
1	$38,000	3,826	1%	38.26	$915.01	$35,009	($2,991)
2	$38,000	3,840	1%	38.40	$915.01	$35,134	($2,866)
3	$38,000	3,853	1%	38.53	$915.01	$35,259	($2,741)
4	$38,000	3,867	1%	38.67	$915.01	$35,384	($2,616)
5	$38,000	3,881	1%	38.81	$915.01	$35,509	($2,491)
6	$38,000	3,894	1%	38.94	$915.01	$35,634	($2,366)
7	$38,000	3,955	1%	39.55	$915.01	$36,186	($1,814)
8	$38,000	4,015	1%	40.15	$915.01	$36,739	($1,261)
9	$38,000	4,076	1%	40.76	$915.01	$37,291	($709)
10	$38,000	4,136	1%	41.36	$915.01	$37,844	($156)
11	$38,000	4,196	1%	41.96	$915.01	$38,396	$396
12	$38,000	4,283	1%	42.83	$915.01	$39,191	$1,191
13	$38,000	4,370	1%	43.70	$915.01	$39,985	$1,985
14	$38,000	4,457	1%	44.57	$915.01	$40,779	$2,779
15	$38,000	4,544	1%	45.44	$915.01	$41,574	$3,574
16	$38,000	4,630	1%	46.30	$915.01	$42,368	$4,368
17	$38,000	4,715	1%	47.15	$915.01	$43,142	$5,142
18	$38,000	4,800	1%	48.00	$915.01	$43,916	$5,916
19	$38,000	4,884	1%	48.84	$915.01	$44,690	$6,690
20	$38,000	4,969	1%	49.69	$915.01	$45,464	$7,464

Present Value of Total Annual Benefits:	**$528,217**
Present Value of Total Annual Costs:	**$528,232**
Net Present Value:	**($15)**
Benefit Cost Ratio:	**1.00**

*Water savings: 1% of total water use

DMM-9—Commercial and Industrial Water Conservation

Description
The City would distributed the October 1994 DWR publication Water Efficiency Guide for Business Managers and Facility Engineers. Water audits could also be offered to all commercial and industrial customers.

Feasibility
Assuming a 1 percent water savings from DMM-9 and a program cost of $10,000, benefits exceed costs by a ratio of almost 1.45 to one. Water savings from the program are expected to be about 9.9 million gallons per year. The value of water saved is about $1,755 per million gallons, which includes all water costs except the cost of heat water. Monitoring efforts would be helpful in determining program effectiveness. Budget would have to added for this work.

Detailed data on water savings and benefits are presented below.

DMM 9: Commercial and Industrial Water Conservation
Individual Component Benefit Cost Analysis Results:
1. Commercial and industrial water conservation program

		Benefits					
		Water Use					
Year	Total Costs	Without (mg)	% Water Saved	Reduction* (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$10,000	749	1%	7.49	$1,755.01	$13,141	$3,141
1	$10,000	751	1%	7.51	$1,755.01	$13,188	$3,188
2	$10,000	754	1%	7.54	$1,755.01	$13,235	$3,235
3	$10,000	757	1%	7.57	$1,755.01	$13,281	$3,281
4	$10,000	759	1%	7.59	$1,755.01	$13,328	$3,328
5	$10,000	762	1%	7.62	$1,755.01	$13,375	$3,375
6	$10,000	774	1%	7.74	$1,755.01	$13,583	$3,583
7	$10,000	786	1%	7.86	$1,755.01	$13,790	$3,790
8	$10,000	798	1%	7.98	$1,755.01	$13,997	$3,997
9	$10,000	809	1%	8.09	$1,755.01	$14,205	$4,205
10	$10,000	821	1%	8.21	$1,755.01	$14,412	$4,412
11	$10,000	838	1%	8.38	$1,755.01	$14,710	$4,710
12	$10,000	855	1%	8.55	$1,755.01	$15,009	$5,009
13	$10,000	872	1%	8.72	$1,755.01	$15,307	$5,307
14	$10,000	889	1%	8.89	$1,755.01	$15,605	$5,605
15	$10,000	906	1%	9.06	$1,755.01	$15,903	$5,903
16	$10,000	923	1%	9.23	$1,755.01	$16,194	$6,194
17	$10,000	939	1%	9.39	$1,755.01	$16,484	$6,484
18	$10,000	956	1%	9.56	$1,755.01	$16,775	$6,775
19	$10,000	972	1%	9.72	$1,755.01	$17,065	$7,065
20	$10,000	989	1%	9.89	$1,755.01	$17,356	$7,356

Present Value of Total Annual Benefits:	**$200,721**
Present Value of Total Annual Costs:	**$139,008**
Net Present Value:	**$61,713**
Benefit Cost Ratio:	**1.44**

*Water savings: 1% of total water use

DMM-10—New Commercial and Industrial Water Use Review

Description
The new City Public Works Department Standard Specifications and Details will include a requirement that new construction provide an estimate of expected water use. Construction plans for new commercial and industrial facilities could be reviewed by a water efficiency expert to insure that the most recent water conservation technologies are used in proposed new facilities.

Feasibility
Assuming the cost of reviewing the plans for water saving could amount to $250 and the expected reduction in water use is 10 percent, benefits exceed costs by a ratio of 2.62 to 1 making the program economically feasible. The value of water savings is $1,778 per million gallons.

Detailed data on the economic evaluation of DMM-10 follow. Costs are based on the number of new firms that are expected to build new facilities in Woodland and water savings is based on the projected change in water use for subsequent years.

DMM 10: New Commercial and Industrial Water Use Review

Individual Component Benefit Cost Analysis Results:

1. New commercial water conservation program

Year	Total Costs*	Benefits					
		Water Use			Unit Cost ($/mg)	Value of Water Saved	Net Benefits
		Without (mg)	% Water Saved	Reduction** (mg)			
0	$3,550.00	749	0%	0	$1,755.01	$0	($3,550)
1	$4,150.00	751	0%	0	$1,755.01	$469	($3,681)
2	$4,150.00	754	0%	1	$1,755.01	$939	($3,211)
3	$4,150.00	757	0%	1	$1,755.01	$1,408	($2,742)
4	$4,150.00	759	0%	1	$1,755.01	$1,877	($2,273)
5	$4,150.00	762	0%	1	$1,755.01	$2,347	($1,803)
6	$5,500.00	774	0%	3	$1,755.01	$4,420	($1,080)
7	$5,500.00	786	0%	4	$1,755.01	$6,494	$994
8	$5,500.00	798	1%	5	$1,755.01	$8,568	$3,068
9	$5,500.00	809	1%	6	$1,755.01	$10,642	$5,142
10	$5,500.00	821	1%	7	$1,755.01	$12,715	$7,215
11	$5,500.00	838	1%	9	$1,755.01	$15,697	$10,197
12	$5,500.00	855	1%	11	$1,755.01	$18,679	$13,179
13	$5,500.00	872	1%	12	$1,755.01	$21,661	$16,161
14	$5,500.00	889	2%	14	$1,755.01	$24,643	$19,143
15	$5,500.00	906	2%	16	$1,755.01	$27,625	$22,125
16	$5,500.00	923	2%	17	$1,755.01	$30,530	$25,030
17	$5,500.00	939	2%	19	$1,755.01	$33,435	$27,935
18	$5,500.00	956	2%	21	$1,755.01	$36,341	$30,841
19	$5,500.00	972	2%	22	$1,755.01	$39,246	$33,746
20	$5,500.00	989	2%	24	$1,755.01	$42,152	$36,652

Present Value of Total Annual Benefits:	**$180,549**
Present Value of Total Annual Costs:	**$68,824**
Net Present Value:	**$111,725**
Benefit Cost Ratio:	**2.62**

*Total costs: New commercial and industrial accounts x cost of plan review

Cost of plan review: $250

**Water savings: 10% of new commercial and industrial water use

DMM-11—Conservation Pricing, Water Service and Sewer Service

Description

The City of Woodland charges approximately $7 per month for unmetered residential water use. Nonresidential water use is metered and charged at a rate of $0.30 per hundred cubic feet ($400 per million gallons) plus meter maintenance charges.

Conservation pricing is a rate structure that increases the unit cost of water as the amount of water use increases to different tiers. Effectiveness of such a program is predicated on the demand for water, the income of the customer and the number of alternatives to save water. None of these variables have been assessed in this study.

Economic Feasibility

The cost of this program is the cost of reading meters and billing customers on the basis of a conservation rate structure. If an effectiveness of 20 percent can be achieved by the rate structure, water savings of over 1.3 billion gallons annually could result. Expected benefits for the program would exceed costs by a ratio of 4.57 to 1. This result is deceiving since the additional revenue generated by the rate structure is not accounted for in this analysis. If the rate structure produced income in excess of costs, procedures would have to be implemented to rebate customers without directly destroying the incentive to conserve water. The results assume that customers will respond as if the additional revenue will not be rebated directly. These and other procedural issues are important when considering this type of a water rate structure.

Detailed data on assumed water savings and costs are summarized in the following table.

DMM 11: Water and Sewer Conservation Pricing
Individual Component Benefit Cost Analysis Results:
1. Water and sewer service conservation pricing

		Benefits					
		Water Use					
Year	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$187,871	5,040	20%	1,008	$915.01	$922,325	$734,454
1	$191,234	5,040	20%	1,008	$915.01	$922,325	$731,091
2	$194,596	5,058	20%	1,012	$915.01	$925,619	$731,023
3	$197,959	5,076	20%	1,015	$915.01	$928,913	$730,954
4	$201,321	5,094	20%	1,019	$915.01	$932,207	$730,886
5	$204,684	5,112	20%	1,022	$915.01	$935,501	$730,817
6	$208,420	5,130	20%	1,026	$915.01	$938,795	$730,376
7	$212,155	5,210	20%	1,042	$915.01	$953,351	$741,196
8	$215,891	5,289	20%	1,058	$915.01	$967,906	$752,016
9	$219,626	5,369	20%	1,074	$915.01	$982,462	$762,836
10	$223,362	5,448	20%	1,090	$915.01	$997,017	$773,656
11	$227,381	5,528	20%	1,106	$915.01	$1,011,573	$784,191
12	$231,401	5,642	20%	1,128	$915.01	$1,032,502	$801,101
13	$235,421	5,756	20%	1,151	$915.01	$1,053,431	$818,010
14	$239,440	5,871	20%	1,174	$915.01	$1,074,360	$834,920
15	$243,460	5,985	20%	1,197	$915.01	$1,095,289	$851,829
16	$247,811	6,100	20%	1,220	$915.01	$1,116,218	$868,407
17	$252,162	6,211	20%	1,242	$915.01	$1,136,611	$884,448
18	$256,514	6,322	20%	1,264	$915.01	$1,157,003	$900,490
19	$260,865	6,434	20%	1,287	$915.01	$1,177,396	$916,531
20	$265,216	6,545	20%	1,309	$915.01	$1,197,788	$932,572
Present Value of Total Annual Benefits:				**$13,916,208**			
Present Value of Total Annual Costs:				**$3,044,282**			
Net Present Value:				**$10,871,925**			
Benefit Cost Ratio:				**4.57**			

*Total Costs: Total accounts x cost of reading meter

Time to read meter:	4	minutes (touch meter)
Cost per hour:	$37.00	City of Woodland wage rate.
Meter reading freqency:	6	times per year
Cost of Meter reading:	$14.80	per meter per year.

**Water Reduction: Total water use x % water saving

Annual water saved per account: 20%

DMM-12—Landscape Water Conservation for New and Existing Single Family Homes

Description

DMM-12 would include providing guidelines, information and incentives for new and existing single-family landscapes. Local nurseries would be encouraged to promote more water efficient plants and landscape designs.

Economic Feasibility

DMM-12 cannot be judged on the efficiency of water conserved since it would be voluntary. Assuming a participation rate of 30 percent and a program effectiveness of 10 percent, water use could decrease by 40 million gallons annually after 20 years. A reasonable budget for this type of program would be $10,000. This set of assumptions yielded a benefit to cost ratio of 0.56.

Detailed data on assumed savings and costs are summarized in the following table.

DMM 12: Single Family Home Landscape Water Conservation
Individual Component Benefit Cost Analysis Results:
1. Single family home landscape conservation program

		Benefits					
		Water Use					
Year	Total Costs	Without* (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$10,000	1,017	3%	31	$166.97	$5,095	($4,905)
1	$10,000	1,021	3%	31	$166.97	$5,113	($4,887)
2	$10,000	1,024	3%	31	$166.97	$5,132	($4,868)
3	$10,000	1,028	3%	31	$166.97	$5,150	($4,850)
4	$10,000	1,032	3%	31	$166.97	$5,168	($4,832)
5	$10,000	1,035	3%	31	$166.97	$5,186	($4,814)
6	$10,000	1,051	3%	32	$166.97	$5,267	($4,733)
7	$10,000	1,067	3%	32	$166.97	$5,347	($4,653)
8	$10,000	1,084	3%	33	$166.97	$5,427	($4,573)
9	$10,000	1,100	3%	33	$166.97	$5,508	($4,492)
10	$10,000	1,116	3%	33	$166.97	$5,588	($4,412)
11	$10,000	1,139	3%	34	$166.97	$5,704	($4,296)
12	$10,000	1,162	3%	35	$166.97	$5,819	($4,181)
13	$10,000	1,185	3%	36	$166.97	$5,935	($4,065)
14	$10,000	1,208	3%	36	$166.97	$6,051	($3,949)
15	$10,000	1,231	3%	37	$166.97	$6,166	($3,834)
16	$10,000	1,254	3%	38	$166.97	$6,279	($3,721)
17	$10,000	1,276	3%	38	$166.97	$6,392	($3,608)
18	$10,000	1,299	3%	39	$166.97	$6,504	($3,496)
19	$10,000	1,321	3%	40	$166.97	$6,617	($3,383)
20	$10,000	1,344	3%	40	$166.97	$6,730	($3,270)

Present Value of Total Annual Benefits:	**$77,829**
Present Value of Total Annual Costs:	**$139,008**
Net Present Value:	**($61,180)**
Benefit Cost Ratio:	**0.56**

Landscape water use: 30% of total single family water use

Water Use Reduction: Landscape water use x participation rate x program effectiveness

Participation rate: 30%

Program effectiveness: 10%

DMM-13 Water Waste Prohibition

Description
The City established a "No-Waste" ordinance in 1991. Enforcement includes notifying "gutter flooders" of waste. The City has no method to quantify the savings of this enforcement but believes that this program is in the public's interest. Enforcement costs are a part of the water department's overhead.

DMM-13 could be evaluated by conducting a survey of customers on how they have changed outdoor water use practices. Surveys could be done on a random sample to reduce costs without jeopardizing the accuracy of the conclusions. A telephone survey of 500 residences could be conducted for about $5,000 that would include a limited set of water use questions. This survey could be repeated at regular intervals as part of a continuing evaluation of the effectiveness of the City's water conservation policy.

DMM-14—Water Conservation Coordinator

Description
In the past, the City has employed a part-time water conservation coordinator and student interns. The water conservation coordinator managed a general program of water conservation.

Economic Feasibility
Assuming a water coordinator was able to reduce water use by 2 percent (112 million gallons) and the budget was $100,000 per year, a benefit to cost ratio of approximately 1 would result. The assumed average value of water saved was $915. The validity of these assumptions should be tested.

DMM: 14 Water Conservation Cordinator
Individual Component Benefit Cost Analysis Results:
Water conservation cordinator

		Benefits					
		Water Use					
Year	Total Costs	Without (mg)	% Water Saved	Reduction (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	$100,000	5,600	2%	112	$915.01	$102,481	$2,481
1	$100,000	5,600	2%	112	$915.01	$102,481	$2,481
2	$100,000	5,620	2%	112	$915.01	$102,847	$2,847
3	$100,000	5,640	2%	113	$915.01	$103,213	$3,213
4	$100,000	5,660	2%	113	$915.01	$103,579	$3,579
5	$100,000	5,680	2%	114	$915.01	$103,945	$3,945
6	$100,000	5,700	2%	114	$915.01	$104,311	$4,311
7	$100,000	5,788	2%	116	$915.01	$105,928	$5,928
8	$100,000	5,877	2%	118	$915.01	$107,545	$7,545
9	$100,000	5,965	2%	119	$915.01	$109,163	$9,163
10	$100,000	6,054	2%	121	$915.01	$110,780	$10,780
11	$100,000	6,142	2%	123	$915.01	$112,397	$12,397
12	$100,000	6,269	2%	125	$915.01	$114,723	$14,723
13	$100,000	6,396	2%	128	$915.01	$117,048	$17,048
14	$100,000	6,523	2%	130	$915.01	$119,374	$19,374
15	$100,000	6,650	2%	133	$915.01	$121,699	$21,699
16	$100,000	6,777	2%	136	$915.01	$124,025	$24,025
17	$100,000	6,901	2%	138	$915.01	$126,290	$26,290
18	$100,000	7,025	2%	140	$915.01	$128,556	$28,556
19	$100,000	7,149	2%	143	$915.01	$130,822	$30,822
20	$100,000	7,273	2%	145	$915.01	$133,088	$33,088

Present Value of Total Annual Benefits:	**$1,723,738**
Present Value of Total Annual Costs:	**$1,541,502**
Net Present Value:	**$182,235**
Benefit Cost Ratio:	**1.12**

Water Conservationist:	$50,000
Progarm support:	$50,000
Program effectiveness:	2%

DMM-15—Financial Incentives

Description

DMM-15 involves using financial incentives to facilitate the implementation of water conservation programs. Specific instruments that can be employed are rebates, loans, grants, etc., to purchase water conservation devices such as low-flow toilets, showerheads or sprinkler heads. The program could also include subsidies to implement water management techniques such as a scheduling system for landscape irrigation.

Economic Feasibility

Many of the previous DMM's could be the subject of a financial incentive program. The value of water saved is estimated in those analyses and would become the basis for an incentive. DMM-2 is a plumbing retrofit program that has been the subject of rebates and grants. Showerhead replacement is a practice that probably does not need an incentive as the cost of the device is low relative to water savings and the value of water saved. Low-flow toilets are not economically efficient in Woodland because of the cost of retrofit and the lower value of water saved.

DMMs -5, -6 and -12 prescribed landscape water conservation practices that could be financed or subsidized instead of employing an ordinance. Subsidizing scheduling services would fit under such a program.

DMM-16—Ultra-low Flush Toilet Replacement

Description

The City established an ultra-low flush toilet replacement program following the State adoption of a ULF mandatory program in January 1992. The City would rebate up to $75 on the cost of each toilet.

Economic Feasibility

Retrofitting existing toilets with low-flow toilets was analyzed in DMM-2. Costs exceeded benefits by a ratio of about 4 to 1. Results are repeated here.

DMM 16: Ultra-low Flush Toilet Replacement

Individual Component Benefit Cost Analysis Results:

1. Retrofit ultra-low flush toilets

	Costs		Benefits					
			Water Use					
Year	Toilets Retrofitted	Total Costs*	Without (mg)	% Water Saved	Reduction** (mg)	Unit Cost ($/mg)	Value of Water Saved	Net Benefits
0	0	$0	3,826	0%	0.00	$1,755.57	$0	$0
1	2,596	$714,010	3,840	0%	7.58	$1,755.57	$13,310	($700,700)
2	2,596	$714,010	3,853	0%	15.16	$1,755.57	$26,620	($687,390)
3	2,596	$714,010	3,867	1%	22.74	$1,755.57	$39,930	($674,080)
4	2,596	$714,010	3,881	1%	30.33	$1,755.57	$53,239	($660,771)
5	2,596	$714,010	3,894	1%	37.91	$1,755.57	$66,549	($647,461)
6	2,596	$714,010	3,959	1%	45.49	$1,755.57	$79,859	($634,151)
7	2,596	$714,010	4,024	1%	53.07	$1,755.57	$93,169	($620,841)
8	2,596	$714,010	4,089	1%	60.65	$1,755.57	$106,479	($607,531)
9	0	$0	4,154	1%	60.65	$1,755.57	$106,479	$106,479
10	0	$0	4,219	1%	60.65	$1,755.57	$106,479	$106,479
11	0	$0	4,280	1%	60.65	$1,755.57	$106,479	$106,479
12	0	$0	4,341	1%	60.65	$1,755.57	$106,479	$106,479
13	0	$0	4,402	1%	60.65	$1,755.57	$106,479	$106,479
14	0	$0	4,463	1%	60.65	$1,755.57	$106,479	$106,479
15	0	$0	4,525	1%	60.65	$1,755.57	$106,479	$106,479
16	0	$0	4,615	1%	60.65	$1,755.57	$106,479	$106,479
17	0	$0	4,706	1%	60.65	$1,755.57	$106,479	$106,479
18	0	$0	4,796	1%	60.65	$1,755.57	$106,479	$106,479
19	0	$0	4,887	1%	60.65	$1,755.57	$106,479	$106,479
20	0	$0	4,977	1%	60.65	$1,755.57	$106,479	$106,479

Present Value of Total Annual Benefits:	**$1,059,758**
Present Value of Total Annual Costs:	**$4,598,904**
Net Present Value:	**($3,539,146)**
Benefit Cost Ratio:	**0.23**

*Installation costs: # retrofited annually x installation costs

Installation: $275 Ace Plumbing, Sacramento: Toilet/showerhead retrofit $295. Split $275 toilet - $20 showerhead.

High flow toilets: 20,771

Years to survey 8 2,596 Toilets retrofitted annually

**Water Reduction: # of retrofitted toilets x water saved/flush x # flushes/day x 365 / 1,000,000

Water saved per flush: 2.00 gallons

Type	ga/flush
Low-flow	2.00
High-flow	4.00

Source: GAO, Aug. 2000

Assumed flushes per day: 4.00

Appendix F

Examples of Public Information Materials

Public Announcement at the Movies

Conserve Water Outdoors

- Water early in the morning or evening
- Sweep the driveway instead of hosing it off
- Wash the car using a hose equipped with a shutoff nozzle

Pick up free garden hose nozzles and other water-saving devices in the Public Works Department at City Hall.
300 First St. (between Court and Main)

Conserve Water Indoors

- Install low-flow shower heads
- Fix leaky toilets
- Wash full loads of laundry & dishes

Pick up free shower heads and other water-saving devices in the Public Works Department at City Hall.
300 First St. (between Court and Main)

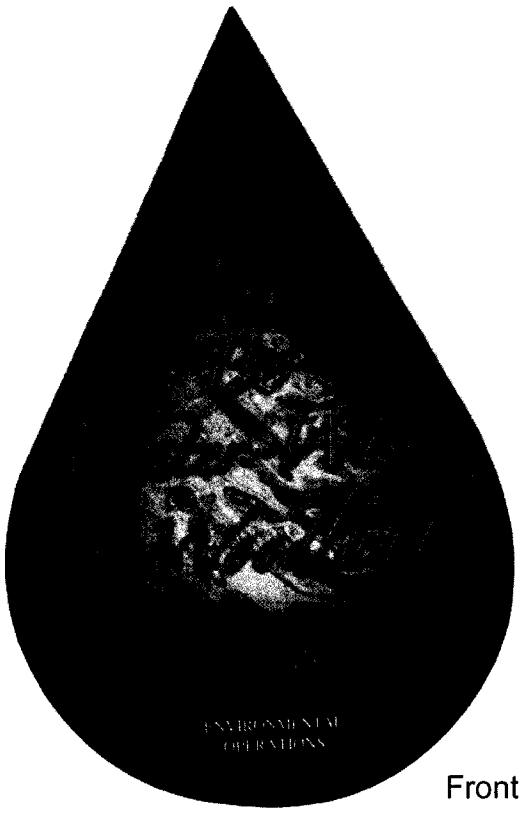
Conserve water by retrofitting plumbing fixtures with water-saving devices.

Pick up free water-saving devices
in the Public Works Department @ City Hall.
300 First St. (between Court and Main)

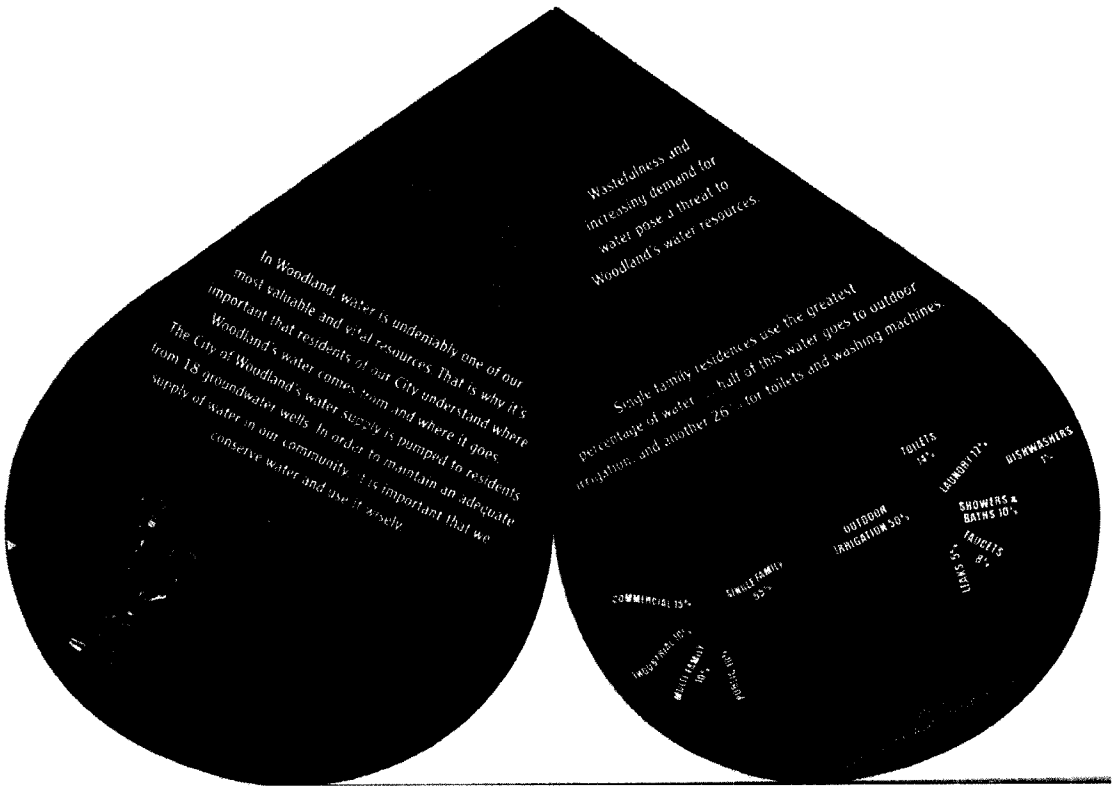
Appendix G

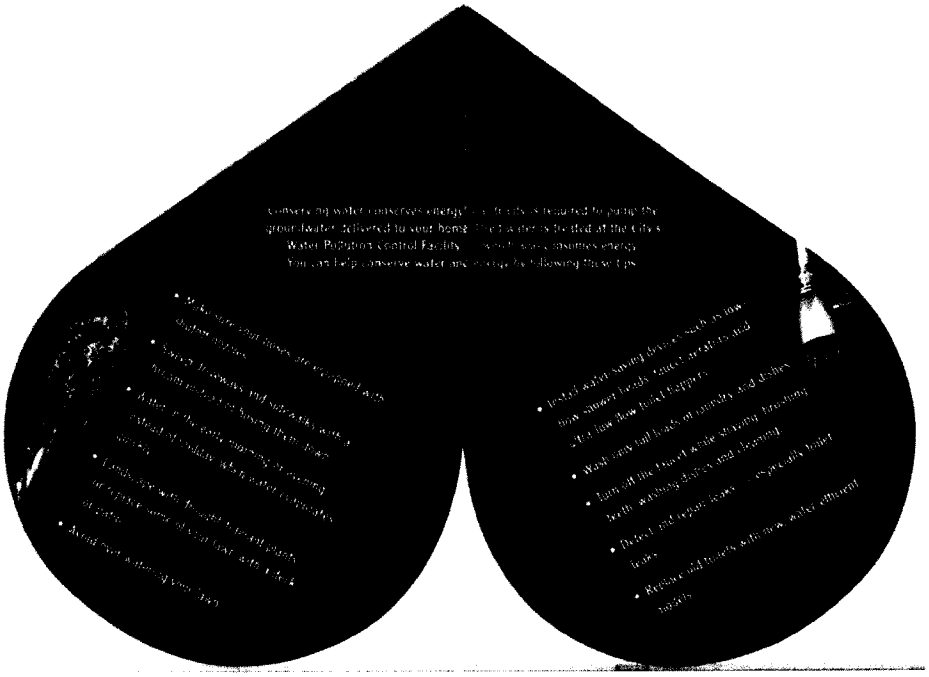
School Education Handout Materials

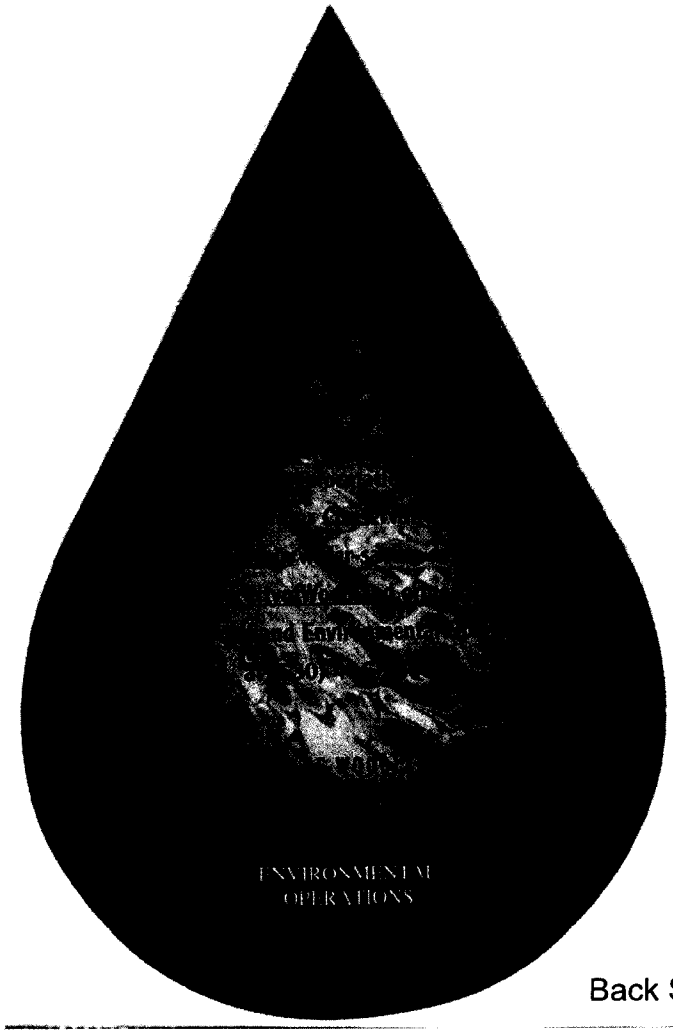
Water-Wise Brochure



Front Side







Back Side

Appendix H

Comments on the 2005 UWMP Update

(No comments were received regarding the City of Woodland's 2005 Urban Water Management Plan Update.)