Water Conservation Plan for Valparaiso City Utilities

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September 2009

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Executive Summary

Valparaiso City Utilities (VCU) sought to explore opportunities for the development of a Water Conservation Program as a means to: (1) promote and provide leadership in environmental sustainability, (2) to potentially off-set or delay capital expansion costs, and (3) to provide customers with a means of increasing water use efficiency. In addition, VCU understands State, regional and national initiatives related to sustainability and water supply planning and conservation, including the Great Lakes Compact, and the Indiana Water Shortage Plan (currently in draft form). Both documents strongly encourage and recommend water efficiency and conservation measures in Indiana.

As part of the development of the water conservation plan, VCU developed the Water Conservation Plan Task Force to provide input, guidance, and be a conduit to the community. The Task Force composed of 11 members included representatives from VCU management and staff, City Engineering staff, Valparaiso Community Schools, Northwest Indiana Regional Planning Commission, Valparaiso University, a local plumbing contractor, and a member from the community. A resource group was also created to provide input and insights on the project and members of this group included staff from other City departments, representatives from NIPSCO and State Agencies, including the Indiana Department of Environmental Management, the Indiana Department of Natural Resources, and the Indiana Chamber of Commerce.

The Task Force's Mission Statement is to "Develop a Water Conservation Plan that increases public awareness, engages and motivates all VCU customers to participate in active water conservation, thus benefiting the users, providers and the environment." Conservation planning goals were jointly developed with the Task Force based on their mission statement. The Task Force defined the water conservation plan objectives to be: 1.) Implement comprehensive public education program for residential, commercial, and industrial users; 2.) Control and reduce costs of municipal and industrial process water and commercial and residential potable water; 3.) Promote and allow for economic development opportunities with limited capital expenditures to attract industry and commerce to Valparaiso; 4.) Develop conservation friendly water and wastewater rates; 5.) Demonstrate that water conservation will work in the Great Lakes region; and 6.) Develop City codes/incentives and policies to achieve goals.

The Task Force with support from the resource group developed a water conservation plan. Although this plan is referred to as the water conservation plan, it should be considered a water efficiency plan.

The U.S. Environmental Protection Agency (USEPA)'s guidelines for developing a Comprehensive Water Conservation Plan were followed, which included the following basic steps:

1. Specify Conservation Planning Goals
2. Develop a Water System Profile
3. Identify Water Conservation Measures
4. Analyze Benefits and Costs
5. Develop Water Conservation Plan

These guidelines present the basic building blocks for tailoring a water conservation strategy to best meet the objectives, constraints, and unique conditions of water service providers.

A water system profile was developed for the service area to understand water use, water users, seasonal impacts, daily variation, etc. Based on the water system profile data, as well as, a survey of customers, water conservation measures were developed. These measures were then evaluated for cost effectiveness, feasibility, applicability, acceptability and other factors. Based on this evaluation, a select number of measures were selected for benefit-cost analysis. These water conservation measures include:

1. Public Education and Public Information (PE/PI)
2. Government Facility Audit and Toilet Replacement
3. Single-Family Indoor/Outdoor Audit
4. Pre-Rinse Spray Valves
5. Ordinance for Automatic Sprinkler Shut-Off Devices
6. Industrial Water Audits
7. School Water Audit
8. Hotel/Motel Showerhead Replacement
9. Toilet Rebates
10. Residential Showerhead Giveaway
11. Water Hose Mechanical Timer
12. Washing Machine Rebates

The benefit-cost analysis evaluated the net present value of each water conservation measure based on actual costs to the utility (loss of revenue, cost of conservation measure, etc.), and the benefits of conservation (reduced operational costs for energy and chemicals, elimination or delay of capital improvement projects – conservation

for example, eliminates the need for another elevated tank and eliminates or defers the need to expand the Airport WTP). Since water rates play a critical role in the analysis, VCU should monitor the IURC's (Indiana Utility Regulatory Commission) progress in developing conservation rate structures for the State.

Based on the mission statement of the Task Force, the water conservation plan will focus on public education and outreach to the community to motivate VCU's customers to understand the value of and to conserve water. The VCU has committed the resources for a public education and public information (PE/PI) program to be implemented over the next 18 months. Additional programs can be implemented in the future that can take the City to the next level of conservation.

A key goal for the PE/PI program is to promote a paradigm shift for Valparaiso on the value of water and set an example for other Midwestern communities that water conservation is possible and beneficial. The first priority will be a PE/PI program that will consist of water conservation messages on customer billing statements, presentations/panel discussions at schools, working with the local newspaper, speaking at city events on the value of water, meeting with businesses and industries, using the City's website and using other avenues to provide a consistent message to the community about the value of water and its impact on the City's livelihood. VCU has joined and/or partnered with key organizations, including the Alliance for Water Efficiency and the EPA Water Sense Program. Valparaiso is the second city in the State to become a member of the EPA WaterSense Program. VCU will use tools and resources developed by these organizations to educate the public and encourage water efficiency.

Water is a precious resource to the City that can allow for economic, social and environmental opportunities for future generations. This plan develops the framework for instituting water efficiency programs to insure sustainable use of water for years to come.

Section 1
Introduction and Background

In November 2007, CDM was contracted by the Valparaiso City Utilities (VCU) in Valparaiso, Indiana to develop a water conservation plan. The mission statement of the Water Department states: "We are dedicated to being the leading water supplier through service, price, and responsibility to our community, environment, and employees." Under the leadership of the Utilities Director, John Hardwick, VCU sought to explore opportunities for the development of a Water Conservation Program as a means to: (1) promote and provide leadership in environmental sustainability, (2) to potentially off-set or delay capital expansion costs, and (3) to provide customers with a means of increasing water use efficiency.

As part of the development of the water conservation plan, VCU developed the Water Conservation Plan Task Force to provide input, guidance, and review to the CDM Project Team. The Task Force composed of 11 members included representatives from VCU management and staff, City Engineering staff, Valparaiso Community Schools, Northern Indiana Regional Planning Commission, Valparaiso University, a local plumbing contractor, and a member from the community. A resource group was created to provide input and insights on the project and members of this group included staff from other City departments, representatives from NIPSCO and State Agencies, including the Indiana Department of Environmental Management, the Indiana Department of Natural Resources, and the Indiana Chamber of Commerce. A list of the Task Force and Resource Group members is provided **Appendix F**.

1.1 What is Water Conservation?

Over the past 30 years, interest and implementation in water conservation has greatly increased. However, much of the implementation of water conservation programs has occurred in more traditionally water-short areas of the South (e.g., Texas) and the West (e.g., Arizona, California). Increasingly, water conservation is being viewed by other areas of the U.S. as an opportunity to increase water use efficiency, potentially reduce customer and utilities costs, and be better stewards of our resources.

Back in 1984, an academic paper entitled *Water Conservation: The Struggle over Definition*, **water conservation** was defined as "any beneficial reduction in water use or in water losses." The concept of needing to be *beneficial* still holds true today, where we need to be concerned about trade-offs between benefits and costs. However, in more recent years, some new terminology has also arisen, primarily the concepts of **water use efficiency** and **water demand management**. A definition of water use efficiency also implies the concept of using less, without sacrificing level of service. Water demand management focuses more on the end users of water (the customers who demand the water); whereas water conservation could also be a *supply-side* measure focusing on reducing water losses before it reaches the customer. Often times, these three terms are used interchangeably.

1.2 Why Consider Water Conservation?

The City's interest in water conservation stems from local and State initiatives, which are described below.

1.2.1 Local Initiatives

There have been a number of varied initiatives by the City of Valparaiso that is indicative of the community's desire to be leader in environmental sustainability. For the development of the Growth Management Plan (GMP, 2000), the City used community-wide opinion surveys, open city meetings, engagement of special interest groups, and a collaborative planning process that engaged City staff and other stakeholders. Working Group and Steering Committee workshops (with varied community leaders and stakeholders) were used to develop vision, goals, and objectives for the future. Ultimately, the GMP produced eight primary goals, and objectives and policies for each of the specified goals. The ordering of the eight goals "reflects the relative priority that developed through the planning process.' Behind "downtown business preservation" and "economic growth," environmental integrity was Goal #3 of eight specified goals. The GMP noted,

> This principal recognizes that the existing natural environment in Valparaiso is a vital and irreplaceable element of its residents' quality of life. Future development should not compromise or diminish the environmental integrity of Valparaiso. In fact, future development should be managed so as to enhance and improve upon existing environmental conditions.

The plan aims to conserve Valparaiso's environmental resources through preservation of natural features, creation of open space and projection of air and water quality and land, ground and water resources.

Although water conservation was not specifically referenced in the goals, objectives, and policies, one of the objectives within this Goal was to "promote public awareness and encourage practices that sustain a healthy environment." Certainly, the consideration of water conservation practices to increase water use efficiency is consistent with this stated goal and objective.

Another city initiative was the 12-member Energy Task Force that was appointed by Mayor Jon Costas in October 2006. The goal of the Task Force was to develop input for the City of Valparaiso's 2008 Strategic Plan regarding policy recommendations for a local energy resource conservation effort. In the Energy Task Force Report to the Mayor Jon Costas (April 2007), some of the guiding principles for developing their recommendations were:

- Be a role model for the community in promoting energy efficiency and conservation;
- Demonstrate leadership in smart energy management; and

- Save taxpayer dollars through energy cost savings.

Two of the Energy Task Force recommendations were:

- "The City of Valparaiso should implement energy efficient building guidelines for existing buildings and new or renovated buildings," with a goal to "reduce the 2007 aggregate energy use of city buildings and structures 10 percent by 2010."

- "The City of Valparaiso should require energy awareness to be a priority for all city employees," with a goal to "develop and implement an energy resource conservation policy for city employees by January 1, 2008.

Although water conservation was not specifically included in the recommendations of the Task Force, there are inherent synergies between energy and water conservation.

In February 2009, the 2009 City of Valparaiso Strategic Plan was released. Two of the 2009 Strategic Plan initiatives include:

- Green City Valparaiso: Good Stewards of our Environment, including "reducing the environmental impact of service delivery, employing energy conservation measures, and setting an example for exploring and implementing sound environmental practices in all aspects of city services."

- Water Supply and Management: Valparaiso City Utilities, including the "implementation of the Water Conservation Plan by starting a public awareness and education program."

In addition, there are several other local factors that influenced VCU's desire to develop a WCP, including:

- Water conservation was one of the recommendations of the Hardness and Capacity Study

- Delay in capital expenditures

- Optimization of energy and chemicals use to reduce costs

- Protection of water resources to accommodate future growth in the City

1.2.2 State Initiatives

The Great Lakes-St. Lawrence River Basin Water Resources *Compact* was signed into law by the Governor of Indiana on February 20, 2008. The Compact is a broad agreement by the Great Lakes States and Provinces for *the sustainable use and responsible management of Basin waters*.

As part of its commitment to the Compact, each of the signatories of the Compact agreed:

- To develop its own Water conservation and efficiency goals and objectives consistent with the Basin-wide goals and objectives, and shall develop and implement a water conservation and efficiency program, either voluntary or mandatory, within its jurisdiction based on the Party's goals and objectives.

- To promote Environmentally Sound and Economically Feasible Water Conservation Measures.

Although VCU does not draw water from Lake Michigan, some of its well fields are located in the Lake Michigan Basin aquifer. VCU desires to be proactive in the State's commitment to sustainability and conservation.

In addition to the State's commitment to the Compact, the State of Indiana is also focusing on the development of a Water Shortage Strategy and a commitment to include and promote water conservation is part of that strategy. Although the Water Conservation Plan contained herein was designed to focus on long-term water conservation/efficiency (rather than short-term drought or other shortage measures), the commitment to include water conservation as part of the State's overall water resources strategy is relevant. An initial version of the State's revised *Water Shortage Pla*n is expected to be released before July 2009. VCU should consider their recommendations and potentially adopt the recommended model ordinance to address shortage conditions. The current Indiana suggested model ordinance is included as an Appendix to this report.

Section 2
Steps in Planning a Successful Water Conservation Program

In 1991, the California Urban Water Agencies (CUWA) recognized that "the science of design and evaluation of water conservation programs lagged behind the interest in, and need for, these programs." (CUWA is an organization of the largest urban water providers in California, where its members serve water to metropolitan areas comprising about two-thirds of the state's population). In response to this need, CUWA sponsored a research effort that produced a state-of-the-art procedures manual on the evaluation of urban conservation programs. Under the sponsorship of CUWA, Planning and Management Consultants, Ltd. (subsequently acquired by CDM) completed the report entitled Evaluating Urban Water Conservation Programs: A Procedures Manual in February 1992. Subsequently, the American Water Works Association (AWWA) has published the report as an AWWA standard handbook to provide guidance to water conservation planners on the steps and procedures for planning and evaluating conservation programs. The first section of the Procedures Manual, devoted to planning procedures, leads the reader through a step-by-step determination of the potential for water conservation within a defined water service area. If carefully executed, the steps outlined in the Procedures Manual permit water planners to formulate viable conservation alternatives and decide upon the optimal level of water conservation in the long term water management plan.

Since that time, a number of guidance documents have been released regarding the systematic approach to developing a water conservation plan. Some of the most commonly referenced guidance and reference documents in the field of water conservation planning include:

- California Urban Water Agencies and American Water Works Association. 1992. *Evaluation of Urban Water Conservation Programs: A Procedures Manua*l. Denver, CO.
- U.S. Environmental Protection Agency, Office of Water. 1998. *Water Conservation Plan Guidelines*. Washington, D.C.
- Vickers, Amy. *Handbook of Water Use and Conservation*. 2001. Waterplow Press. Amherst, MA.
- American Water Works Association. 2006. *Water Conservation Programs – A Planning Manual*. Denver, CO

Each of these references essentially promotes a very similar process for the steps of developing a water conservation plan. One of the unique characteristics of EPA's guidelines is that it takes into account different guidelines and slightly modified steps for small (less than 10,000 persons served), medium (up to 100,000 persons served), and larger utilities (more than 100,000 persons served).

The U.S. Environmental Protection Agency (USEPA) outlines the following as basic contents of a Comprehensive Water Conservation Plan:

1. Specify Conservation Planning Goals
2. Develop a Water System Profile
3. Identify Water Conservation Measures
4. Analyze Benefits and Costs
5. Develop Water Conservation Plan

These guidelines present the basic building blocks for tailoring a water conservation strategy to best meet the objectives, constraints, and unique conditions of water service providers. Following this basic outline, the following are the steps undertaken in the development of a water conservation plan for VCU.

2.1 Step 1. Specify Conservation Planning Goals

This step involves engagement with VCU staff and other interested stakeholders to further specify conservation planning goals. By clearly defining the purpose of the program, a strategy can be designed with specific objectives. As outlined by the EPA Guidelines, several areas should be investigated:

- Eliminating, downsizing, or postponing the need for capital projects
- Improving the utilization and extending the life of existing facilities
- Lowering variable operating costs
- Avoiding new source development costs
- Improving drought or emergency preparedness
- Educating customers about the value of water
- Improving reliability and margins of safe and dependable yields
- Protecting and preserving environment resources

2.2 Step 2. Develop a Water System Profile

To design effective water conservation programs, it is important to have an understanding of the types of water use that occur in the service area and of historical water use patterns and trends. This water system profile can characterize both how much water is being used and how water is being used in the community. Water use in the service area can be characterized with respect to (1) relative needs of different

types of customers, and (2) the purposes for which water is being used. In developing a water system profile, the following are typically collected and analyzed:

2.2.1 Water Utility Data

- Capital or facility plans
- Water production records (amounts of water pumped into the distribution system)
- Water billing records (records which detail each customer's account activity)
- Water sales records (summaries of total water sales or water sales to customer groups)
- Number of accounts/service connections by type
- Water rates and pricing policies

2.2.2 Service Area Data

- Population served
- Housing characteristics
- Business and employment characteristics
- Major customer characteristics (top users)
- Weather characteristics

Water use forecasts are typically prepared to compare projected water demands with available water supplies to determine adequacy of water supply sources, to determine the need for expanded water and wastewater distribution and treatment facilities, and to determine impacts of potential water conservation measures.

2.3 Step 3. Identify Water Conservation Measures

This step typically begins with an initial screening of potential conservation measures. The screening process begins by identifying all known conservation practices that (1) are applicable to water uses in the service area and (2) have not been already implemented or approved for implementation by local, state, or other authorities. The initial screening of each measure examines (1) technical feasibility--whether the measure will result in a significant reduction in water use and (2) social acceptability--whether the measure will be adopted by water customers. Using estimates from literature sources, pilot program results, or empirical studies from water agencies, the potential water savings of conservation measures will be estimated.

After determining their applicability, feasibility, acceptability, and potential water savings, conservation measures are developed into fully implementable water conservation program alternatives.

2.4 Step 4. Analyze Benefits and Costs

A benefit-cost analysis provides a screening mechanism for choosing the most efficient water conservation program measures. Carefully formulated conservation alternatives can be compared in terms of their cost and their yield in savings. The types of program costs that are typically considered include:

- Utility program costs
- Decreased utility revenue
- Customer program costs

The types of benefits that can be considered include:

- Utility cost savings
- Program participant benefits
- System reliability

The result of the benefit-cost analysis will be a ranking of conservation alternatives according to defined criteria.

2.5 Step 5. Develop Water Conservation Plan

From the results of the benefit -cost analysis, a strategy can be developed that most effectively meets the conservation program goals. An implementation plan for the selected conservation measures and program components is then developed. This will include:

- Program content
- Definition of target population(s)
- Program incentives
- Customer contact modes
- Public involvement/education strategy
- Schedule implementation and duration
- Specification of responsible agencies

- Resource requirements for a defined planning horizon (including staff, materials, equipment)

Section 3
Water System Profile

3.1 Demographic Characteristics

The Valparaiso City Utilities-Water Department provides water service to approximately 30,000 customers in the city and outlying communities. Based on the information in **Table 1**, it is estimated that the City of Valparaiso has a population of approximately 30,000 persons and approximately 12,000 occupied housing units, representing approximately 20 percent of the population of Porter County. Between 2000 and 2007, both the City of Valparaiso and Porter County has experienced modest growth at about 1.3 percent per year.

Table 1.
Historical Demographic Characteristics

	1990	2000	2007	Percent Increase 1990-2000	Average Annual Rate of Change 1990-2000	Average Annual Rate of Change 2000-2007
City of Valparaiso						
Population	24,414	27,428	29,951	12.35 %	1.17 %	1.27 %
Occupied single-family units	5,371	6,490		20.83 %	1.91 %	
Occupied multifamily units	3,607	4,424		22.65 %	2.06 %	
Total occupied housing units	8,978	10,914		21.56 %	1.97 %	
Employment	11,970	13,870		15.87 %	1.48 %	
Porter County						
Population	128,932	146,798	160,578	13.86 %	1.31 %	1.29 %
Occupied single-family units	33,835	41,480		22.59 %	2.06 %	
Occupied multifamily units	11,324	13,169		16.29 %	1.52 %	
Total occupied housing units	45,159	54,649		21.01 %	1.93 %	
Persons per Household-SF	3.01	2.83		-5.98 %	-0.61 %	
Persons per Household-MF	2.01	1.97		-1.99 %	-0.20 %	
Persons per Household-Total	2.77	2.62		-5.42 %	-0.56 %	
Employment	61,823	73,823		19.41 %	1.79 %	

SF = Single Family; MF = Multi-family

The City of Valparaiso also represents about 20 percent of the labor force of Porter County. As indicated in the Valparaiso Comprehensive Plan, "Valparaiso's labor force is less dependent on steel manufacturing (as compared to Porter County), although it has more jobs in manufacturing per 1,000 workers than the national average. Due to its location Valparaiso benefits from the desire of smaller manufacturing industries to

relocate or expand near interstates and major highway located east, west, south and north. Valparaiso is an attractive location for expansion and relocation of businesses and industries serving the Chicagoland marketplace. Wholesale and retail trade serves as the mainstay for Valparaiso's economic base. This situation is largely the result of companies that have relocated to more desirable communities like Valparaiso."

Demographic projection data to 2030 were available for Porter County and for Super Analysis Zones (SAZs for transportation planning). Although the City of Valparaiso SAZ is a larger geographic area than the city boundaries, the projections are indicative of the expected growth of the area. As shown in **Table 2**, population between 2000 and 2030 is expected to increase by 11 percent, or approximately 0.3 percent per year. Employment growth is expected to increase at a rate of 0.8 percent per year. Larger growth is expected in the services industry, and the manufacturing employment is expected to slightly decline.

Table 2.
Projected Demographic Characteristics

	2000	2030	Percent Increase 2000-2030	Average Annual Rate of Change 2000-2030
City of Valparaiso (SAZ)				
Population	41,611	45,984	11 %	0.3 %
Total Occupied Housing Units	15,925	18,826	18 %	0.6 %
Persons Per Household	2.61	2.44	-7 %	-0.2 %
Employment	26,114	32,953	26 %	0.8 %
Manufacturing	2,905	2,321	-20 %	-0.7 %
Trade	7,014	8,439	20 %	0.6 %
Service	14,145	19,443	37 %	1.1 %
Other	2,050	2,750	34 %	1.0 %
Porter County				
Population	146,798	164,915	12 %	0.4 %
Total Occupied Housing Units	54,649	64,733	18 %	0.6 %
Persons Per Household	2.69	2.55	-5 %	-0.2 %
Employment	54,126	64,784	20 %	0.6 %
Manufacturing	12,198	8,317	-32 %	-1.3 %
Trade	13,410	16,522	23 %	0.7 %
Service	23,309	32,957	41 %	1.2 %
Other	5,209	6,988	34 %	1.0 %
Porter County				
Population***	146,798	179,675	22 %	0.7 %

Source: ***STATS Indiana; IRBC; all other data obtained from NIRPC, 2030 Connections (Super Analysis Zones)

3.2 Water Supply System Characteristics

The Valparaiso City Utilities' water system consists of the following components and facilities:

- Groundwater supply– VCU has 16 shallow wells located in three well fields, Flint Lake, Country Club, and Airport. The eight wells located in the Flint Lake and Country Club well fields are located in the Lake Michigan Basin Aquifer. The eight wells located in the Airport well field are located within the Kankakee Basin Aquifer.

- Two water treatment plants (WTPs) – Flint Lake and Airport WTPs. The Flint Lake WTP treats groundwater from the Flint Lake and Country Club wells; and the Airport WTP treating groundwater from the Airport wells. Each WTP has pressure filters designed to remove iron and manganese from the raw water (groundwater), chemical feed facilities consisting of sodium hypochlorite, phosphate and fluoride, 2-MG (million gallon) storage tank and high service pumps.

- Three elevated tanks. VCU has three elevated tanks, two 0.5-MG and one 1-MG, designed to maintain adequate pressure in the distribution system, have emergency capacity and storage volume for fire fighting.

3.3 Current Water Use Profile

Table 3 shows water production from the Airport and Flint Lake well-fields. Average day water production has not substantively changed between 2000 and 2008, with an average daily water production of 4.0 million gallons per day (mgd). The maximum-day water production has shown greater variability, likely driven by weather conditions during the peak water use periods. Maximum-day water production ranged from 6.1 mgd in 2006 to 8.0 mgd in 2001, and the maximum-day to average-day ratio (peaking factor) ranged from 1.5 to 2.0.

Table 3.
VCU Water Production Characteristics

Year	Average Day Water Production (mgd)	Maximum Day Water Production (mgd)	Peaking Factor
2001	4.0	8.0	2.0
2002	4.2	6.8	1.6
2003	3.9	6.7	1.7
2004	3.7	6.4	1.7
2005	4.0	7.1	1.8
2006	4.1	6.1	1.5
2007	4.1	7.2	1.8
2008	4.0	--	--
Average	4.0	6.9	1.7

Figure 1 shows the month-to-month and seasonal variability in average-daily water production, maximum-daily water production, and total water sales. The data in both **Table 3** and **Figure 1** do not indicate any substantive growth trends in overall water production and demand.

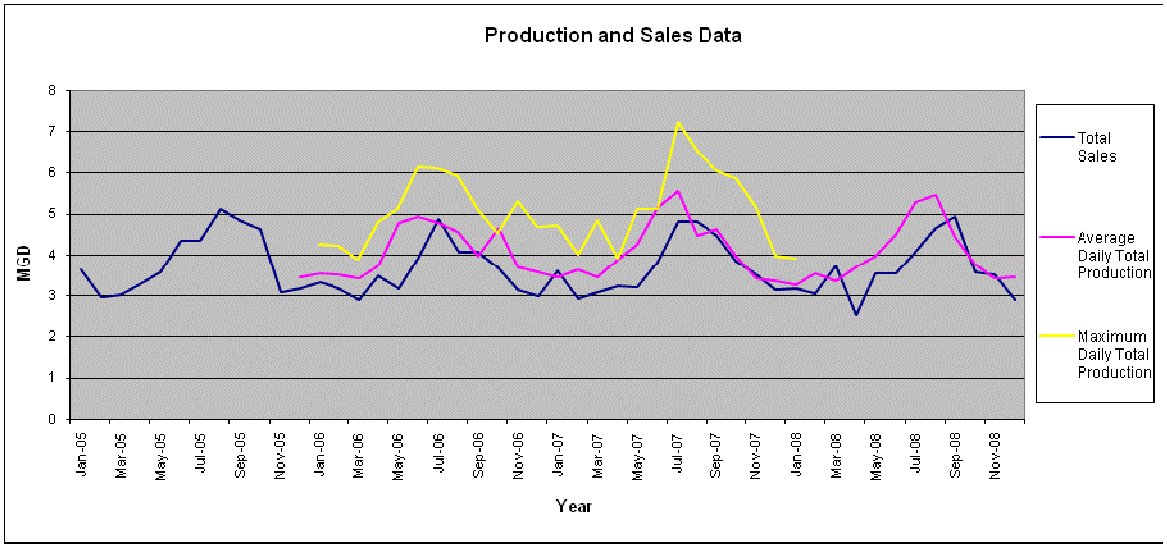


Figure 1.
Water Production and Sales Data

Figure 2 shows the clear and distinct relationship between daily water production and maximum daily temperature. A correlation calculation indicates that 68 percent of the variability in water production is related to maximum daily temperature. An analysis between daily production and rainfall did not yield a similar trend.

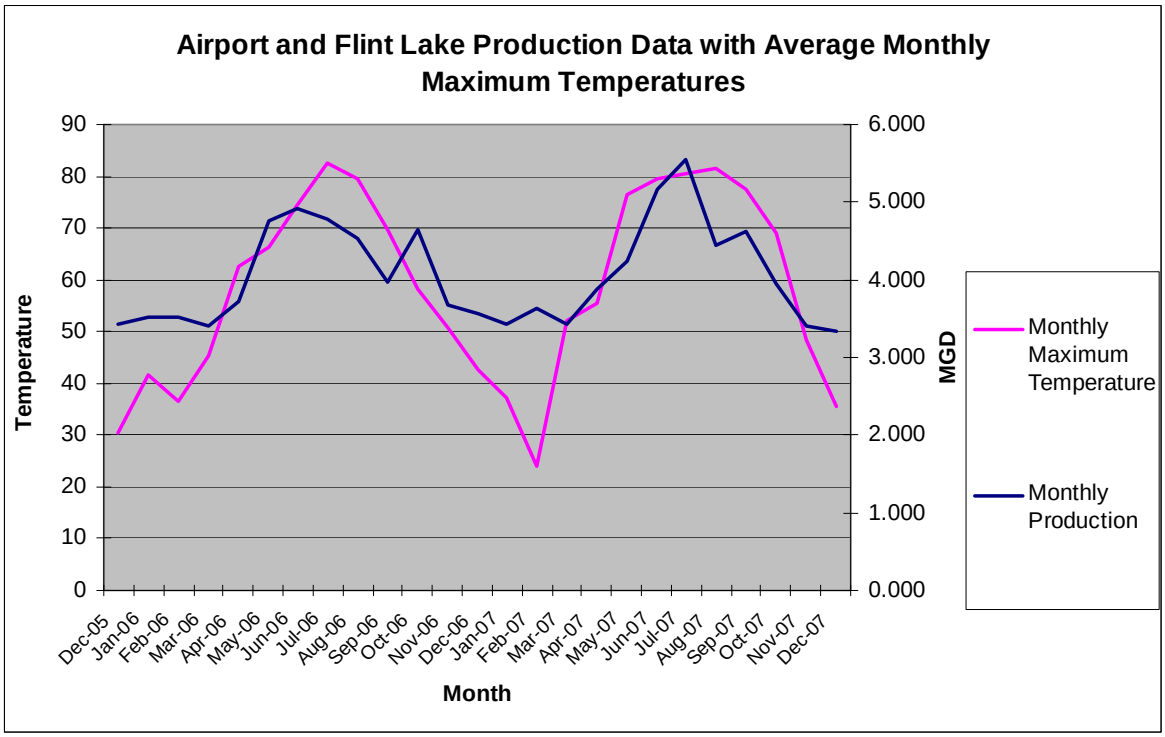


Figure 2.
Water Production and Maximum Daily Temperature

Table 4.
Distribution of Water Sales and Accounts by VCU Customer Groups (January 2008 to December 2008)

	VCU Defined Customer Groups	Total Sales (cubic feet)		Average # of Bills		Average Water Use per Account (gpd)
A	Apartments, Trailer Parks	27,534,958	16 %	1,261	11 %	448
B	Bars, Restaurants	5,774,090	3 %	75	1 %	1,583
C	Churches	439,307	0 %	31	0 %	289
D	Laundromats, Cleaners	973,930	1 %	5	0 %	3,994
E	Educational, Schools	2,863,970	2 %	29	0 %	2,044
F	Auto Repair, Auto Sales, Gas Stations	1,070,254	1 %	65	1 %	340
G	Government	3,774,370	2 %	53	0 %	1,489
H	Fraternities	204,180	0 %	8	0 %	551
I	Industrial	12,646,930	7 %	63	1 %	4,086
J	Motels	2,203,900	1 %	9	0 %	5,021
L	Warehouse, Storage Buildings	117,657	0 %	24	0 %	101
M	Medical Doctors, Dentist, Clinics, Nursing Homes	13,301,148	8 %	83	1 %	3,304
N	Not Billed - Record consumption only	850,830	0 %	7	0 %	2,466
P	Professional Offices - Real Estate, Banks, Lawyers, Insurance	1,743,657	1 %	130	1 %	275
Q	Social Services	489,333	0 %	26	0 %	379
R	Residential	78,382,845	45 %	9,485	79 %	169
S	Stores, Businesses	6,512,104	4 %	404	3 %	331

Table 4.
Distribution of Water Sales and Accounts by VCU Customer Groups (January 2008 to December 2008)

	VCU Defined Customer Groups	Total Sales (cubic feet)		Average # of Bills		Average Water Use per Account (gpd)
T	Utilities	135,110	0 %	5	0 %	554
U	Sales for Resale – LAC	6,582,260	4 %	5	0 %	26,995
V	Valparaiso University	3,918,820	2 %	37	0 %	2,157
W	Car Wash	2,412,970	1 %	10	0 %	4,948
X	Sewage Only - Metered consumption	0	0 %	0	0 %	
Y	Yard Meters - Water only	3,723,889	2 %	175	1 %	372
Z	Other	0	0 %	0	0 %	
	TOTAL	175,656,512	100 %	11,988	100 %	300
COMBINED CUSTOMER GROUPS						
	INDUSTRIAL (I, X)	12,646,930	7 %	63	1 %	4,086
	COMMERCIAL (B,C,D,F,J,L,M,P,Q,S,T,W,Y)	38,897,349	22 %	1,041	9 %	762
	RESIDENTIAL (R,Z)	78,382,845	45 %	9,485	79 %	169
	MULTI-FAMILY (A, H)	27,739,138	16 %	1,269	11 %	449
	VALPARAISO UNIVERSITY (V)	3,918,820	2 %	39	0 %	2,157
	GOVERNMENT (E, G)	6,638,340	4 %	81	1 %	1,676
	RE-SALE (U)	6,582,260	4 %	5	0 %	26,995
	Non-billed	850,830	0 %	7	0 %	2,466
	TOTAL	175,656,512	100 %	11,989	100 %	300

Table 4 shows the distribution of water use and accounts during 2008. The VCU customer accounting system tracks water use and accounts by 24 customer groups. As expected, the residential (single-family) customer group represents the largest component of water sales. In 2008, the residential customer group represented 45 percent of water use and 79 percent of the customer accounts. Average annual residential water use in 2008 was 170 gallons per day (gpd) per account.

Beyond the single-family customer group, the combined *commercial* category represents 22 percent of the water use and 9 percent of customer accounts. Within the commercial category, the highest categories of water use are for medical facilities, retail businesses, and bars/restaurants.

The largest per account water use in 2008 was by motels (5,021 gpd per account), car washes (4,948 gpd), industrial facilities (4,086 gpd), laundromats/cleaners (3,994 gpd), and medical facilities (3,304 gpd).

Figure 3 shows water sales to the combined customer groups between January 2005 and December 2008. The seasonality of water use in the residential sector is apparent and clearly impacts the peaking factors. However, it is also apparent that there is not

any noticeable growth trend over the time period in any of the combined customer groups.

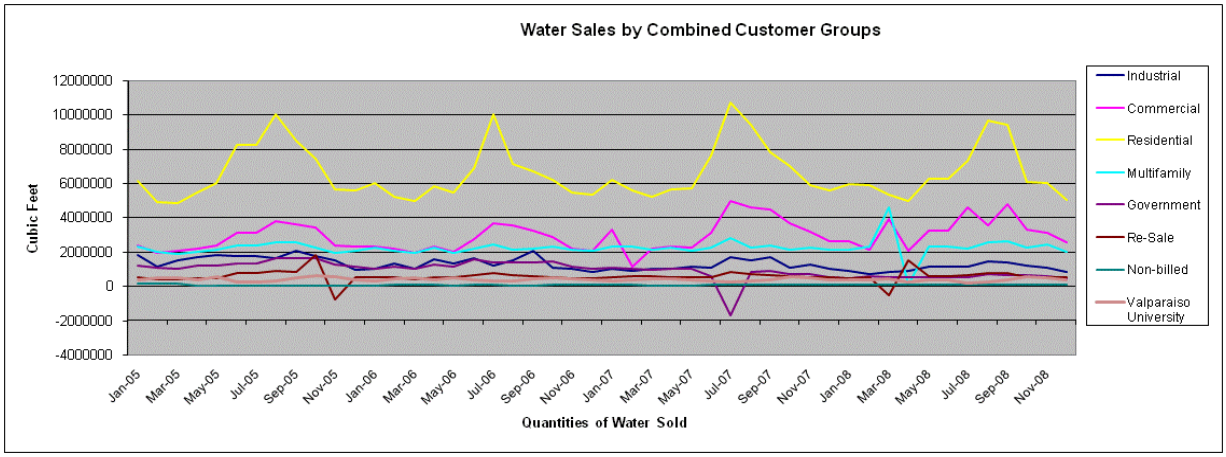


Figure 3.
Water Sales by Combined Customer Groups

Figure 4 shows average water use per account by the combined customer groups between January 2006 and December 2008. Although there is variability in use from month-to-month within each customer group, there is no clear growth trend over the time period.

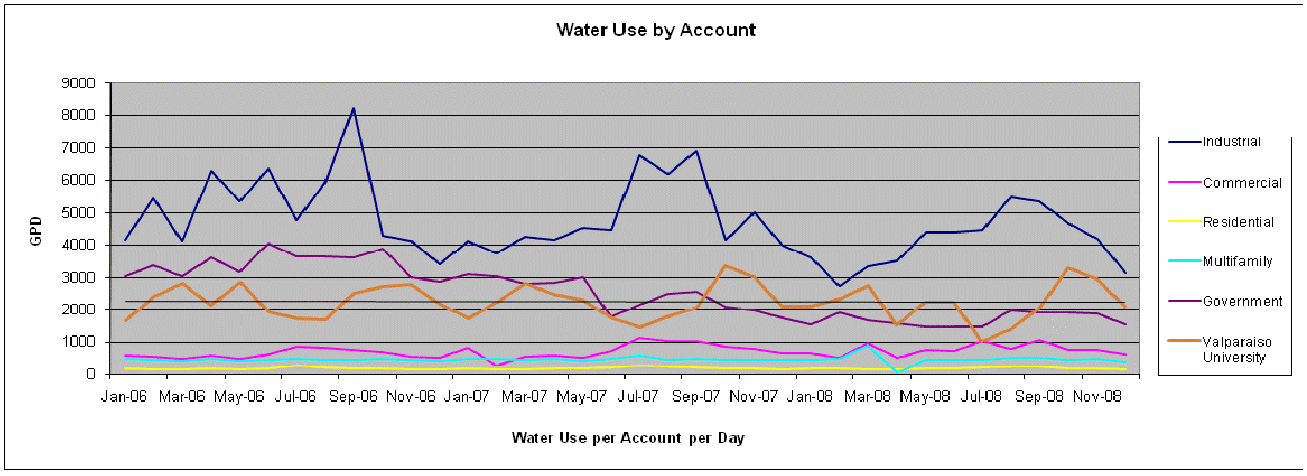


Figure 4.
Water Use per Account by Combined Customer Groups

Figure 5 isolated the average water use per account for the residential (single-family) customer group between January 2006 and December 2008. Average daily per account residential water use was 167 gallons in 2006, 179 gallons in 2007, and 169 gallons in 2008. The seasonality in single-family water use per account is apparent and although average daily per account water use may be about 170 gallons per account per day, during the summer season average daily water use in the residential customer group has exceeded over 250 gallons per account per day.

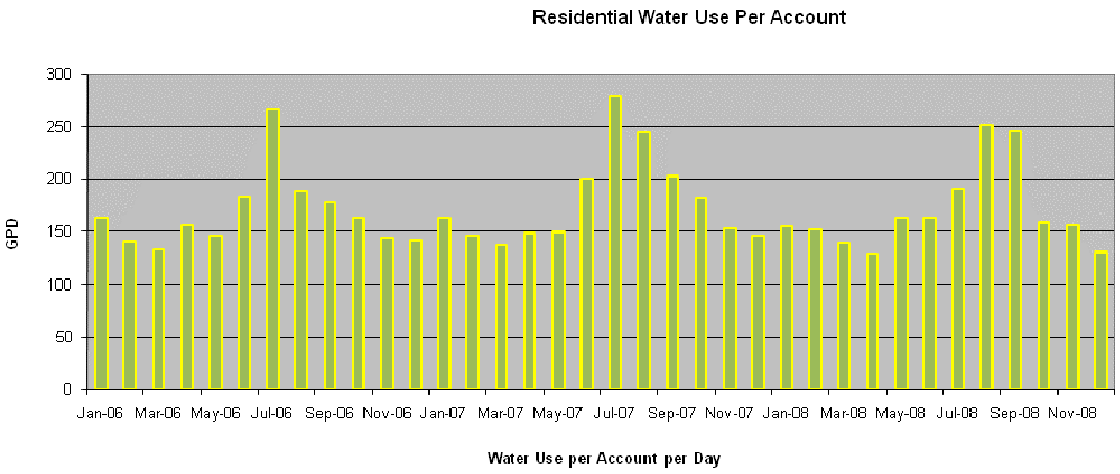


Figure 5.
Residential Water Use per Account by Combined Customer Groups

Figure 6 shows the number of billed accounts by combined customer groups and in total over the three-year period between January 2006 and January 2009. There does appear to be a very slight growth in the number of accounts over the time period. The average number of accounts billed was 11,678 in 2006, 11,868 accounts in 2007, and 11,989 in 2008.

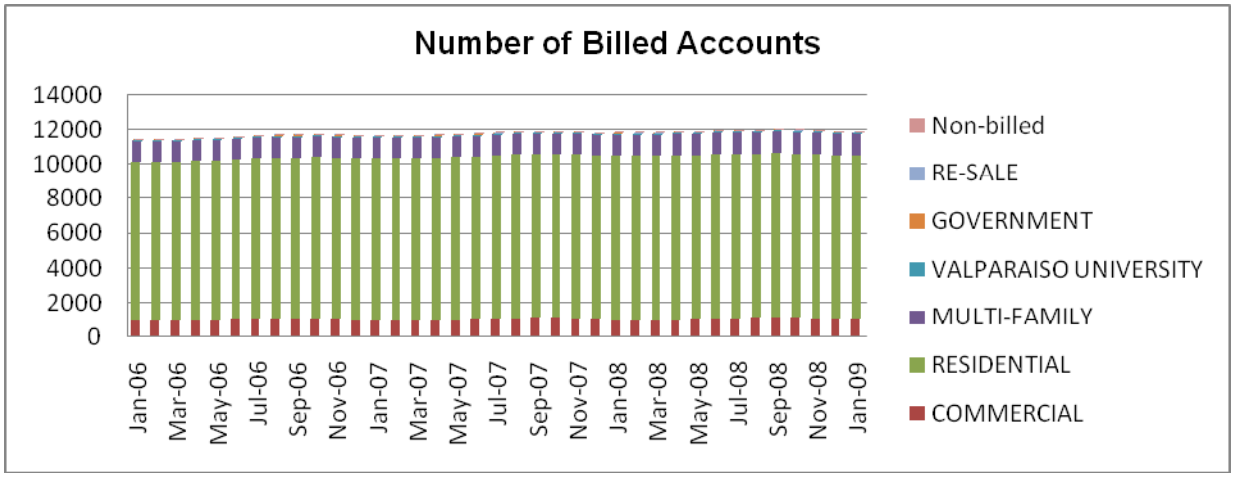


Figure 6.
Number of Billed Accounts by Combined Customer Groups

Table 5 shows the 10 largest water users in the VCU service area between May 2006 and May 2007, and shows a variety of commercial, industrial, governmental, and multifamily uses.

Table 5.
Valparaiso City Utilities (10 largest users)
May 2006 to May 2007

	Cubic Feet
Porter Hospital System	7,303,580
LAC Utilities – Wholesale	6,557,580
Valparaiso University	4,054,940
Cathay Pigments	3,804,200
Porter County Government	3,006,120
Gene B. Glick Apartments	2,213,730
Jet Corr Manufacturing	1,517,100
L I Combs Apartments	1,387,500
AOC LLC	1,193,800
Golfview Apartments	1,178,240

3.4 Projected Water Demands

Table 6 shows projected alternate water demand forecast scenarios. Scenario A is based upon *Water Demand Projections*, by Malcolm Pirnie, Inc. for VCU in May 2006. The methodology used to prepare these projections was based upon historical average day demand data from VCU for the period 1992 to 2005 period. A linear demand regression was used to this average day demand, and represents average day demand would increase by 60 percent between 2005 and 2055. Therefore, these projections assume that trends of the past will continue into the future. Maximum day demand is based upon a peaking factor of 1.78.

Table 6.
Projected Baseline Water Demand (without conservation)

	Scenario A: Malcolm-Pirnie, Inc, 2006; Linear Demand Growth		Scenario B: Disaggregated Factor Forecast	
Year	Average Demand	Maximum Demand	Average Demand	Maximum Demand
	(MGD)	(MGD)	(MGD)	(MGD)
2005	4.0	7.1	4.0	7.1
2010	4.2	7.5	4.1	7.4
2015	4.5	8.0	4.3	7.6
2020	4.7	8.4	4.4	7.8
2025	5.0	8.9	4.5	8.1
2030	5.2	9.3	4.7	8.3

Based on *Water Demand Projections*; Malcolm Pirnie, Inc., May 2006

Scenario B is based upon a disaggregated water demand factor forecast. The number of accounts in the combined customer groups in 2008 was assumed to grow at the annual average rate of the appropriate demographic projections shown in **Table 7**. The industrial accounts were projected to grow at the annual average rate of manufacturing employment. The other commercial accounts were projected to grow at the annual average rate of non-manufacturing employment. Single-family and

multifamily residential accounts were projected to grow at the annual average rate of projected occupied housing units. The projected number of accounts was then multiplied by the 2008 water use per account to derive total estimated gallons per combined customer group in the future years. The sum of the water use in the customer groups represents estimated total water sales. Total average daily production was estimated based upon past trend in total average daily production versus sales. The same peaking factor of 1.78 was used to estimate future maximum day demands. This approach of water demand forecasting accounts for projected future demographic conditions and for the fact that customer groups with different rates of growth will have an impact on future water demand.

Table 7.
Scenario B: Alternate Water Demand Projections

	Number of Customer Accounts	Average Per Account Water Use (gpd)	Average Annual Rate of Change 2000-2030*		Average Daily Water Use and Production (gpd)				
Combined Customer Groups	**2008**	**Jan 05 to Dec 08**			**2010**	**2015**	**2020**	**2025**	**2030**
Industrial	62	4706	-0.75 %	a	286,809	276,279	266,136	256,365	246,952
Commercial	1030	708	0.93 %	b	742,559	777,710	814,524	853,081	893,464
Valparaiso University	38	2228	0.93 %	b	86,239	90,321	94,597	99,075	103,765
Government	85	2305	0.93 %	b	198,938	208,356	218,219	228,548	239,367
Re-sale	5	27011	0.93 %	b	137,579	144,092	150,912	158,056	165,538
Non-billed	7	2305	0.93 %	b	16,501	17,282	18,100	18,957	19,854
Residential	9389	172	0.56 %	c	1,631,899	1,678,056	1,725,518	1,774,323	1,824,508
Multifamily	1230	450	0.56 %	c	559,164	574,979	591,242	607,965	625,160
Total	11845	306			3,666,481	3,775,885	3,888,755	4,005,204	4,125,345
TOTAL SALES (mgd)					3.67	3.78	3.89	4.01	4.13
AVERAGE DAILY PRODUCTION (mgd)					4.14	4.27	4.39	4.53	4.66
* See Table 2 for demographic projections and annual rates of change									
a. Projected rate of change for manufacturing employment									
b. Projected rate of change for non-manufacturing employment									
c. Projected rate of change for occupied housing units									

3.5 Water Demand and Supply Under Baseline Conditions

Baseline conditions compare future water supplies and expected source enhancements or infrastructure improvements with projected water demands without considering the implementation of additional water conservation program efforts. **Figure 7** shows that a new well field will be needed in about 2012 to account for the phase-out of the Airport well-field. This project will be needed regardless of water conservation and therefore will not be included in the benefit-cost analysis. Two projects that can impact the benefit-cost analysis include:

- Expansion of the Airport WTP by the year 2015 to supply the projected maximum day demand of the system
- A new 1-MG elevated tank potentially needed by the year 2025 to meet projected peak hour demand of the system.

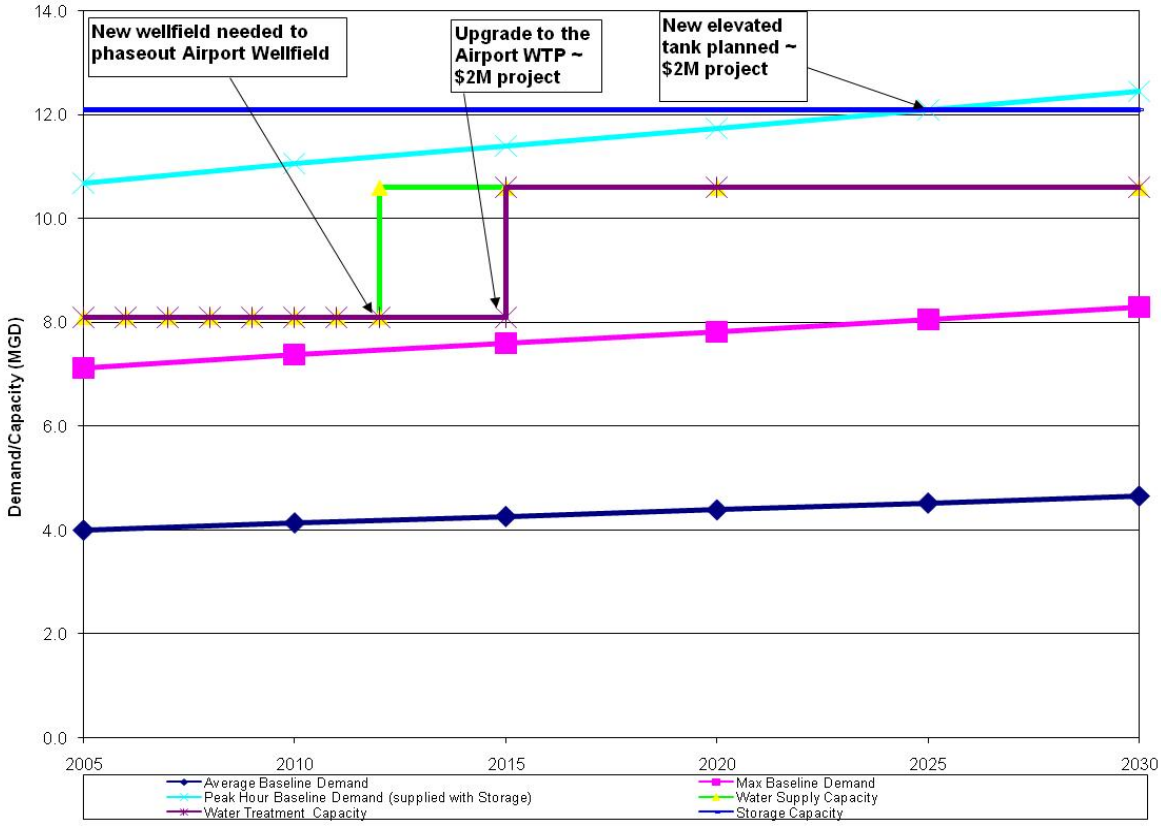


Figure 7.
Water Demand-Supply Curve under Baseline Conditions

This information will be used in subsequent analyses of the impact of water conservation programs, and the analyses of potential benefits and costs.

Section 4
Water Conservation Goal and Perceptions

An initial step in the development of a water conservation plan was to determine the goals and objectives of VCU. Furthermore, perceptions about water conservation from both the general public and from the Task Force were obtained to guide the assessment of water conservation measures.

4.1 Water Conservation Program Goals

As discussed in Section 1, a Water Conservation Task Force was created. The purpose of the Task Force was to assist in the development of the plan and to promote water efficiency in the community and to explain why/how/what is being implemented by VCU.

At the Kickoff Meeting of the Water Conservation Task Force, the following were stated objectives of the water conservation plan.

1. Implement comprehensive public education program for residential, commercial, and industrial users (It was also suggested to have the community schools integrate water conservation into the curriculum)

2. Control and reduce costs of municipal and industrial process water and commercial and residential potable water

3. Evaluate the impact of water conservation on capital costs for water and wastewater

4. Evaluate the impact of water conservation on operations & maintenance costs, energy and chemical costs

5. Promote and allow for economic development opportunities with limited capital expenditures to attract industry and commerce to Valparaiso

6. Develop conservation friendly water and wastewater rates

7. Demonstrate that water conservation will work in the Great Lakes region

8. Develop City codes/incentives and policies to achieve goals

The stated mission of the water conservation Task Force was:

> "Develop a Water Conservation Plan that increases public awareness, engages and motivates all VCU customers to participate in active water conservation, thus benefiting the users, providers and the environment."

The Task Force identified the following as having the greatest potential for improvements in water use efficiency:

1. Utility operations & maintenance (hydrant flushing, filter back-washing and other process and in-house uses)

2. New construction best practices (residential, industrial, commercial, and public buildings)

3. High water users in all areas (Valparaiso University, Hospital, car washes, restaurants, professional buildings)

4. Residential plumbing systems; water saving devices and appliances (toilets, clothes washers, dishwashers); irrigation systems and practices; leaks (infrastructure and customer)

The Task Force identified the following as potential barriers to water conservation in the community:

1. Lack of understanding of the need for, and how to, use water efficiently

2. Life style, perceptions

3. Costs:

    a. Costs to customers for upgrading systems and appliances;

    b. Costs to VCU for lost revenue

4. Inconvenience

5. Political and economic impact

VCU indicated that one of the recommendations of the Hardness and Capacity Study was that VCU consider the implementation of a conservation program. VCU also indicated its desire to follow the recommendations of the proposed Indiana Water Shortage Plan. It was noted that although a portion of VCU's service area is outside of the drainage area of the Great Lakes Basin, it also desired to follow the Great Lakes-St. Lawrence River Basin Sustainable Water Resources Agreement/Compact in regard to water conservation. VCU also expressed desire to be a leader in the State of Indiana regarding the development of a water conservation plan.

Other reasons for considering water conservation included: delay in capital expenditures, optimization of energy and chemical costs, protection of water resources to accommodate future growth in the City and many others.

4.2 General Public Perceptions

As part of a periodic customer service survey conducted by VCU, a series of questions were added to address water conservation issues. Conducted by Hauser Consulting in February and March of 2008, a combination of key leader interviews, focus groups, and telephone survey was used to gain better understanding of VCU customer perceptions. Interviews of 12 to 20 minutes were conducted with 303 randomly selected VCU customers.

As reported by Hauser Consulting (May 2008), key findings of the survey as related to water conservation were:

- *A majority of customers believes that their fees for water (74 percent), and storm water and sewer (59 percent) are fair. Additionally, a majority of customers believes that VCU works hard to keep their bills as low as possible (55 percent agree and only 18 percent disagree). In light of the challenges of today's economy, these findings indicate a positive general satisfaction with VCU's fee structure and cost control initiatives.*

- *There has been a significant increase in the awareness that VCU's main source of water is wells since 2001, but still half the customer base is confused about the source of water (i.e., VCUs primary source of water supply is from wells). At the same time only 46 percent know that the storm water and sewer department was merged with the water department approximately 2 years ago. Residents with incomes between $25,000 and $50,000, and women were most likely to be wrong about the source of water.*

- *High numbers of residents believe that water conservation is important both personally (86 percent) and communally (89 percent). Even though support is high, fewer residents (56 percent) say they have taken action to conserve water in the past year. Most of the actions taken were behavioral instead of mechanical:*

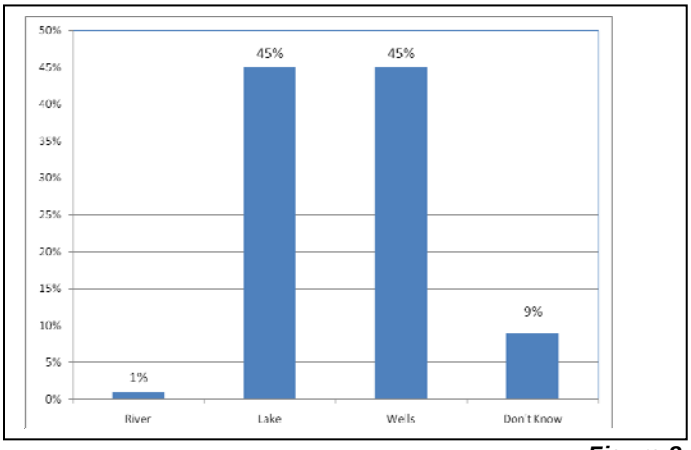


Figure 8.
Perceived Source of Water

  - *73 percent took shorter showers*
  - *73 percent repaired a leak*
  - *73 percent watered their lawns and shrubs less*
  - *62 percent did fewer car washes*

- *64 percent did fewer washing machine loads*

See **Figure 9** for reported actions when survey respondents were asked: "What actions have you taken to conserve water?"

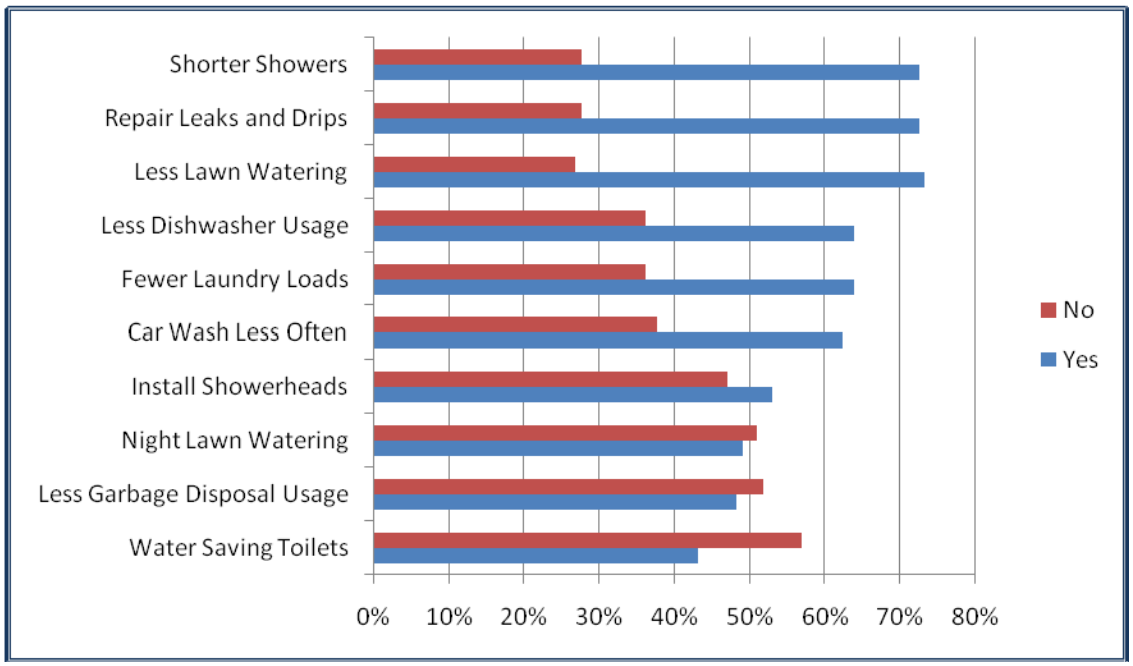


Figure 9.
Reported Actions to Conserve Water

- *The strongest support for water conservation comes from the lowest income group and women. Those with lower household income levels tended to be more likely to agree that water conservation is very important to them "personally" and that their community needs to understand that water conservation is important and take steps to conserve.*

- *The top water conservation messages were "protecting the environment" and "preventing future water shortages" and "saving money on their water bill"* (see **Table 8** for responses on reasons to conserve water). Those living in Valparaiso for more than 5 years were more likely to agree that preventing future water shortages during drought conditions is an important reason to conserve water.

- *The best way to share these* (conservation) *messages was through printed communication coming directly from Valparaiso City Utilities* (see **Figure 10**). *While other methods such as Radio or TV advertising scored lower, the ultimate communication effort would need to emphasize all communication channels to spur behavioral changes. For low income groups, word-of-mouth was significantly more important.*

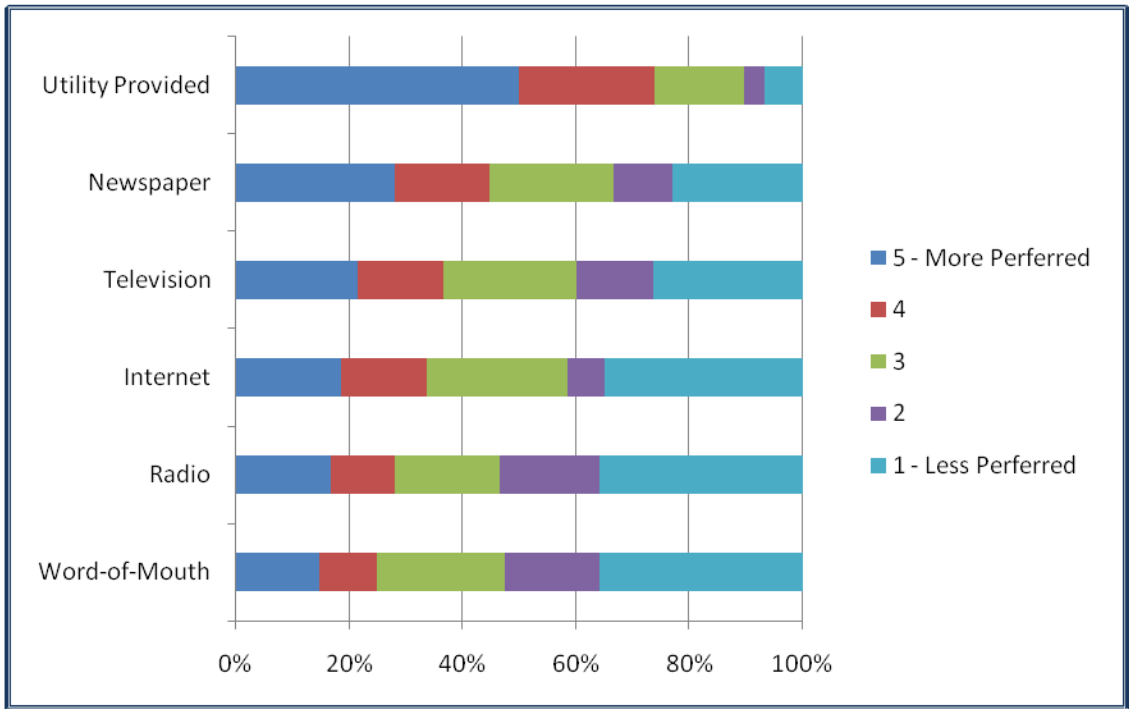


Figure 10.
Preferences to Receive Information about Water Conservation

Table 8.
Reasons to Conserve Water

Most Important Reasons to Conserve	Strongly Agree	Agree	Combined
Preventing future shortages	47%	50%	96%
Protecting the environment	45%	48%	93%
Saving money on water bill	26%	57%	83%
Saving money on energy bill	24%	59%	83%
Need additional information on how to conserve	9%	34%	43%
For me personally water conservation is very important	24%	60%	83%

4.3 Task Force Inputs on Conservation Measures

To gain Task Force insights into the types of conservation programs that would be more likely to be acceptable to the community, the Task Force was asked to rate their interest in evaluating various programs (where "1" is not interested and "5" is very interested). See **Table 9** for measured responses.

Table 9.
Task Force Preferences on Conservation Measures to Evaluate

Programs (Ratings scale is 1= not interested, 5=very interested)	Sector	Aver-age	Rank based on Average
School Education Programs	ALL	4.44	1
Public Education/Information Program	ALL	4.44	2
High Usage Audit Program (top tier customers)	RES	4.33	3
Industrial/Commercial/Institutional Water Audit Program	ICI	4.31	4
Industrial/Commercial/Institutional Survey (survey how water is used in the ICI sector so that conservation programs can be developed that specifically target this sector)	ICI	4.13	5
Green Certification Requirements for New Construction	ALL	3.94	6
Residential Outdoor Water Audit Program (offering audits to residential customers to review outdoor water use and make recommendations to increase water use efficiency)	RES	3.93	7
Residential Indoor Water Audit Program (offering audits to residential customers to review water use and make recommendations to increase water use efficiency)	RES	3.87	8
University Water Audit	ICI	3.69	9
Single-family Residential Water Use Survey Program (survey how water is used in the single-family customer class so that conservation programs can be developed that specifically target this sector)	RES	3.53	10
Large Landscape Conservation Programs (focusing on large landscape areas -e.g., golf courses, schools, public areas)	ICI	3.5	11
Rain Barrel Demonstration Program	ALL	3.5	12
Fixture Replacement in City-Owned Buildings	ICI	3.44	13
Water Waste Ordinance (local ordinances targeting over-watering and leakage)	ALL	3.38	14
Multifamily Residential Water Use Survey Program (survey how water is used in the MF sector so that conservation programs can be developed that specifically target this sector)	RES	3.36	15
Landscape Irrigation Ordinance (requiring rain/moisture sensors/ET controllers on all new construction)	ALL	3.25	16
Residential Ultra-Low Flush Toilet Rebate Program (offering rebates on replacements of lower efficiency toilets)	RES	3.21	17
Residential Plumbing Retrofit (offering low-flow showerheads, leak detection tablets, educational materials)	RES	3.14	18
Cooling System Ordinance (prohibit/eliminate single-pass cooling systems)	ICI	3.13	19
Commercial Dishwasher Program	ICI	2.81	20
Commercial Kitchen Program (targeting dishwashers, pre-rinse spray valves, garbage grinders, ice-making machines)	ICI	2.8	21
High-Efficiency Washing Machine Rebate Programs (offering rebates for replacement of lower efficiency	RES	2.79	22

Table 9.
Task Force Preferences on Conservation Measures to Evaluate

Programs (Ratings scale is 1= not interested, 5=very interested)	Sector	Aver-age	Rank based on Average
washing machines)			
Residential Ultra-Low Flush Toilet Replacement Program (offering direct installation of lower efficiency toilets)	RES	2.79	23
Urinal Replacement Program	ICI	2.78	24
Hotel Showerhead Replacement Program	ICI	2.53	25
Laboratory and Medical Equipment Efficiency Program	ICI	2.53	26
Self-Generating Water Softeners and Pressure Regulators Rebate Programs	RES	2.21	27
Hot Water Recirculation Program	RES	2.21	28
Multifamily Sub-metering Program	RES	2	29

Note: ICI=industrial, commercial, and institutional customers, RES=residential customers, ALL=all water customers.

Other conservation measures with Task Force interest included:

- Commercial carwashes (incentives)
- Water bill modification
- Water conservation ordinances for new construction
- Program cost-sharing/partnering
- Landscape irrigation ordinances
- Water conserving rates
- Consumptive use criteria

The Task Force also provided the following as recommendations for PE/PI (public education/public information) "message" to convey to customers:

- Water conservation =
    - $$$ saved for customers
    - $$$ saved for water utility
    - $$$ saved on energy bills
    - $$$ saved on additional capital costs

- Water is precious resource
  - Not to be wasted
  - Environmental benefits
  - Save water for future use/additional community growth

Section 5
Conservation Program Development

A range of potential conservation measures to meet the goals and objectives were considered. Consideration was also given to the social acceptability of conservation and the desire of the community to adopt potential measures. Conservation measures were then assessed with respect to technical feasibility, potential water savings, and potential costs and benefits of implementation.

Water conservation measures generally fall into one of three categories: education, regulations, or management measures. Education programs can be a wide variety of tools and techniques that are used to educate and or inform consumers why water conservation is important and provide them with information about how to achieve water efficiency. Regulation programs may include local or state ordinances that promote increased water use efficiency. At the local level, this may include plumbing ordinances, landscape ordinances, or water waste prohibitions. Management measures include those that are implemented by the utility that provides customers with incentives and tools to better manage water use. Management measures may also include pricing programs.

Conservation measures may also be broken into two general categories: hardware and behavior. Hardware measures involve making changes in water using equipment and technologies to increase water use efficiency. Examples of hardware measures may include plumbing replacements/modifications (high efficiency toilets) or equipment replacement/modifications (e.g., replacement of once-through cooling system with a recycling cooling system). Behavioral measures are those that change the way we use water, with or without hardware modifications (e.g., changing frequency and duration of lawn watering practices).

In developing water conservation programmatic activities, the following are considered:

- Program content (this may include one or more conservation measures)
- Definition of target population
- Program incentives
- Customer contact modes
- Schedule implementation and duration
- Specification of responsible agencies
- Program costs

5.1 Public Education and Information

In the water conservation field, it is generally accepted that any water conservation program must have a public education and information (PE/PI) component. Consumers not only need to understand how to increase water use efficiency, but they also need to understand why. However, the difficulty with the public education/information programmatic component is the inherent difficulty in quantifying the water savings that are attributable to the PE/PI activities. Most conservation experts would agree that PE/PI have a synergistic effect on all conservation program initiatives, such that water savings will be enhanced with a PE/PI component.

Therefore, public information, education and awareness are important aspects of any water conservation program. These types of activities are typically in the forefront of any water conservation effort and are essential in bringing public awareness to conservations programs and promoting water conservation goals in the community or region.

Studies in the sociology of the adoption of new behaviors and technologies indicate that information is one of three key components to the adoption of technology, along with the availability of the technology and an incentive to change. Information provides an awareness of the availability of the new technology, awareness of the need to change, and information on how to implement the change. Thus, a water conservation information campaign should be an integral part of any water conservation program.

Good public information, education and awareness programs encourage water users to implement specific water saving measures. Some commonly identified water conservation information, education and awareness actions include:

- School education materials
- Public speakers program
- School programs and exhibits
- Customer assistance hotline
- Conservation pamphlets, bill inserts and newsletters
- Radio, TV and newspaper messages
- Billboards, bus, and subway messages
- Property manager workshops
- Residential landscape workshops

- Trade association irrigation and landscape workshops (serving residential and nonresidential customers)

Reports by Nadel (1990) and Maddaus (1987) suggest that residential educational programs reduce annual water usage from 0 to 5 percent. An analysis of historical water demand for the City of Albuquerque indicated their summer education program had impacts of 7 to 10 percent reduction in summer monthly water use in the residential sector after accounting for effects of weather, price of water, income, housing density, and other concurrent conservation programs (Davis *et al.*, 2002). This reduction is specifically in residential summer water use. The impact of public education programs on annual water use would be a lower percent reduction.

Given that not all households will respond by adapting water conserving behaviors and that water conservation marketing is generally more heavily emphasized in summer, it may be assumed that water conservation education programs can reduce residential water use by about 2 percent. An education program may encourage participation in other conservation programs thus further increasing its impact and providing the impetus for the adoption of technologies made available through other programs.

The Water Conservation Task Force clearly identified PE/PI as a high priority for VCU water conservation plan. Furthermore, the greatest interest to the Task Force was educating the general public about water conservation and school education programs.

A number of assumptions were used in the development of parameters for the PE/PI program. First, the PE/PI program would initially require some pre-developed education materials. Sources of these materials were envisions from the American Water Works Association and the Water-Use-It-Wisely campaign. Furthermore, participation by VCU staff in the Indiana Water Education for Teachers (WET) Program and other educational opportunities was anticipated. Second, the PE/PI program would be an ongoing programmatic initiative. Third, the PE/PI program would be supported by a half-time Water Conservation Coordinator at a cost of approximately $41,500/year.

The Task Force also expressed interest in a rain barrel demonstration program. Rain water harvesting systems, or specifically rain barrels, can be used to collect water during rainfall periods through downspouts, and then use the water at a later period for landscape or other outdoor uses. (This is untreated water and is not to be used for potable purposes.) Rain barrel programs have become a popular activity (with possible impacts also on reducing storm water flows) with programs implemented by numerous communities throughout the U.S. and Canada (including Vancouver, BC; Cary, NC; Seattle, WA; Chicago, IL; Austin, TX; Tampa, FL). To date, there have not been independently documented impacts of the water savings of rain barrel programs. It is envisioned that the primary benefit of a rain barrel program would be as a public education tool. As part of a public education activity (e.g., a "water

week"), VCU could sponsor a rain barrel demonstration (possibly with rebates). This might be done in coordination with a local retailer and/or rain barrel manufacturer. Rain barrels range in cost between $55 and $230 for 55 to 60 gallon capacity tanks. The City of Austin, TX offer 75 gallon rain barrels (retail $95) at a subsidized cost of $60; River Falls, WI offers a $30 rebate; and James City, VA offers a $50 rebate.

It was assumed that a rain barrel demonstration program could be part of a PE/PI program after Year 1. A rain barrel demonstration program could be part of another VCU-sponsored educational event. VCU could announce the program on a water bill and/or press releases. Possible partners for a rain barrel demonstration program could be Porter County, Northern Indiana Regional Planning Commission, retailers (Lowes, Home Depot); local community groups, or local environmental groups (e.g., Save the Dunes).

Table 10 highlights possible PE/PI program parameters of Year 1. The following detail some of the possible content and assumptions of the PE/PI program:

- School education programs
  - Drinking water week activities
  - Class room activities
- Public speakers program
- Tailored public education/information materials
  - Trade show display for local events
  - Brochures/fact-sheets on local conditions
- Generic public education/information materials (AWWA/Water Use it Wisely)
- Customer hotline
- Conduct/sponsor workshops
  - Landscape industry workshops
  - Green building workshops (for developers)
  - Water efficiency workshops for the public
- Target population
  - All customers for PE/PI activities
  - 12,000 customers
  - School programs: 3rd and 4th grades - Approximately 900 students

- Schedule and duration
  - Launch Summer 2009
  - Water week activities, May
  - Indefinite duration
  - Workshops, more likely a Year 2 activity
- Possible partners
  - Northern Indiana Public Service Company
  - Northern Indiana Regional Planning Commission
  - Local retailers
- Potential program costs
  - Approximately $60,000/year
  - Any rebates offered, cost to utility

Table 10.
Public Education/Information Program

Year 2010	Quantity	Unit Price	Subtotal Cost	Estimated Taxes and Shipping	First Year Program Costs
A. Program Costs, Year 1					
Residential Water Use: An Inside Look (poster for mounting); taxes and shipping and mounting	1	$5.95	$5.95	$0.42	$6.37
The Story of Drinking Water: Teachers Guide	1	$10.00	$10.00	$0.70	$10.70
The Story of Drinking Water: CD-Rom	1	$50.00	$50.00	$3.50	$53.50
The Story of Drinking Water: Booklet	1000	$0.42	$420.00	$29.40	$449.40
Whaddya Know about H20 DVD and Teachers Guide	1	$50.00	$50.00	$3.50	$53.50
Conserve Every Day DVD	1	$50.00	$50.00	$3.50	$53.50
"Water Fun for You" Coloring Book	1000	$0.42	$420.00	$29.40	$449.40
5 Basic Ways to Conserve Water (brochure)	1000	$0.31	$310.00	$21.70	$331.70
Water Conservation at home (16 pages)	1000	$0.55	$550.00	$38.50	$588.50
Water Use It Wisely Starter Package	1	$2,500.00	$2,500.00	$175.00	$2,675.00
Water Conservation and Efficient Use (DVD)	1	$195.00	$195.00	$13.65	$208.65
A Consumer's Guide to Water Conservation (DVD)	1	$50.00	$50.00	$3.50	$53.50
Leak detection dye tablets	1000	$0.16	$160.00	$11.20	$171.20
Subtotal					**$5,104.92**

Table 10.
Public Education/Information Program

Year 2010	Quantity	Unit Price	Subtotal Cost	Estimated Taxes and Shipping	First Year Program Costs
Indiana WET Program Training (mileage, per diem, and materials) for Conservation Coordinator					**$500.00**
AWWA Conf./Seminars for Conservation Coordinator					**$2,000.00**
Consultant support					**$10,000.00**
Labor (1/2 time--loaded)					**$41,600.00**
TOTAL PROGRAM COSTS					**$59,204.92**
B. Estimated Water Savings, Gallons per Day, 2%, Year 1					82,900
C. Costs per Gallon of Water Saved, Year 1					$0.71

5.2 Single-family Indoor/Outdoor Audit

Home water audits are a common component of residential water conservation programs. In many cases, water audits are offered by water utilities to high-volume water customers, or when there is an unexplained noticeable spike in water use of individual customers (which may be indicative of some type of leak on the customer side of the meter). Some audits include the distribution of low-cost retrofit devices (e.g., showerheads, faucet aerators) or toilet leak detection devices. The other aspect of a home audit is the review of water-using equipment (e.g., toilets, showers, faucets, irrigation equipment) and behaviors in conjunction with resident. The audit typically then provides the resident with guidance on increasing water use efficiency inside and outside of the home.

The basic steps of residential water audit include (Vickers, 2001):

1. Explain purpose of audit
2. Determine water use (meter reads and estimate water use of various fixtures and appliances)
3. Test toilets and repair or recommend repairs
4. Provide retrofit devices (toilet displacement, showerheads, aerators, hose shut-off nozzle)
5. Evaluate lawn and irrigation characteristics and equipment
6. Evaluate other outdoor uses
7. If applicable, customize an irrigation schedule

8. Identify all conservation opportunities

9. Evaluate water efficiency measures for a given site (e.g., potential savings for modifications, potential costs for implementation, payback periods)

10. Educate consumers

The target population of a single-family audit program may be:

- High water users (top 10 to 20 percent)
- Any customer that has abnormal spike in usage (if identifiable with customer billing system)
- Low income customers
- Or by request

VCU might consider offering program incentives for program participation (e.g., a unit credit on water bill) or a potential link with other rebate initiatives (clothes washer or rain barrel program initiatives).

A potential partner for such as program might be the Northern Indiana Public Service Company (if linked to energy audit program). Potential program costs might include:

- Training for conservation coordinator on audit procedures (indoor and landscaping/irrigation systems)
  - Various courses available through Irrigation Association, costs range $200-$500 per course, ~ 2 day courses, plus travel costs
  - Potential certification as irrigation auditor
- Indoor audit procedures, on-site instruction, ~$1-2K
- Minor equipment needs, $200
- Retrofit devices, if provided (showerheads, aerators)
- Labor costs (approximately 2.5 hours per site including planning, contact/scheduling, traveling, and on-site audit time)
- Travel cost to/from site
- Administrative costs

The potential water savings from a water audit will depend on actions taken during audit. Vickers (2001) reports savings of 20 to 30 gallons per day per home can be

achieved (indoor and outdoor). Contra Costa County Water District (CA) reports average of 16 percent per home (substantially more savings from homes with outdoor irrigation). They reported "savings over the first year, second year, and beyond average 17 percent, 16 percent, and 13 percent respectively" (Chesnutt et. al, 2007). In a subsequent analysis of the Contra Costa Water District program, Whitcomb (2000) reported savings between 42 and 55 gallons per day per audited home. However, it was noted that between 60 to 70 percent of water use is estimated to be outdoor use, and most of the savings was achieved during summer months (Chesnutt et. al, 2007). Chesnutt also reported that savings from water audits targeting high water users was about 32 gallons per day, compared with untargeted audits with savings of about 21 gpd. It should be noted that all of these reported studies are based on audits completed in California (where outdoor irrigation is a much larger component of average household use compared to Valparaiso), and therefore, should be viewed as higher than the savings that might be expected from a similar program initiative in Valparaiso.

Table 11 details some of the programmatic assumptions used to calculate potential water savings from a water audit program. It was assumed that in the first year of the program (2014) 25 audits would be completed, and after that the program would complete 50 audits per year (through 2030), for a total of 825 completed single-family audits).

Table 11.
Single-Family Indoor/Outdoor Audit (top quartile or when usage spikes) (top 5%)

Key Assumptions:			
25 single-family indoor/outdoor audits (1st year)			
Water savings: 10% of daily household use			
250 gallons per household per day for top 5% of customers			
Program Duration: 2014 to 2030 with 825 completed audits.			
A	***Costs of the Conservation Measure***	**Amount per Audit**	**First Year Costs**
1	Materials (leak tablets, educational materials, showerhead, faucet aerator)	$15.00	$375.00
2	Labor (2.5 hours @ 40.00)	$100.00	$2,500.00
3	Marketing and advertising		$500.00
4	Other (travel), average of 10 miles per audit ($0.585/mile)	$5.85	$146.25
5	Total program costs	$140.85	$3,521.25
B	***Estimated Water Savings***		
6	Number of audits		25
7	Estimated water savings per unit (250 gpd/hh * 10%)	gallons per day per household	25
8	Total water saving per day all participants	gallons/day	625
C.	***Costs per Gallon of Water Saved, Year 1***	$/gallon/day	$5.63

5.3 Nonresidential Audits

Similar to the residential programmatic effort, a nonresidential audit can target commercial, industrial, and/or institutional customers. However, there is great

variability in the types, patterns, and magnitude of water use at various businesses and facilities. Oftentimes, a nonresidential audit would involve preparing a thorough review of water use at a given site, and then preparing a detailed site water conservation plan.

Furthermore, there is a distinction to be made between a nonresidential *survey* program and a nonresidential *audit* program. *Survey* programs (baseline studies) are designed to obtain information about how customers are using water and to assess their attitudes toward water conservation. The objective of a *survey* program is to make determinations of how water is used (not how much) by samples of customers and conclusions drawn about customer groups (e.g., measurements of types and flow rates of toilets, showerhead, leakage rates, types of water-using equipment, landscape irrigation equipment and practices). The results of a *survey* program is intended to facilitate the development of a more specific nonresidential water program and to estimate more accurately the potential water savings and cost-effectiveness of such programs during both the planning and implementation stages. A *survey* program may target a specific type of nonresidential customer (e.g., hotels or hospitals or restaurants), so that a more detailed water conservation program strategy can be developed for that specific type of customer. *Survey* programs, of themselves, may have limited water savings potential, other than increasing public awareness of water use. However, when used as a mechanism to develop a more targeted water conservation initiative, the survey program can be viewed as an initial step toward a more informed initiative to reduce nonresidential water use. Per site, the implementation of surveys is less costly than audit program.

A nonresidential *audit* is a more detailed investigation of site conditions at a given facility. It would involve a very detailed review of water use at the site and the development of detailed recommendations of how water use efficiency can be improved at site. Whereas a *survey* of an individual facility might only take a few hours, a detailed site *audit* might involve four to eight hours or even days, given the size of the facility and the extensiveness of water-using equipment. The basic steps of a commercial, industrial, or institutional site water audit include (Vickers, 2001):

1. Obtain support from facility owners, managers, and employees
2. Conduct on-site inventory of water use
3. Calculate all water-related costs
4. Identify and evaluate water-efficiency measures
5. Evaluate payback periods using life-cycle costing
6. Prepare and implement an action plan
7. Track and report progress

VCU might consider offering program incentives for program participation (e.g., a unit credit on water bill). Typically, audit programs target a specific customer class (e.g., hospitals, schools, hotels/motels, restaurants or manufacturing) or large water users.

Typically, audits are initiated with an initial letter introduction and then phone contact/scheduling. Similar to a residential audit, a potential partner in such a program might be the Northern Indiana Public Service Company (if linked to energy audit program).

For the purpose of the analysis, in this case, it is assumed that the audit program would target industrial customers, starting in 2015. Currently, there are 62 industrial accounts, and it is assumed that 30 customers would participate in the program over a 6 year period. For more complex industrial processes, this program initiative will likely need to hire contract support, and depending upon size of facility, an on-site audit may take one or more days.

On average, program costs would include: labor costs (approx. 4 to 8 hours per site including planning, contact/scheduling, traveling, on-site audit time, and reporting time); travel costs to/from site, and administrative costs.

The potential water savings depends on actions taken during audit and then on the actions taken by the establishment to implement recommendations in the audit report. Reported water savings of CII Programs have been varied, but some studies have reported substantive water savings compared to prior use. A national study by EPA/CA DWR of 13 cities reported potential savings of 9 to 31 percent in CII uses (Chesnutt et. al, 2007).

It is assumed that a water audit at an industrial facility could save 10 percent of water use. It is assumed that facilities would implement recommended changes to achieve this savings.

Table 12 details the assumption used in this analysis.

Table 12.
Industrial Water Audits

Key Assumptions: 62 industrial accounts; average use = 4700 gpd			
Target 30 industrial users (over 5 years)			
Water savings: 10% of use			
Duration: 5 audits per year, 2016 to 2021; 30 total			
4,700 gallons per day per facility			
A	***Costs of the Conservation Measure, Year 1***	**Amount per Audit**	**First Year Costs**
1	Materials		$200.00
2	Contract Labor (24 hours @ $175)	$4,200.00	$21,000.00
3	Marketing and advertising		$100.00
4	Other (travel), average of 10 miles per audit ($0.585/mile)	$5.85	$29.25
5	Total program costs for the life of the measure	$4,265.85	$21,329.25

Table 12.
Industrial Water Audits

B	***Estimated Water Savings, Year 1***		
6	Number of audits		5
7	Estimated water savings per unit (10% * 4700)	gallons per day per facility	470
8	Total water saving per day all participants	gallons	2350
C	***Costs per Gallon of Water Saved, Year 1***	**$/gallon/day**	**$9.08**

5.4 School Water Audit

The description of the nonresidential survey and/or audit described in Section 5.3 also applies here. There are currently 28 accounts in the VCU customer billing system in the education/schools category (not including Valparaiso University), and on average they use approximately 2,000 gallons per day per account. For the purpose of this analysis it is assumed that 12 schools would participate in this program over a two-year period. It is assumed that a water audit at a school facility could save 15 percent of water use. It is assumed that facilities would implement recommended changes to achieve this savings. Very likely savings would be achieved by targeting repair leaks, retrofitting toilets and faucets, and adhering to recommended outdoor watering schedules. **Table 13** details the assumption used in this analysis.

Table 13.
School Audit Program

Key Assumptions: 12 Schools			
Water savings: 15% of use			
2,000 gallons per day per school			
Program duration: 6 audits in 2016 and 6 audits in 2017			
A	***Costs of the Conservation Measure, Year 1***	**Amount per Unit**	**First Year Costs**
1	Materials		$100.00
2	Contract Labor (12 hours @ $175)	$2,100.00	$12,600
3	Marketing and advertising		$100.00
4	Other (travel), average of 10 miles per audit ($0.585/mile)	$5.85	$35.10
5	Total program costs	$2,139.18	$12,835.10
B	***Estimated Water Savings, Year 1***		
6	Number of audits		6
7	Estimated water savings per unit (15% * 2000)	gallons per day per school	300
8	Total water saving per day all schools (6 schools in year 1)	gallons per day	1800
C	***Costs per Gallon of Water Saved, Year 1***	**$/gallon/day**	**$7.13**

5.5 Hotel/Motel Showerhead Replacement

Although the National Energy Policy Act mandates the flow rates of showerheads, many older facilities have showerheads that do not meet efficiency standards. Furthermore, some showerheads, particularly in older facilities have leaks.

According to the U.S. Bureau of Census' County Business Patterns, there are approximately 30 hotels in Porter County. Some additional research needs to be conducted to determine the number of hotels/motels in the Valparaiso service area, the approximately age of the facility and whether the facility has completed any major plumbing retrofits/modifications in the past 10 years, and the number of rooms per facility. Only those hotels older than 1990 without any major plumbing retrofits would be targeted. It is assumed that the Water Conservation Coordinator would coordinate with targeted facilities, get management buy-in, and provide the replacement showerheads to the facilities. With bulk purchase discounts, it is assumed that quality commercial grade showerheads could be purchased for approximately $20 per showerhead. No direct install services would be provided.

It is assumed that the more efficient showerheads would replace those that do not meet current efficiency (flow rate) standards, and the savings would be 1.5 gallons per minute per installed showerhead. **Table 14** provides additional water savings and cost assumptions.

Table 14.
Hotel/Motel Showerhead Program

Approximately 30 hotels in county			
Key assumptions:			
Target 400 showerhead replacements, older establishments to maximize savings, 200 Year 1 & 200 Year 2			
Water savings: 1.5 gpm * 8 minutes			
A	**Costs of the Conservation Measure, Year 1**	**Amount per Showerhead**	**First Year Costs**
1	Materials (replacement showerhead)	$20.00	$4,000.00
2	Labor (40 hours @ 40.00)		$1,600.00
3	Total program costs	$22.40	$5,600.00
B	**Estimated Water Savings, Year 1**		
4	Number of showerheads		200
5	Estimated water savings per unit (gpd)		12
6	Estimate water savings per day	gallons for all units	2400
C	**Costs per Gallon of Water Saved, Year 1**	**$/gallon/day**	**$2.33**

5.6 Toilet Rebates

Within single-family homes, the top water using appliance/fixture is typically the toilet. Since the implementation of the National Energy Policy Act in 1992 which mandated that all toilets manufactured in the U.S. must meet maximum 1.6 gallons per flush (gpf) standards, the toilet manufacturers have met this requirement with increasing higher quality toilets. As shown in **Table 15**, based upon 2000 U.S. Census data, in 2000 about 81 percent of single-family homes (5,257) in Valparaiso had been built prior to 1990. Seventy-three percent of the homes had been built prior to 1980. Therefore, given that the National Energy Policy Act was implemented in 1992 and given that some homes may have replaced the original toilets, it appears that there would still be a substantive market to increase toilet water use efficiency in Valparaiso.

Table 15.
Tenure by Year Structure Built

Occupied Single-family Housing Units in Valparaiso (2000)		
Year Built	**Number of Units**	**% Distribution**
Built 1999 to March 2000	192	3.0%
Built 1995 to 1998	551	8.5%
Built 1990 to 1994	490	7.6%
Built 1980 to 1989	522	8.0%
Built 1970 to 1979	1,078	16.6%
Built 1960 to 1969	1,126	17.3%
Built 1950 to 1959	983	15.1%
Built 1940 to 1949	492	7.6%
Built 1939 or earlier	1,056	16.3%
TOTAL	**6,490**	

Many water agencies have implemented toilet replacement programs either through direct installation programs or through toilet rebate programs. The toilet rebate programs have focused on encouraging consumers to purchase quality toilets that meet higher efficiency standards, and have less administrative burden than direct install programs.

A rebate on purchased toilets provides an incentive to consumers to replace older toilets (generally 3.5 or more gallons per flush) sooner than would be expected through natural replacement rates. Although the current Federal standard is 1.6 gpf toilets, the market has seen a transformation to even higher efficiency toilets (i.e., rated at 1.28 gpf). The rebate can be used to off-set the participant's cost of purchasing and installing the higher efficiency toilet. In most cases where toilet rebate programs have been implemented, there is an *approved list* of toilets that would meet the acceptability criteria. The U.S. Environmental Protection Agency's WaterSense program provides listings of high efficiency toilets that have met their certification criteria (see: http://www.epa.gov/owm/water-efficiency/pp/het.htm).

Typically, residential rebate programs must meet certain criteria of eligibility for participation. A basic process for a customer to participate in a rebate program may include:

1. Complete an application for the rebate (many utilities offer on-line applications)

2. Have an existing residential (or single-family) account in the water system, with no outstanding payments due

3. Must own or rent a single-family home built prior to 1993 (this can be confirmed through property records)

4. Purchase an approved toilet, with verification of payment for a specific model, within a specified time period.

5. Agree to a verification process (either through a home installation verification visit or provision of old toilet for recycling)

6. Agree to participate in follow-up surveys

A review of toilet rebate programs currently being implemented (via on-line searches), current rebate values for toilets in single-family homes range from $50 to $150 per rebate (higher rebates are more frequently offered in the multifamily and nonresidential sectors).

For the Valparaiso toilet rebate program, it is assumed that only single-family residents would be targeted; and consideration should be given to market the program to residents of older neighborhoods and lower income neighborhoods (i.e., those homes more likely to have less efficient toilets and who would benefit from the rebate).

Potential water savings from an installed high efficiency toilet can be calculated based upon manufacturing parameters and other assumptions.

For example,

- 1.6 gallons per flush * 5 flushes per day per person = 8 gallons
- 3.5 gallons per flush * 5 flushes per day per person = 28 gallons
- This equates to a savings of 20 gallons per day per person per installed toilet.

However, there are other considerations that factor into actual water savings. This may include the number of toilets in the home, the actual flush rate of the replaced toilet, the number of flushes per person per day in the home, the number of people per home, etc.

Therefore, more accurate estimates of water savings may be produced from empirical analysis of field studies of implemented programs. Chesnutt et al. (2007) reported a range of water savings from high efficiency toilet replacement programs. One study showed a 22 gallon per day water savings per toilet (or 10.6 percent reduction in total water consumption). More interestingly, they found a "declining marginal effectiveness of [installed] ultra-low-flush toilets," such that the second and third toilet replaced in a home have less water savings. They found a water savings of 30 gallons per day per toilet for the first toilet installed, 21 gallons per day for the second toilet installed, and 19 gallons per day for the third toilet installed. Logically, this is likely attributed to the fact that certain toilets in a home have more frequent use than others.

Table 16 provides some assumptions about a potential toilet rebate program for Valparaiso.

Table 16.
Toilet Rebate Program

Key assumptions: $150 rebate, 1000 rebates			
Water savings: 30 gpd/hh			
Year 1 rebates: 200 units; Duration: 2012 to 2017 (total of 1,000 units replaced)			
A	**Costs of the Conservation Measure, Year 1**	**Amount per Unit**	**First Year Costs**
1	Labor (0.5 hours per rebate @ 40.00)		$4,000.00
2	Rebates or other payments	$150	$30,000.00
3	Marketing and advertising		$300.00
4	Total program costs	$171.50	$34,300.00
B	**Estimated Water Savings, Year 1**		
5	Number of rebates		200
6	Estimated water savings per unit (gpd)		30
7	Estimate water savings per day	gallons for all units	6,000
C	**Costs per Gallon of Water Saved, Year 1**	**$/gallon/day**	**$5.72**

5.7 Washing Machine Rebates

After toilets, water use for clothes washing machines is typically the second highest water use inside a home, accounting for about 22 percent of indoor water use. The higher efficiency clothes washers can use up to half as much water as older models.

In the 1980s and 1990s, water agencies in water-stressed areas focused on *low hanging fruit* with their water conservation program efforts, first focusing on plumbing fixtures (toilets, showers, faucets),then outdoor water use, and then nonresidential uses. After picking this *low hanging fruit*, another type of water use became an increased focus for water efficiency efforts. This increased focused was on the second highest water use (on average) in single-family homes, that is, the washing machine. By the early 2000s, water conservation program efforts targeting washing machines were fairly standard. One primary reason was that increased efficiency in washing machines potentially saved both water and energy for consumers. Similar to toilets, there has been a market transformation toward more efficient clothes washing machines. The U.S. Environmental Protection Agency's ENERGY STAR program has long been a recognized consumer guide for energy efficient products (e.g., covering a wide range of electrical appliances). Over recent years, the ENERGY STAR program now not only addresses an energy factor in its ratings of clothes washing machines, but also has been including a water factor. EPA provides the following definitions:

> "A Modified Energy Factor (MEF) is a measure of energy efficiency that considers the energy used by the washer, the energy used to heat the water, and the energy used to run the dryer. The higher the MEF, the more energy efficient the clothes washer. Water Factor (WF) measures water efficiency in gallons of water consumed per cubic foot of capacity. The lower the WF, the more water efficient the clothes washer. "

On their listings of ENERGY STAR's qualified product lists, both MEF and WF are listed.

Water savings from the replacement of older inefficient clothes washing machines will vary based upon the age of the replaced machine, water use of the replaced machine, the water use of the new machine, as well as the frequency of use.

Chesnutt et al. (2007) report a range of water savings from washing machine replacements from various studies (with different measurement parameters). For example, they report the following examples of water savings:

- Consortium for Energy Efficiency: up to 9,000 gallons per year per replaced machine
- Tampa Bay (FL) Water Department study: 46.8 percent decrease in clothes washer water use
- East Bay Municipal Utility District study (Oakland, CA): 36.7 percent decrease in clothes washer water use
- Seattle Home Water Conservation Study 37.7 percent decrease in clothes washer water use

A water savings of 9,000 gallons per year would equate to about a 25 gallons per day per household water savings for a single-family residential home. For VCU, it is assumed that a washing machine rebate program would target single-family homes with an estimate of 100 rebates per year for a total of 500 rebates over a five year period. The cost of new clothes washing machines can vary substantively with type and model, but a common range would be $500 to $1,500 with higher efficiency models costing between $50 to $300 more than standard machines. A review of several water agencies offering clothes washer rebate programs found a range of rebates from $50 per washer to $175 per washer.

A clothes washer rebate program may be an opportunity for VCU to partner with the local energy provider, NIPSCO, as higher water efficiency clothes washers will likely also be an energy saver as well. In such a case, a partnership may be able to reduce the cost of the rebate to VCU.

Table 17 provides the detailed assumptions used in the analysis of water savings and program costs.

Table 17.
Washing Machine Rebate Program

Key assumptions:			
$150 rebate, 500 rebates, 9000 gallons per year per washer			
100 rebates 1st year, duration 2015 to 2020			
A	**Costs of the Conservation Measure, Year 1**	**Amount per Unit**	**First Year Costs**
1	Labor (0.5 hours per rebate @ 40)		$1,824.50
2	Rebates or other payments	$150	$15,000.00
3	Marketing and advertising		$300.00
4	Total program costs for the life of the measure	$171.25	$17,124.50
B	**Estimated Water Savings, Year 1**		
5	Number of washers		100
6	Estimated water savings per unit (gpd)		24.7
7	Estimate water savings per day	gallons for all units	2,466
C	**Costs per Gallon of Water Saved, Year 1**	**$/gallon/day**	**$6.94**

5.8 Residential Showerhead Giveaway

Water use by showers is typically the third largest use of water inside homes, with an average water use of about 13 gallons per capita per day (Mayer et al., 1999). The Task Force indicated interest in product giveaways as a means of raising awareness of water conservation as well as providing a mechanism to induce water savings.

Federal legislation passed in 1992 requires that showerheads have a maximum flow rate of 2.5 gallons per minute (gpm). However, Vickers (2001) indicates that in the period between 1980 and 1994, typical maximum fixture capacity was between 2.75 and 4 gpm, and prior to 1980, typical capacity was between 5.0 to 8.0 gpm.

Also, it has been noted that although the Federal Energy Policy Act mandated that by 1994 that showerheads sold, installed, or imported must meet the 2.5 gpm maximum flow rate, there are showerheads available in the marketplaces that do not conform to this standard. In December, 2005 the City of Seattle and the California Urban Water Conservation Council (CUWCC) put out a press release announcing that they are seeking sanctions against the manufacturers of said showerheads. Some of the showerheads in violation exceed the standard by as much as five times. Together the City of Seattle and the CUWCC are notifying the United States Department of Energy (DOE) of results from showerhead testing, in hopes that the manufacturers will halt production of these water-wasting showerheads. The DOE is responsible for enforcing the national standard.

It is common for water utilities to provide free water conserving showerheads to customers. These showerheads are often available to be picked up at the water utility's office location; sometimes it is required that the old showerhead is brought in for an exchange. Other mechanisms of distribution might include: giveaways at community events, giveaways at school programs, etc. Also, because a reduction in showerhead use may also have impact on energy use, partnership with NIPSCO may be beneficial.

Potential water savings of showerhead replacements will vary based upon the flow rate of the replaced showerhead, the flow rate of the new showerhead, the pressure on the system, and the frequency of showerhead use. AWWA (2006) reports that potential reductions in water use from the residential sector is about 21 percent of shower use. **Table 18** shows these potential shower water savings.

Table 18.
Potential Shower Water Savings

Options	Flow Rating	Device Life (yr)	Potential Water Savings (gal/cap/day)
New showerhead	2.5 gpm	5-10	2.3 (~21%)
Shower flow restrictor	2.5 gpm	10	(~21%)

Source: AWWA, 2006

Based upon the range of potential flow rates of the replaced showerhead, a conservative estimate of a water savings of 1 gallon per minute was used. It was assumed that 500 showerhead replacements would be distributed in a one-year program and that only 75 percent of those distributed would actually be installed (increased percentage of installation can be achieved if requirements are that an old showerhead be provided as a trade-in). Using standard rates of 8 minute showers and 2.6 persons per home, it was estimated that a showerhead replacement could saving approximate 21 gallons per single-family home.

Costs of showerheads can certainly vary, however, the $9 per showerhead estimate assumes that VCU could get a bulk rate discount on showerheads (note that this cost per showerhead is less than that assumed for the hotel/motel showerhead program, as it is expected that a commercial grade showerhead would be more expensive).

Table 19 provides the detailed assumptions used in the analysis of water savings and program costs.

Table 19.
Residential Showerhead Giveaway

Key assumptions: Target 500 showerhead replacements, 75% actual installations, 1 gpm, 8 minutes, 2.6 persons			
Duration: 1 year program: 2011			
A	**Costs of the Conservation Measure, Year 1**	**Amount per Showerhead**	**First Year Costs**
1	Materials (replacement showerhead)	$9.00	$4,500.00
2	Labor (40 hours @ 40.00)		$1,600.00
3	Total program costs	$12.20	$6,100.00

Table 19.
Residential Showerhead Giveaway

B	**Estimated Water Savings, Year 1**		
4	Number of showerheads		500
5	Percent actually installed (75%)		375
6	Estimated water savings per unit (gpd)		20.8
7	Estimate water savings per day	gallons for all units	7800
C	**Costs per Gallon of Water Saved, Year 1**	**$/gallon/day**	**$0.78**

5.9 Pre-rinse Spray Valves

Pre-rinsing spray valves in commercial kitchens are typically used for pre-rinsing activities prior to placing dishware and kitchen utensils in the dishwashing machine and also for manual cleaning of dishware and other food apparatus in commercial kitchen type environments. In some cases nearly half of the water used in dishwashing activities can be attributed to pre-rinsing activities performed to remove food from dishware and utensils prior to placing them into the dishwasher. A conservation program to replace less efficient pre-rinsing spray valves (PRSV) with more efficient high pressure/low volume spray valves offers an opportunity to reduce water use in commercial kitchens. The Alliance for Water Efficiency reports that "a traditional PRSV uses high volumes of water, usually 2 to 5 gallons per minute (gpm). A high- efficiency PRSV uses 1.6 gpm or less; and removes food residue faster than the traditional PRSV."

An example of a program promoting the use of more efficient high pressure/low volume spray valves in commercial kitchens is the one offered by the California Urban Water Conservation Council (CUWCC). The Council's 2002 to 2006 Rinse and Save Program installed more than 16,000 high-efficiency pre-rinse spray valves and reported average savings of 137 gallons per day and 50,000 gallons per year per installed valve (see: http://www.allianceforwaterefficiency.org/commercial_dishwash_intro.aspx?terms=dishwashers).

The Rinse and Save Program predominantly targeted small food service facilities using direct mail followed by door-to-door canvassing. Efficient pre-rinse spray valves were offered and installed for customers for free. Similar to a showerhead distribution program, PRSV's will also have impact of saving energy. Therefore, consideration should be given to partnering with NIPSCO on such a program.

Whereas the common pre-rinsing spray valve uses up to 3 gallons per minute, CUWCC defines an efficient spray valve as one that uses 1.6 gallons or lower while maintaining the same cleaning capabilities of the higher water using spray valve.

Table 20 presents total estimated savings and other useful information about pre-rinsing spray valves in the food service operations in the State of California.

Table 20.
Total Estimated Savings and Other Useful Information about Pre-Rinsing Spray Valves

Food Service Category	Population of Pre-rinse valves*	Hours of usage per day	Water savings per valve (gallons/day)	Gas savings per valve** (therms/day)	Total gas savings (therms/ year)	Total water savings (ccf/year)
Medium	15,000	6	300	2	11,000,000	2,200,000
Small	35,000	4	200	1.3	16,600,000	3,400,000
Very small	25,000	2	100	0.7	6,400,000	1,200,000
Total	75,000				34,000,000	6,800,000

** Based on National Association of Food Equipment Manufacturers (NAFEM) inventory of California installed dishwashing machine populations and types.*

***Assumes a Water heating efficiency of 70% and 55 degrees F temperature rise.*
Source: Koeller and Dickenson, AWWA, 2003.

A web search of the cost of pre-rinse spray values determined a typical cost of about $60 per PRSV. However, based upon quantities purchased, bulk discounts may be available. The Food Service and Technology Center provides information about various products and their testing to meet efficiency criteria (see: http://www.fishnick.com/equipment/sprayvalves/). For VCU, it is assumed that a PRSV distribution program would follow that of the CUWCC Rinse and Save Program, such that restaurants would be targeted using direct mail followed by door-to-door canvassing, and that PRSV would be offered and installed for customers for free.

Based upon U.S. Bureau of Census' County Business Patterns, it was found that there are approximately 250 restaurants in Porter County. Based on that, it was estimated that VCU would target 50 restaurants in Valparaiso for PRSV distribution and installation. Based on CUWCC findings, it was assumed that water savings would be about 130 gallons per day per restaurant. **Table 21** provides the detailed assumptions used in the analysis of water savings and program costs.

Table 21.
Pre-Rinse Spray Valves

Approximately 250 restaurants in county			
Key Assumptions:			
Target 50 restaurants in 2011; 15 per year from 2012 to 2016			
Water savings: 137 gallons per day per establishment			
A	**Costs of the Conservation Measure, Year 1**	**Cost per Restaurant**	**First Year Costs**
1	Materials (pre-rinse spray valve)	$60.00	$3,000.00
2	Labor (1.5 hours @ $40)	$60.00	$3,000.00
3	Marketing and advertising		$300.00
4	Other (travel), average of 10 miles per audit ($0.585/mile)	$5.85	$292.50

Table 21.
Pre-Rinse Spray Valves

5	Total program costs	$131.85	$6,592.50
B	**Estimated Water Savings, Year 1**		
6	Number of restaurants		50
7	Estimated water savings per unit (gpd)	gallons per day per establishment	130
8	Estimate water savings per day	gallons for all units	6500
C	**Costs per Gallon of Water Saved, Year 1**	**$/gallon/day**	**$1.01**

5.10 Water Hose Mechanical Timer

Water conservation programs often target outdoor water use for increases in water use efficiency. There are a wide range of opportunities for increases in outdoor/landscape water use efficiency, including (Vickers, 2001):

- Water-wise landscape planning and design (including use of native and low-water use turf and plants)
- Landscape irrigation systems and devices
- Landscape irrigation scheduling
- Soil improvements
- Mulches

The potential for water savings from outdoor water uses is dependent upon how much water is typically used outdoors. On average, single-family residential water use in the VCU service area has been about 172 gallons per household per day (average from January 2006 to December 2008). Based upon the seasonal variation in residential water use (see **Figure 5** in Section 3), it was estimated that about 76 percent of water use is non-seasonal (approximates indoor use) and about 24 percent is seasonal use (approximates outdoor use). The component of seasonal (outdoor) water use is not high compared to other areas of the country. In the *Residential End Uses of Water* study conducted for the American Water Works Association Research Foundation, a study of 14 sites in the U.S. and Canada, the percent of annual use that is for indoor purposes ranged from 90 percent of total annual use in Cambridge, MA to 25 percent of total annual use at a site in Southern California. On average across the country, in single-family homes, about 70 percent of water is used for indoor purposes and 30 percent in used for outdoor purposes. The greatest use of outdoor water use is typically for watering lawns, plants, or gardens. Across the country, one of the major inefficiencies of water use is attributed to landscape water use. One of the greatest contributors to that inefficiency is typically attributed to automatic irrigation systems. (For example, have you ever seen an automatic sprinkler system running during a rain storm?) There are a number of reasons for this inefficiency including:

- Excessive irrigation beyond that required by the natural system
- Timing of irrigation (during heat of day)
- Frequency and duration of irrigation beyond that required by the natural system
- Inefficient equipment/poor maintenance (e.g., broken sprinkler heads)
- Incorrect irrigation scheduling for automatic systems

Of those homes in Valparaiso that irrigate their landscape, it is not known what percentage use automatic irrigations systems versus a hose (with or without a sprinkler). The Task Force indicated interest in product giveaways as a means of raising awareness of water conservation as well as providing a mechanism to induce water savings. Targeting those homes that use a hose and sprinkler system, one possible giveaway is a water hose mechanical timer. The mechanical timers can generally be attached to a faucet, hose, or sprinkler and can be set for automatic shut-off (either based on gallons or duration of time). Costs for mechanical timers start at about $5 up to $40. Based upon a web search it appeared that a typical cost was about $10 per device (with a potential for bulk purchase discounts). It is estimated that water savings from water hose mechanical timers can be about 5 to 10 percent of outdoor use.

VCU can advertise this giveaway program through press-releases, information on their website, or on their water bill. It is expected that VCU would give mechanical timers to single-family residential customers free-of-charge. These devices can be made available for pick-up at the water utility's office location. Other mechanism of distribution might include giveaways at community events (however, it is recommended that the devices only be given to those who might use it).

Based upon the estimate of seasonal (76 percent) and non-seasonal (24 percent) water use percentages, it is estimated that an average single-family home uses about 15,000 gallons of water outdoor annually. If a water hose mechanical timer can reduce outdoor use by 8 percent the water savings would be about 1,200 gallons per single-family home annually. **Table 22** provides the detailed assumptions used in the analysis of water savings and program costs.

Table 22.
Water Hose Mechanical Timer

Key assumptions: water hose mechanical timer ($6)			
500 kits, 75 % installation			
Average residential water use (gpd/household)			172
Average residential water use (annual water use/hh)			62,780
Non-seasonal use, %			76%
Non-seasonal use (annual water use/hh)			47,713
Seasonal use, %			24%
Seasonal use (annual water use/hh)			15,067
Water savings: 8% of outdoor use, annual water use/hh			1,205
Duration, 2 year program, 2015 to 2016 (250 year 1; 250 year 2)			
A	**Costs of the Conservation Measure, Year 1**	**Amount per Timer**	**First Year Costs**
1	Materials (mechanical hose timer)	$10.00	$2,500.00
2	Labor (8 hours @ $40)		$320.00
3	Total program costs	$11.28	$2,820.00
B	**Estimated Water Savings, Year 1**		
4	Water hose mechanical timer, purchased		250
5	Percent actually installed (75%)		187
6	Estimated water savings per unit (gpd), annualized	8% of outdoor use	3
7	Estimate water savings per day, annualized	gallons for all units	619
C	**Costs per Gallon of Water Saved, Year 1**	**$/gallon/day**	**$4.55**

5.11 Ordinance for Automatic Sprinkler Shut-Off Devices

Much of the discussion regarding outdoor water use and opportunities for outdoor water use efficiency in the previous subsection applies to this potential conservation initiative. Vickers (2001) states that "automatic irrigation systems often waste water because users or landscape service providers don't understand how or don't bother to set the frequency and duration of irrigation runs correctly." There are a number of opportunities to increase water use efficiency of irrigation systems, including (Vickers, 2001):

- Improving irrigation system designs
- Regular adjustments of irrigation system controllers
- Installation of a water-efficient irrigation system controller
- Installing rain shutoff devices
- Inspecting and maintaining sprinkling components
- Checking for sprinkler distribution system uniformity

The irrigation industry has become very sophisticated with respect to equipment modifications for water use efficiency. The U.S. Environmental Protection Agency's WaterSense program has initiated draft specifications for certifying weather- or sensor-based irrigation control technologies (see: http://www.epa.gov/owm/water-efficiency/pp/controltech_overview.htm). As noted on the WaterSense website:

> "Weather- or sensor-based irrigation control technology uses local weather and landscape conditions to tailor irrigation schedules to actual conditions on the site or historical weather data. Instead of irrigating according to a preset schedule, advanced irrigation controllers allow irrigation to more closely match the water requirements of plants. These new control technologies offer significant potential to improve irrigation practices in homes, businesses, parks, and schools across the United States. WaterSense plans to label weather-based irrigation controllers and soil moisture sensors."

A brief survey by VCU of area developers of single-family homes found that about 30 to 40 percent of new homes built in the area in the past five years had an automatic irrigation system. One opportunity to increase water use efficiency of these automatic irrigation systems is to mandate that all new construction in the city/county use "sensors and valves that shut-off hoses and irrigation system controllers during and after rainfall (Vickers, 2001). " **Appendix D** provides an example of such an ordinance.

Based upon the estimate of seasonal (76 percent) and non-seasonal (24 percent) water use percentages, it is estimated that an average single-family home uses about 15,000 gallons of water outdoors annually. Vickers (2001) reports "installing a device that shuts off an automatic irrigation system can save an estimated 5 to 10 percent of water used outdoors. Rain sensor cost $15 to $45."

An ordinance for automatic sprinkler shut-off devices on all new single-family construction with an automatic irrigation system can be developed. **Table 23** provides the detailed assumptions used in the analysis of water savings and program costs. It is assumed that the ordinance would be implemented in 2016. As shown previously in **Table 2**, the number of occupied housing units in the Valparaiso Super Analysis Zone is projected to increase from 15,925 units in 2000 to 18,826 units in 2030, representing an average annual rate of change of 0.56 percent. Applying this annual rate of change to the number of VCU single-family accounts from 2016 to 2030, a projected number of 862 new single-family accounts would be added to the VCU system by 2030. If half of those new accounts were to install an automatic sprinkling system, approximately 431 new single-family accounts would be subject to the ordinance by 2030.

Table 23.
Ordinance for Automatic Sprinkler Shut-Off Devices

Average residential water use (gpd/hh)			172
Average residential water use (annual water use/hh)			62,780
Non-seasonal use, %			76%
Non-seasonal use (annual water use/hh)			47,713
Seasonal use, %			24%
Seasonal use (annual water use/hh)			15,067
Water savings: 8% of outdoor use, gallons per year			1,205
Duration: 28 units per year between 2016 and 2030			
A	**Costs of the Conservation Measure, Year 1**		**Total Cost of the Measure**
1	Contract Labor (24 hours @ $175), to write ordinance		$1,800.00
2	Monitoring and enforcement (16 hours per year at $40 between 2016 and 2030)		$640.00
3	Total program costs (Year 1)		$2,440.00
B	**Estimated Water Savings, Year 1**		
4	Estimated water savings per unit (8% * seasonal use)	gallons/year	1,205
5	Estimated water savings per unit (annualized)	gallons/day	3
6	Total water savings per day all participants (half of all new homes per year), approximately 28 per year between 2016 and 2030 (431 new single-family accounts) (annualized)	gallons/day	91
C	**Costs per Gallon of Water Saved, Year 1**	$/gallon/day	$26.74

5.12 Government Facility Audit and Toilet Replacement

In any implemented conservation program, it is recommended that the implementing agency (i.e., VCU):

1. Lead by example

2. Demonstrate its successes

Social research related to water conservation behaviors during drought periods suggest that "a belief that others in the relevant group will also conserve" is tied to positive water conservation behaviors. Therefore, regardless of any other programmatic initiatives that may be undertaken by VCU, the utility and the City needs to demonstrate its own commitment to the cause. This can be undertaken by conducting a review of how much water is being used by the City/utility and for what purposes. A facilities audit can be conducted to determine opportunities for increased water use efficiency. A facilities audit of City/utility facilities may follow the basic steps of a commercial, industrial, or institutional site water audit described earlier (Vickers, 2001):

1. Obtain support from facility owners, managers, and employees

2. Conduct on-site inventory of water use

3. Calculate all water-related costs
4. Identify and evaluate water-efficiency measures
5. Evaluate payback periods using life-cycle costing
6. Prepare and implement an action plan
7. Track and report progress

Part of the on-site inventory of water use may include testing the flow rates of toilet, urinals, faucets, etc. to determine their efficiency level. For the purpose of this assessment, it is assumed that 20 toilets in City/utility facilities can be replaced in 2010 with higher efficiency toilets.

Vickers (2001) reports that:

> "In an office, replacing a 3.5 gpf toilet with a 1.6 gpf will save an estimated 1.9 gallons per capita per day for males and 5.7 gallons per capita day for females, the equivalent of 494 gallons per capita per year and 1,482 gallons per capita per year, respectively. A study of more than 200 1.6 gpf pressurized-tank toilets that replaced high-volume (2.5 gpf and higher) fixtures in a variety of commercial properties in two California communities, the city of Petaluma and Rohnert Park, found that the average savings per toilet was 26 gallons per day."

As discussed earlier, the market has seen a transformation to even higher efficiency toilets (i.e., rated at 1.28 gpf). Therefore, there may be even larger potential water savings than 26 gpd per toilet. However, for the purpose of this analysis, the water savings estimate of 26 gallons per day per toilet was used. For the City/utility facilities, it was assumed that 20 toilets could be replaced at a cost of about $400 each (including installation). The costs of this initiative also included 80 hours of staff time to survey the government facilities to identify opportunities for potential increases in water use efficiency not only with toilets but in other areas as well. **Table 24** provides the detailed assumptions used in the analysis of water savings and program costs.

Table 24.
Government Facility Audit and Toilet Replacement

Key assumptions: 20 toilet replacements, $400 per toilet, including installation cost			
Water savings: 26 gpd per toilet			
Duration: 2010, 1 year program			
A	**COSTS OF THE CONSERVATION MEASURE, Year 1**	**Amount per unit**	**First Year Costs**
1	Labor (80 hours for survey of government facilities @ 40.00)		$3,200.00
2	Toilet Replacement Costs	$400	$8,000.00
3	Total program costs	$560	$11,200.00

Table 24.
Government Facility Audit and Toilet Replacement

B	**ESTIMATED WATER SAVINGS, Year 1**		
4	Number of toilets replaced		20
5	Estimated water savings per toilet (gpd)		26
6	Estimate water savings per day	gallons for all units	520
C	**COSTS PER GALLON OF WATER SAVED, Year 1**	$/gallon/day	$21.54

5.13 Water Savings and Program Costs (Year 1)

Estimates of potential water savings and program implementation costs were provided for each of the 12 programmatic initiatives described in this section. For ease of comparison, only the initial year water savings and initial year program implementation costs were presented in the comparison tables. It needs to be recognized that in many cases, the program implementation costs are often weighted toward the beginning of program efforts, but the water savings and other corresponding benefits can be achieved during the life of the measure. This issue will be addressed in the following section. However, the comparison in **Table 25** provides a one-year snapshot comparison of estimated water savings and potential costs to the water utility.

Table 25.
Preliminary Comparison of Program Water Savings and Cost (Year 1 only)

Program	Estimated Water Savings (Year 1, gallons per day)	Estimated Water Savings (Year 1, total gallons)	Program Costs (Year 1, Dollars)	Cost-Effective-ness (Year 1, $/gallons per day)
Public Education and Information	82,900	31,258.500	$59,205	$0.71
Residential Showerhead Giveaway	7,800	2,847,000	$6,100	$0.78
Pre-Rinse Spray Valves	6,500	2,372,500	$6,593	$1.01
Hotel/Motel Showerhead Replacement	2,400	876,000	$5,600	$2.33
Water Hose Mechanical Timer	619	226,008	$2,820	$4.55
Single-Family Indoor/Outdoor Audit	625	228,125	$3,521	$5.63
Toilet Rebates	6,000	2,190,000	$34,300	$5.72
Washing Machine Rebates	2,466	900,000	$17,125	$6.94
School Water Audit	1,800	657,000	$12,835	$7.13
Industrial Water Audits	2,350	857,750	$21,329	$9.08
Government Facility Audit And Toilet Replacement	520	189,800	$11,200	$21.54
Ordinance For Automatic Sprinkler Shut-Off Devices	91	33,303	$2,440	$26.74

Section 6
Benefits and Costs of Conservation Programs

A benefit-cost analysis of conservation programs will assist in determining which programs are most advantageous for implementation. In some cases, there is a point where efforts to conserve water resources require more resources than can be saved. In a world of increasingly limited budgets, it becomes increasingly important to choose the most efficient programs that are economically viable. Therefore, benefit-cost analyses provide a screening mechanism for choosing the most efficient alternatives. Carefully formulated program alternatives can be compared in terms of their cost and their yield in water savings. Furthermore, benefit-cost analyses enable supply side initiatives (e.g., additional source capacity or treatment plant expansion) to be compared to conservation program alternatives using the same economic criteria. A benefit-cost analysis also evaluated the effect of water conservation efforts on the sizing and timing of future water facilities.

Benefit-cost analysis and cost-effectiveness are two terms that are sometimes used synonymously. However, there is a distinction between the two. In benefit-cost analysis, both the benefits and costs are examined. Cost effectiveness only refers to a comparison of the costs (the numerator) of various actions and the water savings (the denominator), with the measurement parameter being dollars per quantity of water saved. However, benefit-cost analysis allows comparison of alternatives of differing levels of benefits.

Benefit-cost analysis is conceptually very simple, but its application can be quite involved because of the many benefit and cost elements that must be accounted for. In this section, a description is provided of potential benefits and costs that can be accounted for in any water conservation analysis. Then, the assumptions and findings of the water conservation programs described in the previous section are documented.

6.1 Potential Water Conservation Benefits

The benefits of water conservation alternatives arise from the reduction in water use and/or losses. Some of the benefits can be related to the reduction in water supply costs. Other benefits are indirectly related to the reductions in water use (e.g., energy cost savings). Implementing water conservation alternatives may reduce the short-run incremental costs of water and wastewater disposal. Short-run incremental costs are those costs that can be immediately changed in response to changing water use patterns, and are not associated with capital facilities. They include the costs of chemicals, energy, labor, materials, etc.

Long-run incremental costs of water supply and wastewater disposal may also be reduced, and are those costs associated with providing capital facilities for water

supply and wastewater disposal. The forgone costs of delaying, deferring, or eliminating additional capital expenditures may be major benefit of a water conservation program.

In preparation of a benefit-cost analysis, the following benefit categories can be considered:

- Utility cost savings
  - Reduced operation and maintenance variable costs (e.g., chemical and energy costs)
  - Deferred, eliminated, or downsized new facilities
- Program participant benefits
  - Incentives
  - Reduced water bills
  - Reduced wastewater bills
  - Reduced energy bills
- External benefits (e.g., environmental benefits associated with reduced pumpage/use)
- Enhanced system reliability

VCU's benefits from water conservation can be divided in two categories:

- Annual energy and chemical cost savings resulting from less pumpage and chemical treatment of water and wastewater.
- Deferred or eliminated capital projects needed to increase system capacity to meet projected demands.

6.1.1 Annual Energy and Chemical Cost Savings from Conservation

VCU provided annual energy and chemicals costs and for both water and wastewater operations, as well as water production and wastewater collection flows. Based on this data, an estimate of dollars saved per 1,000 gallons of flow conserved was calculated, as follows:

- Water $0.24/1,000 gallons
- Wastewater $0.27/1,000 gallons

Labor, operations and maintenance costs are considered fixed costs and therefore were not factored in the cost analysis.

6.1.2 Deferred or Eliminated Capital Projects

As discussed in Section 3, the impact of water conservation could be realized with either the delay or elimination of two capital projects:

- Expansion of the Airport WTP by the year 2015 to supply the projected maximum day demand of the system estimated at a present worth capital cost of $2M.
- A new 1-MG elevated tank potentially needed by the year 2025 to meet projected peak hour demand of the system estimated at a present worth capital cost of $2M.

The financial benefit of delaying or eliminating both projects was factored in the benefit-cost analysis.

6.2 Potential Water Conservation Costs

Each water conservation alternative is associated with a proposed implementation plan. It includes specific actions to be taken to implement and maintain the program, target population, and duration of programmatic activities. The details are used to estimate implementation program costs.

In preparation of a benefit-cost analysis, the following cost categories can be considered:

- Utility program costs
  - Administration costs
  - Unit costs of equipment or materials
  - Field labor costs
  - Paid incentives
  - Publicity/marketing costs
  - Program monitoring and evaluation costs
- Decreased utility revenue
- Customer program costs
  - Equipment, materials, installation costs borne by the customer
  - Operation and maintenance costs borne by the customer

The potential water conservation program costs were provided as part of Section 5.

The potential impact of water conservation savings on utility revenue was based upon the current marginal price of water and wastewater to VCU customers. For metered customers, the rates shown in **Table 26** rates apply to monthly quantities of water use. For residential customers, it was assumed that their marginal usage (i.e., the last unit of quantity used) would typically fall into the first consumption block (i.e., first 2,000 CF/month) and all other types of customers would, on average fall into the second consumption block (i.e., next 8,000 cubic feet). The sewer marginal rate would apply to all water savings. The decreased water utility revenue from water savings from potentially implemented conservation programs were calculated by the quantity of water saving multiplied by the marginal rate of water and sewer service (e.g., for residential customers, water savings in CCF/year were multiplied by the marginal rate [1.85+3.16] to determine lost utility revenue).

Table 26.
Current VCU Water and Sewer Rates

Water Rates	Rate per 100 cubic feet
First 2,000 cubic feet	$1.85
Next 8,000 cubic feet	$1.50
Next 1,490,000 cubic feet	$1.17
Over 1,500,000 cubic feet	$0.93
SEWER RATES	Rate per 100 cubic feet
All usage per 100 cubic feet	$3.16

6.3 Potential Water Savings

Based upon the implementation of each water conservation program initiative described in Section 5, **Table 27** shows the combined water savings impact between 2010 and 2030. The largest water savings would be attributed to a more aggressive public education/public information program (PE/PI outreach program). The basic assumption of the PE/PI program is that it would achieve 2 percent of the municipal water use in 2010 and 7 percent by the year 2030. Other conservation program initiatives would represent an additional 2.5 percent savings in water use by the year 2030.

Table 27.
Potential Water Savings and Restricted Water Demand (Average Daily Demand)

	2010	2015	2020	2025	2030
Baseline Demand (MGD)	4.14	4.27	4.39	4.53	4.66
Est. water savings--PE/PI (gpd)	82,862	192,004	285,629	316,812	326,315
% savings	2.0%	4.5%	6.5%	7.0%	7.0%
Est. water savings--Other measures (gpd)	520	56,414	97,514	107,263	114,695
% savings	0.0%	1.3%	2.2%	2.4%	2.5%
RESTRICTED WATER DEMAND--12 measures (MGD)	4.06	4.02	4.01	4.10	4.22
% savings	2.0%	5.8%	8.7%	9.4%	9.5%

With standard factors of maximum-day to average day use of 1.78 and of peak hour to maximum day use of 1.5 (as calculated for VCU), the resulting restricted water demand is shown on **Figure 11**.

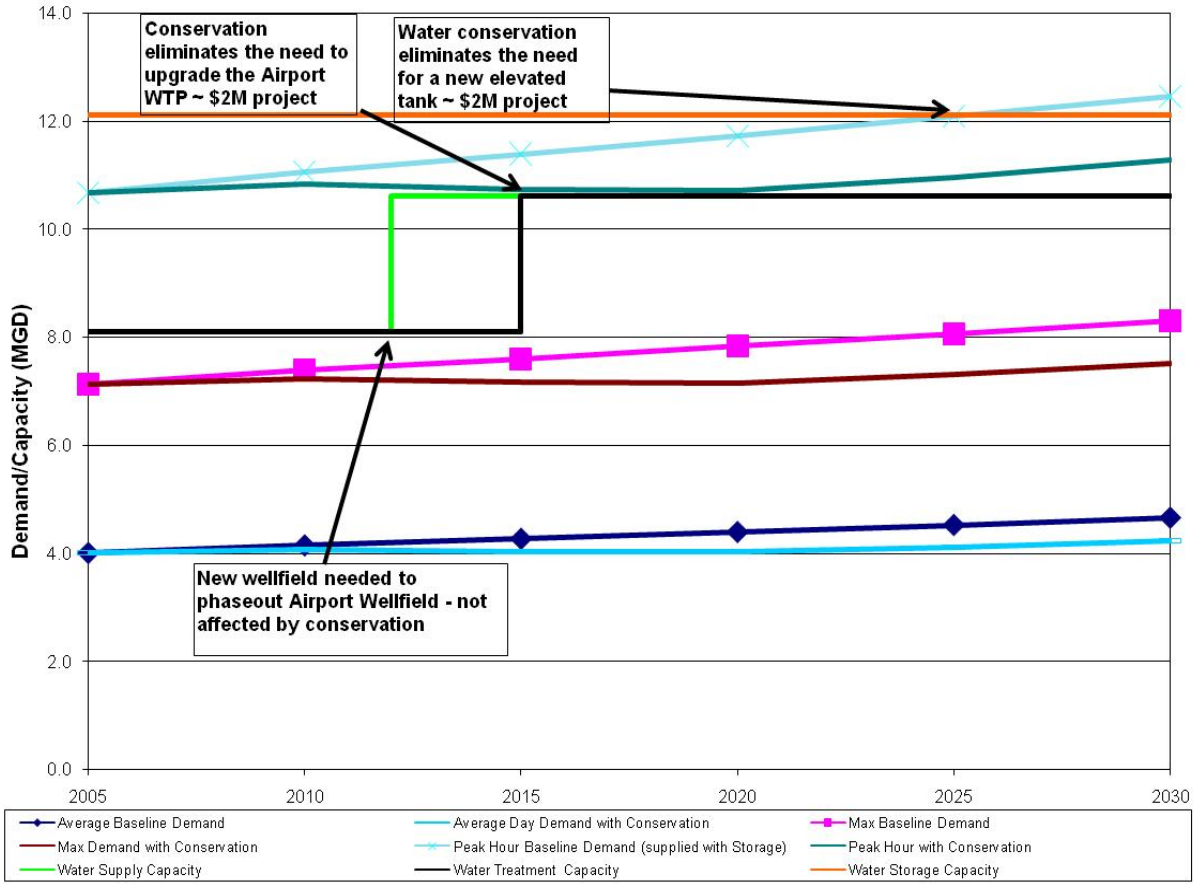


Figure 11.
Impact of Water Conservation on Water Supply and Demand

If VCU were to implement the 12 water conservation program initiatives (or some variant thereof) resulting in approximately a 10 percent reduction in average day demands by the year 2030, the two capital project referenced in Section 6.1.2 could be eliminated for the planning horizon to 2030.

6.4 Benefit-Cost Calculations

The estimated water savings and calculated benefits and costs associated with each conservation program initiative is shown in **Table 28**; the savings, benefits, and costs represent a cumulative total across the lifespan of the program during the planning horizon (from 2010 to 2030). Note that the benefit-cost analysis presented in **Table 28** only reflects the utility perspective (or point of view). There are other perspectives that can also be considered: the participant perspective (i.e., some household or customer account that participants in the program and may gain benefits from it) or the community perspective (i.e., a broader point that includes the utility, participant,

and non-participants). Varied perspectives can offer a wider view of the benefits and costs of a conservation program initiative. For example, in a rebate program offered by the utility, the rebate itself is a cost to the utility, but it is a benefit to the participant. However, unless the water utility is willing (or financially able) to undertake potential programmatic costs of an initiative, then the potential benefits to the participant (though they may be great) may be a mute point.

The net present value of each water conservation measure and potential water savings are summarized in **Appendix B**[1]. The cost of water conservation programs shown in **Appendix B** are those related to the actual cost of the programs as well as the water and wastewater lost revenue. The net present value provides a comparison of costs and benefits throughout the life of the conservation initiative. The net present value is calculated as the difference between the present value of benefits and the present value of costs. A program with a positive net present value indicates that benefits exceed the costs.

The benefit-cost ratio is another commonly used method of measuring economic efficiency. For a given accounting perspective, this method determines the ratio of the present value benefits to the present value of costs. Those conservation measures with a benefit-cost ratio greater than that 1.0 are economically efficient.

Appendix B Spreadsheet does not include the impact of the deferral or elimination of capital facilities as these would only be impacted by the combined effect of water saving from all programmatic initiatives.

As shown in the individual conservation tables and **Appendix B**, none of the water conservation program initiatives have benefits that exceed the costs. The most substantive factor in this calculation is the water and wastewater revenue impact (i.e., the lost revenue to the utility of reducing water use). If the water and wastewater revenue impact were not considered, the most beneficial programs would be the pre-rinse spray value program (restaurants) and the residential showerhead giveaway program.

Table 28 shows the combined effect of all 12 evaluated water conservation programs and their associated benefits and costs to the utility. However, **Table 28** also shows the dollar benefit (in net present value of eliminating the two major capital expenditures).

Table 28.
Benefit Cost Analysis--Summary All Programs

[1] In an analysis of benefits and costs, inflation is typically not considered. However, in order to compute net present value, it is necessary to discount future benefits and costs. This discounting reflects the time value of money. Benefits and costs are worth more if they are experienced sooner. All future benefits and costs should be discounted. The higher the discount rate, the lower is the present value of future cash flows. A forecast of nominal or market interest rates for 2008 based on the economic assumptions of the Federal 2009 budget estimate that nominal 20 year rate to be 4.9 percent (OMB, Circular No. A-94, 1992 and 2008 updates). In the benefit-cost analysis presented herein, a 5 percent discount rate was used.

Table 28.
Benefit Cost Analysis--Summary All Programs

1. Water savings (ccf)	$3,358,900
2. Program costs	
Implementation costs	$1,172,360
Water & Wastewater Revenue impact	$8,704,760
TOTAL Present Value Costs	$9,884,740
3. Program benefits	
Reduced energy & chemical costs for water treatment (dollars per gallon)	$331,060
Reduced energy & chemical costs for ww treatment (dollars per gallon)	$374,460
Benefit of eliminating elevated tank (2015)	$1,492,430
Benefit of eliminating Airport water treatment plant expansion (2015)	$1,492,430
Present Benefits	$3,690,380
Net Present Value	($6,194,360)
Benefit-Cost Ratio	**0.37**

As shown in **Table 28**, the economic costs of these devised water conservation initiatives outweigh the economic benefits, and it is therefore in the best interest of VCU to approach water conservation program implementation cautiously, focus on PI/PE and implementation of pilot studies to verify the impact on the utility. A phased approach to minimize the financial impact on the City should be considered and a rate impact analysis needs to be initiated. The next Section provides an implementation approach and schedule for the VCU.

Section 7

Implementation and Next Steps

7.1 Implementation

Given the results of the financial analysis presented in Section 6, it is important to consider a phased approach to water conservation. A phased approach to water conservation limits the immediate financial impact on the utility and builds a solid foundation for additional programs that can be implemented over the years.

The first phase of any water conservation program is public education and outreach. As discussed earlier in the report, there is still a lack of knowledge in the community about water supply source, and how much supply exists, etc. Therefore, by developing a systematic public education and public information (PE/PI) program, the community is more likely to support additional programs, such as audits, toilet replacement, etc., down the road.

The second phase of the plan can include water audits at different facilities, starting with City-owned facilities. Water audits can raise awareness in the community and also identify opportunities for increasing efficiency without making any sacrifices.

The third phase of the plan can include more structural water conservation measures, such as toilets and showerhead replacements.

7.2 Next Steps

As part of research conducted in the late 1980s on factors that affect consumer adoption of water conservation during drought, some relevant conclusions were made that apply to both long-term and short-term (drought) water conservation initiatives. The most basic premise is that fostering water conservation comprises two important concepts: (1) convincing the consumers that they should conserve water and (2) providing them with information on how to do it.

Attitudes which have been found to be associated with consumer's water conservation behavior include:

1. Perceived seriousness of the situation: consumers will make an effort to conserve if they believe that there is a need

2. Social/moral commitment: conservation programs will be more effective if appeals are made to social responsibilities stressing the need to make a fair contribution

3. Perceived efficacy of conservation: consumers will adopt conservation behavior if they are convinced that their individual effort can make a difference

4. Perceived inconvenience and cost: consumers will adopt only those conservation practices for which personal cost and inconvenience are not excessive

5. Perceived equity: conservation campaigns will be effective if consumers are convinced that all members of the community are required and make sincere efforts to conserve

Based on the above five points, it is important to develop and promote a paradigm shift for Valparaiso on the value of water and set an example for other Midwestern communities that water conservation is possible and beneficial.

The first priority will be a PE/PI program that will consist of water conservation messages on customer billing statements, presentations/panel discussions at schools, working with the local newspaper, speaking at city events on the value of water, meeting with businesses and industries, using the City's website and using other avenues to provide a consistent message to the community about the value of water and its impact on the City's livelihood. VCU has joined and/or partnered with key organizations, including the Alliance for Water Efficiency and the EPA WaterSense Program. Valparaiso is the second city in the State to become a member of the EPA WaterSense Program. VCU will use tools and resources developed by these organizations to educate the public and encourage water efficiency.

7.3 Monitoring

Based on the financial analysis presented in Section 6, it is important to monitor the financial impact of water conservation on the utility's financial health. The IURC is in the process of developing (and eventually promoting) water conservation friendly rates. VCU is monitoring IURC's progress and will consider rate changes, as recommended by the IURC.

Regardless of any programmatic activity that VCU decides to pursue down the road, it is recommended that pilot programs be initiated prior to the full-scale implementation of any initiative.

Appendix A
Meeting Presentations and Meeting Summaries

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: May 15, 2009
Meeting Time: 8:30 a.m. to 10:00 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list.

Attendants:

The following Task Force members/resource persons were in attendance:
John Hardwick, Jim Fitzer, Bob Schwartz, Amrou Atassi, Jim Pingatore, George Brown, Shihua Chen, Michael Simpson, Kathy Luther and Jim Deardorff.

Materials Distributed During The Meeting:

- Agenda (attached)

Agenda Item 1 – Introductions and Today's Objectives

The objectives of the meeting were:

- Recap the last (February 13, 2009) meeting
- Discuss the implementation schedule and next steps of the WCP
- Hold a roundtable discussion of the PE/PI program of the WCP

Agenda Item 2 – Documents Distributed

- Agenda
- February Meeting Summary

Agenda Item 3 – Implementation Schedule and Next Steps

CDM presented the implementation schedule and next steps of the Public Education/Public Information Program of the Water Conservation Plan:

A. Target Audience/Groups
B. How Do We Get To Our Audience - Contact Modes
C. Resource Requirements
D. What Is The Message?
E. Partner Organizations
F. Schedule and Metrics

Agenda Item 4 – Roundtable Discussion of Next Steps

The group held a roundtable discussion of the six topics presented in agenda item 3, and the following list represents the ideas and suggestions of the group:

A. Target Audience/Groups

1. School system – teachers, students and parent-teacher associations
2. Community organizations – charitable groups such as United Way agencies
3. City Council
4. Home builders – Porter County Builders Association
5. City Planning Commission
6. Banta Activity Center - seniors
7. Speakers bureau
8. Plumbers (use Fred Jarvis as a resource)
9. Vendors/Retailers – VonTobel's, Home Depot, Menards
10. Valparaiso University (Fred Plant)
11. Hospital – Director of Engineering
12. Property managers – First American Management, Gene B. Glick (two of the property managers in Valparaiso)
13. Industries – Cathay Pigments, Jet Corr, Rexam Beverage Can

B. How Do We Get To Our Audience - Contact Modes

1. School education materials through the School Board of Education
2. Public speakers program
3. School programs/exhibits
4. Billing information/bill inserts (VCU is in the process of modifying the bills)
5. Newspaper messages/multi -media
6. Property manager workshops
7. Residential landscape workshops
8. Meetings/presentations with builders, industries, plumbers, retailers, vendors
9. Presentations at City Council, City Planning Commission
10. Earth Day – display
11. City's Website
12. Giveaways – pencils, rulers, water bottles
13. U-Tube/Twitter/virtual communication
14. Workshops/sponsor events – invite Ed Gladfelter from the Alliance for the Great Lakes and Mary Ann Dickinson from the Alliance for Water Efficiency, also include cities/communities that have developed WCPs such as Madison, WI
15. City workshops
16. City newsletter
17. Meetings/presentations

C. Resource Requirements

1. Materials :
   - PowerPoint presentation/visual aids/boards
   - Giveaways
   - Live video at events (Valparaiso University as a resource)
   - Videos 2-3 minutes/lively U-Tube video (15-30 seconds)/flashpoint
2. AWE/WaterSense toolkit/AWWA materials
3. Radio/TV public service announcements similar to those for stormwater and wellhead protection
4. Billboards
5. Staff:
   - Jim half time
   - Support from VCU staff
6. Demonstrations from different vendors

D. What Is The Message?

1. Water efficiently
2. Use it wisely (use our H2O efficiently)
3. Avoid term "water conservation"
4. Look for AWE/WaterSense/AWWA terms/messages
5. Consistent message

E. Partner Organizations

1. NIRPC – PE stormwater/water – committees/workshops (Kathy Luther)
2. NIPSCO – sponsor/special events/Earth Day (Jim Fitzer)
3. Great Lakes Utilities in Indiana – Michigan City,Hammond,Indiana American
4. Valparaiso University – Fred Plant/environmental group/Engineering Dept.
5. Valparaiso school system – Asst. Superintendent
6. Vendors and builders such as Aldred, Charlson, Coolman - introduce WaterSense "Certification" program
7. AWE/WaterSense
8. Indiana Section AWWA
9. IDEM/IURC – pushing conservation/IDNR – water resources committee
10. Local environmental programs - Save The Dunes, Coastal Advisory Board
11. Recycling & Waste Reduction District of Porter County
12. Local retailers

F. Schedule and Metrics

1. Prioritization – the Task Force did not want to limit the program to a certain schedule – a specific schedule can be developed internally by VCU
2. Metrics
3. – customer survey
   - monitor water use per household

Agenda Item 5 – Adjournment

This was the last official meeting of the Water Conservation Task Force.

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: February 13, 2009
Meeting Time: 8:30 a.m. to 10:30 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list.

Attendants:

The following Task Force members/resource persons were in attendance:
Fred Jarvis, Tim Burkman, Bob Schwartz, Amrou Atassi, Jim Pingatore, George Brown, Michael Simpson, Steve Poulos and Eva Opitz.

Materials Distributed During The Meeting:

- Agenda (attached)

Agenda Item 1 – Introductions and Today's Objectives

The objectives of the meeting were:

- Recap the last (January 9, 2009) meeting
- Review cost-benefit analysis of water conservation
- Evaluate toilet replacement program

Agenda Item 2 – Documents Distributed

- Agenda
- January Meeting Summary
- Toilet Replacement Program

Agenda Item 3 – Benefit Cost Analysis

CDM gave a presentation on Benefits and Costs of Conservation Program Options which included: chemical and energy costs for both water and wastewater; program options from a Utility perspective; impact of the demand-supply curve; and a summary of the benefit-cost analysis.

This presentation was in draft form in order to provide for feedback from the group at today's meeting. Based on the input received from the group, the final copy of the cost-benefit analysis will be prepared and presented at the next meeting.

Included in CDM's presentation was a demand-supply curve showing the projects that can be delayed because of water conservation, including a new elevated tank and expansion of the Airport WTP. The benefit of delaying these projects was included in the benefit-cost analysis.

The benefit-cost analysis did not account for the "sprinkling allowance" on sewer rates. CDM and VCU will evaluate the impact of this on the cost analysis.

Although the preliminary numbers don't show a positive value (i.e. costs outweigh the benefits), the Task Force agreed that the WCP was not financially driven. The cost-benefit analysis will be finalized and presented as part of the plan implementation strategy at the next meeting. The plan will focus on education and public outreach to prepare the community for different water conservation program initiative/changes in the future.

Agenda Item 4 – Toilet Rebate Program

Bob Schwartz gave a presentation on a Proposed Toilet Replacement Program. Copies of the program details/costs were distributed to the Task Force.

The Task Force feels it is too premature to discuss specific programs before discussing education and public outreach to prepare the public for city-wide programs that involve toilet replacement.

Agenda Item 5 – Action Items for Next Meeting

The Task Force will conclude discussions of benefit-cost analysis as well as proceed with implementation strategies focusing mainly on education and public outreach plans.

Agenda Item 6 – Next Meeting

The next meeting is scheduled for **April 17, 2009** at 8:30 am. This is a change from the original date of March 13, 2009.

A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include concluding the discussion of the data collection and assumptions for benefit-cost analysis.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	February 27, 2009	Jim Pingatore and Amrou Atassi
2	Prepare final cost-benefit analysis	April 17, 2009	CDM
3	Prepare an agenda for the April 17th meeting	April 10, 2009	Jim Pingatore and Amrou Atassi
4	Attend next meeting	April 17, 2009	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: January 9, 2009
Meeting Time: 8:30 a.m. to 9:15 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list.

Attendants:

The following Task Force members/resource persons were in attendance: John Hardwick, Tim Burkman, Bob Schwartz, Amrou Atassi, Jim Pingatore, George Brown, Shihua Chen, Mike Simpson, Fred Plant and Kathy Luther.

Materials Distributed During The Meeting:

- Agenda (attached)

Agenda Item 1 – Introductions and Today's Objectives

The objectives of the meeting were:

- Recap the last (November 14, 2008) meeting
- Review and assessment of progress up-to-date

Agenda Item 2 – Documents Distributed

- November Meeting Summary

Agenda Item 3 – Recap of Last Meeting

The meeting summary was quickly reviewed with the Task Force. There were no additional comments or changes.

Agenda Item 4 – Review & Assessment of Progress Up-To-Date

CDM reviewed the components of the Water Conservation Plan that have been accomplished to date:

1. Specify Conservation Planning Goals
2. Develop a Water System Profile
3. Identify Water Conservation Measures

4. Analyze Benefits and Costs – currently being developed

Components remaining for completion:

1. Finalize benefit-cost analysis based on O&M data to be provided by Water and Wastewater.
2. Implementation plan and schedule.

Agenda Item 5 – Items/Issues Not Discussed/Addressed in WCP

Bob Schwartz indicated that having a 'city ordinance' with summer rates and restrictions was not discussed in previous meetings and perhaps should be included as one of the measures to be evaluated. CDM and VCU would like to hear from the other members of the Task Force as to whether or not they agree with Bob Schwartz.

Bob Schwartz feels that the assumptions made by CDM in their 'water conservation measures' presentation (November 14th Meeting) related to toilet replacement do not match his calculations and assumptions. Bob distributed a copy of his proposed VCU Residential Toilet Replacement Program dated 01/07/2009 to the Task Force. This document was not shared with CDM or VCU staff prior to the meeting.

Bob requested to be on the agenda at the next meeting for a 15-min presentation (10-min for presentation and 5 for Q&A) on toilet replacement. CDM, VCU staff and the Task Force will review Bob's proposal and assumptions/calculations prior to the next meeting.

Agenda Item 6 – Data Collection And Assumptions For Benefit-Cost Analysis

CDM will collect data from the Water and Wastewater Departments on energy and chemical costs as part of the benefit-analysis. The energy cost related to pumping should include both the demand charge and the use charge. For capital expenditures that can be deferred due to water conservation, CDM should assume the following:

1.) No capital improvements/expenditures can be deferred as part of Wastewater.
2.) The only capital improvements/expenditures that can be deferred as part of Water is a new water tower.

For the cost-analysis, CDM shall assume the following:

1.) For VCU personnel involved with water conservation, such as the water conservation planner or presentations made at schools, etc., CDM shall assume a cost of $40 per hour. This includes the raw rate plus benefits.
2.) For contracted personnel involved with water conservation measures, CDM shall assume a cost of $75 per hour.

Agenda Item 7 – Action Items For Next Meeting

The Task Force will continue discussions of benefit-cost analysis for different water conservation measures.

Bob Schwartz will present his data on a VCU Residential Toilet Replacement Program.

Agenda Item 8 – Next Meeting

The next meeting is scheduled for February 13, 2009 at 8:30 am.

A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include continuing the discussion of the data collection and assumptions for benefit-cost analysis.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	January 19, 2009	Jim Pingatore and Amrou Atassi
2	Review Bob Schwartz's proposed Residential Toilet Replacement Program	February 13, 2009	All
3	Provide requested O&M and water use data for the cost-benefit analysis	January 21, 2009	VCU Staff
4	Prepare draft cost-benefit analysis	February 13, 2009	CDM
5	Prepare an agenda for the February 13th meeting	February 6, 2009	Jim Pingatore and Amrou Atassi
6	Attend next meeting	February 13, 2009 at 8:30 am	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: November 14, 2008
Meeting Time: 8:30 a.m. to 10:00 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list.

Attendants:

The following Task Force members/resource persons were in attendance: John Hardwick, Tim Burkman, Bob Schwartz, Amrou Atassi, Eva Opitz, Jim Fitzer, George Brown, Shihua Chen, Mike Simpson, Fred Jarvis, and Jim Deardorff.

Materials Distributed During The Meeting:

- Agenda (attached)

Agenda Item 1 – Introductions and Today's Objectives

The objectives of the meeting were:

- Recap the last (October 17, 2008) meeting
- Discuss cost effectiveness of water conservation measures (CDM presentation and feedback)
- Discuss the data and assumptions for the benefit-cost analysis

Agenda Item 2 – Documents Distributed

- Water Conservation Questionnaire
- October Meeting Summary

Agenda Item 3 – Recap Of Last Meeting

The meeting summary was quickly reviewed with the Task Force. There were no additional comments or changes.

Agenda Item 4 – Cost-Effectiveness of Conservation Measures

A PowerPoint presentation was shared with the Task Force to show the cost of different water conservation measures versus the saved quantity of water. A copy of the

presentation is provided with the Meeting Summary. Several issues were discussed during the presentation, including:

- Regarding educational programs:
  - Should the school programs (i.e. videos, etc.) be tied to the water conservation planner or the schools?
  - The Task Force supports the use of educational materials provided/recommended by AWWA
  - The "Water Use It Wisely" materials are very common, widely used and well developed.
  - The information from these programs should be tailored to fit Valparaiso's needs and issues.
- Regarding audits:
  - There are 100 restaurants in the Valparaiso area. VCU can perhaps target 50%.
  - Fred Jarvis suggested verifying the assumed flow for showerheads in hotels. The older design uses 5 gpm, but the new design uses 2.5 gpm. The new hotels are likely to use showerheads with 2.5 gpm flow. Additional research in this area may be necessary to determine the true cost-benefit of this measure.
- Landscape Irrigation – The presentation shows that the "water hose timer" to be used 365 days/year. This should be revised to reflect irrigation season only.
- Some of the proposed conservation measures go beyond water conservation and these should be flagged for other benefits, such as energy, etc.
- The use of recirculation pumps as a water conservation measures in homes should be eliminated due to the potential for calcium carbonate build-up in homes' plumbing pipes.

Agenda Item 5 – Data and Assumptions for Benefit-Cost Analysis

In addition to the comments/notes provided above, the Task Force should review the data/assumptions provided in the presentation. Any comments or concerns should be submitted to CDM before the next Task Force meeting.

Agenda Item 6 – Action Items for Next Meeting

The Task Force will continue the discussion of water conservation measures, costs, benefits and long-term strategy. The discussion of program benefits will require understanding the reduced or deferred capacity expansion costs. CDM will work with VCU to collect the required data. John Hardwick indicated that capacity expansion is not a factor for the wastewater treatment plant, since they've recently expanded the plant.

Agenda Item 7 - Next Meeting

The next meeting is scheduled for January 9th, 2009 at 8:30 a.m.

A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include continuing the discussion of the water conservation questionnaire distributed at today's meeting.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	November 26, 2008	Amrou Atassi
2	Complete CDM Questionnaire and Provide Input/Feedback	December 12, 2008 (extended)	All
3	Review and Provide Feedback on CDM Technical Presentation on Cost Effectiveness of Conservation Measures (especially the data and assumptions)	January 5, 2009	All
4	Develop a phased approach for water conservation planning showing cost, benefit, target % reduction in water usage, etc.	Ongoing	All
5	Prepare an agenda for the January 9th meeting	January 5, 2009	Jim Pingatore and Amrou Atassi
6	Attend next meeting	January 9, 2009 at 8:30 am	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: October 17, 2008
Meeting Time: 8:30 a.m. to 10:00 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list. A copy of the meeting agenda is attached to the meeting summary. The following were present at the meeting:

Attendants:

The following Task Force members/resource persons were in attendance: John Hardwick, Tim Burkman, Bob Schwartz, Amrou Atassi, Jim Pingatore, Kathy Luther and Jim Deardorff. Contact information for the attendants is attached.

Materials Distributed During The Meeting:

- Agenda (attached)
- September 12, 2008 Meeting Summary
- Water Conservation Questionnaire

Agenda Item 1 – Introductions And Today's Objectives

The objectives of the meeting were:

- Recap the last (September 12, 2008) meeting
- Review feedback on the CDM technical memorandum and presentation on water conservation measures/programs
- Continue the discussion on water conservation measures/costs/benefits and long-term strategy

Agenda Item 2 – Documents Distributed

Water Conservation Questionnaire

Agenda Item 3 – Recap Of Last Meeting

The meeting summary was quickly reviewed with the Task Force. There were no additional comments or changes.

John Hardwick announced that effective January 1, 2009, Daryl Brown would retire from his full-time position and continue on a part-time capacity administering the back-flow

prevention program. Jim Pingatore will then assume the responsibilities of well-head protection administrator for half time in addition to being the water conservation planner. Thus, Jim will be working fulltime at the Water Department, and will be available half time on the water conservation program.

Amrou and Jim will review the 5-year capital budget for water conservation after the meeting and will provide a rough budget by Friday, October 24th. Jim's salary and benefits will not be included in the 5-year capital budget.

Agenda Item 4 – Review Feedback On CDM Technical Memorandum &Presentation On Water Conservation Measures/Programs

Task Force members and resource persons were asked to give their feedback to Amrou and Jim regarding the CDM Technical Memorandum # 1 on Water Conservation Measures and Techniques.

John Hardwick reminded the group that VCU made a $5,000.00 donation to "Save the Dunes Conservation Fund" as a rain barrel program partner.

Agenda Item 5 – Group Discussions On Water Conservation Measures/Costs/Benefits And Long-Term Strategy

John Hardwick reported that the Indiana Utility Regulatory Commission had its first meeting on October 9th to discuss water conservation rate structures. The group agreed that it would be best not to evaluate the current rate structure and its impact on water conservation until the IURC had finalized its evaluation and recommendations.

Amrou Atassi distributed a water conservation questionnaire to the group to solicit feedback on the following different program components, including education programs, water audit programs, regulations and rebates. Input from the group on targeted water savings and recommended program budget was also solicited in the questionnaire.

The group was asked to score the programs for their anticipated customer acceptability/receptivity as low, medium or high, and to determine their potential implementation as short, mid or long term (the education programs also needed to be ranked in perceived priority, and the targeted savings and budget questions only required a recommendation for the next five years). A copy of the water conservation questionnaire is attached to the meeting summary.

Kathy Luther asked the Task Force to consider the issues of lost revenue per gallon of water conserved as well as the cost savings per gallon of water conserved for both the water and water reclamation departments.

Agenda Item 6 – Action Items For Next Meeting

The Task Force will continue the discussion of water conservation measures, costs, benefits and long-term strategy.

Agenda Item 7 - Next Meeting

The next meeting is scheduled for November 14, 2008 at 8:30 a.m.
A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include continuing the discussion of the water conservation questionnaire distributed at today's meeting.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	October 31, 2008	Jim Pingatore and Amrou Atassi
2	Complete CDM Questionnaire and Provide Input/Feedback	November 3, 2008 (extended)	All
3	Review CDM Technical Presentation on Water Conservation Program Initiatives and Provide Input/Feedback	Ongoing	All
4	Develop a phased approach for water conservation planning showing cost, benefit, target % reduction in water usage, etc.	Ongoing	All
5	Prepare an agenda for the November 14th meeting	November 7, 2008	Jim Pingatore and Amrou Atassi
6	Attend next meeting	November 14, 2008 at 8:30 am	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: September 12, 2008
Meeting Time: 8:30 a.m. to 11:15 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list. A copy of the meeting agenda is attached to the meeting summary. The following were present at the meeting:

Attendants:

The following Task Force members/resource persons were in attendance: John Hardwick, Tim Burkman, Bob Schwartz, George Brown, Fred Plant, Amrou Atassi, Jim Pingatore, Steve Poulos, Kathy Luther, John Julien, Scott Miller and Eva Opitz (via phone). Contact information for the attendants is attached.

Materials Distributed During The Meeting:

- Agenda (attached)
- August 8, 2008 Meeting Summary
- Conservation Plan Draft Table of Contents
- NIPSCO Residential Rebate Program

Agenda Item 1 – Introductions And Today's Objectives

Introductions included John Julien and Scott Miller representing Umbaugh, the financial consultant to the Task Force.

The objectives of the meeting were:

- Recap the last (August 8, 2008) meeting
- Review feedback on the CDM Technical Memorandum # 1
- Present water conservation program initiatives
- Continue the discussion on water conservation measures to include Umbaugh's financial analysis

Agenda Item 2 – Documents Distributed

Jim Fitzer provided copies of NIPSCO's Residential Rebate Program.

Agenda Item 3 – Recap Of Last Meeting

The meeting summary was quickly reviewed with the Task Force. There were no additional comments or changes.

Agenda Item 4 – Review Feedback On CDM Technical Memorandum On Water Conservation Presentation and Draft Table of Contents

Task Force members and resource persons were asked to give their feedback to Amrou and Jim regarding the CDM Technical Memorandum # 1 on Water Conservation Measures and Techniques.

The Task Force asked that the impact of revenue loss be considered in the Table of Contents under Section 5 -Economic Analysis.

Agenda Item 5 – Presentation On Conservation Program Initiatives

Eva Opitz participated via conference call with a presentation of CDM's Technical Memorandum on Water Conservation Measures and Techniques. Based on input from the Task Force Questionnaire completed in April of 2008, the areas of greatest interest to the Task Force are school education programs, public education/information programs and residential high usage audit programs. A copy of the entire presentation is attached to the meeting summary. All members are encouraged to provide input and feedback at the next Task Force meeting.

Bob Schwartz suggested the addition of conservation messages through News Releases and as part of the monthly customer billing statement. Showing historical billing information for each month, similar to a NIPSCO statement was suggested, but currently the billing system does not allow for that and for the inclusion of bill stuffers. These suggestions will be considered during the evaluation of new billing systems that VCU will be looking at in the future.

Kathy Luther will be providing some information on WET (Water Education for Teachers) that can be included with the Water Conservation Plan.

Agenda Item 6 – Financial Analysis Of Water Conservation Measures

Task Force member John Julien (Umbaugh) commented on the financial impact of water conservation measures. Valparaiso City Utilities currently has a monthly minimum bill and a declining block rate structure. There are more cost opportunities than resources available and when customer usage patterns are altered, that affects the Utilities financial situation. Public education programs are helpful but rate structures are what impact customers.

CDM asked the Task Force for guidance in projecting spending on water conservation over time and/or for guidance to the level of conservation (percent reduction in usage) over time. Since there is no available information for either parameter, different scenarios can be presented. John Hardwick suggested that the Task Force create scenarios to show what expenditures can result in percentages of water conserved based on a phased approach. The phased approach will allow the VCU to implement a water conservation program over time and implement additional measures over time.

With regard to the current rate structure and impact on water conservation, John Hardwick indicated that the Indiana Utility Rate Council (IURC) is currently looking into this matter and suggested that the Task Force review future IURC recommendations with regard to water conservation structures. It is not recommended that the Utility rush to review the current rate structure at this point.

To allow for input from all the Task Force members, this discussion will be re-opened at future meetings.

Agenda Item 7 – Action Items For Next Meeting

The Task Force will continue the discussion of water conservation benefits and costs.

Agenda Item 8 - Next Meeting

The next meeting is scheduled for October 17, 2008 at 8:30 a.m.
A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include continuing the discussion of water conservation measures.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	September 23, 2008	Jim Pingatore and Amrou Atassi
2	Review CDM Technical Memorandum and Provide Input/Feedback	October 10, 2008	All
3	Review CDM Technical Presentation on Water Conservation Program Initiatives and Provide Input/Feedback	October 10, 2008	All

4	Develop a phased approach for water conservation planning showing cost, benefit, target % reduction in water usage, etc.	Ongoing	Task Force
5	Prepare an agenda for the October 17th meeting	October 9, 2008	Jim Pingatore and Amrou Atassi
6	Attend next meeting	October 17, 2008 at 8:30 am	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: August 8, 2008
Meeting Time: 8:30 a.m. to 10:30 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list. A copy of the meeting agenda is attached to the meeting summary. The following were present at the meeting:

Attendants:

The following Task Force members/resource persons were in attendance:
John Hardwick, Jim Deardorff, Michael Simpson, Fred Jarvis, Jim Fitzer, Bob Schwartz, George Brown, Fred Plant, Amrou Atassi, Jim Pingatore, Steve Poulos, Kathy Luther, Daryl Brown and Eva Opitz. Contact information for the attendants is attached.

Materials Distributed during the Meeting:

- Agenda (attached)
- June 13, 2008 Meeting Summary
- Valparaiso University – The Roots of Green

Agenda Item 1 – Introductions and Today's Objectives

The objectives of the meeting were:

- Recap the last (June 13, 2008) meeting
- Hear a report on the USEPA Draft Water-Efficient Single-Family New Home Specification
- Hear a report on Valparaiso University's Environmental Stewardship Program
- Continue the discussion on water conservation measures and present CDM's Technical Memorandum # 1 on Water Conservation Measures and Techniques

Agenda Item 2 – Documents Distributed

Fred Plant distributed copies of Valparaiso University's Environmental Stewardship Program – The Roots of Green.

Agenda Item 3 – Recap of Last Meeting

The meeting summary was quickly reviewed with the Task Force. There were no additional comments or changes.

Agenda Item 4 – USEPA Draft for Water Efficient Single-Family Home Specification

Task Force member Fred Jarvis (Safe-Flow Plumbing) reviewed and commented on the USEPA WaterSense Draft Water-Efficient Single-Family New Home Specification http://www.epa.gov/watersense/docs/home_draft_spec508.pdf with regard to: service pressure, toilets, bathroom and kitchen faucets, showerheads, hot water delivery systems, appliances and other equipment.

Agenda Item 5 – Valparaiso University Environmental Stewardship Programs

Task Force member Fred Plant (Executive Director of Facilities Management) presented a synopsis of Valparaiso University's Environmental Stewardship Inventory from "The Roots of Green" report that was given at the VU Board of Directors Meeting last month. A copy of the entire presentation is attached to the meeting summary.

Agenda Item 6 – Data Collection Surveys

Jim Pingatore reported on the surveys he conducted with local builders, landscapers and managers of multi-family complexes. He used questionnaires that were developed by CDM to better understand how water is being used as well as assess the potential for future water conservation initiatives. A copy of the entire survey is attached to the meeting summary.

Agenda Item 7 – Water Conservation Technologies

Eva Opitz presented the table of contents from the CDM Technical Memorandum # 1 on Water Conservation Measures and Techniques. A copy of the entire report is attached to the meeting summary.

Agenda Item 8 – Action Items For Next Meeting

Jim Fitzer will provide folders containing information on the NIPSCO Residential Rebate program.

John Julien from Umbaugh will present an analysis of water conservation benefits and costs.

Agenda Item 9- Next Meeting

The next meeting is scheduled for September 12, 2008 at 8:30 a.m. THE OCTOBER MEETING WILL BE ON OCTOBER 17th, NOT ON OCTOBER 10th.

A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include continuing the discussion of water conservation measures to include benefits and costs.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	August 18, 2008	Jim Pingatore and Amrou Atassi
2	Review of CDM Technical Memorandum	September 12, 2008	All
3	Prepare an agenda for the September 12th meeting	September 5, 2008	Jim Pingatore and Amrou Atassi
4	Attend next meeting	September 12, 2008 at 8:30 a.m.	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: June 13, 2008
Meeting Time: 8:30 a.m. to 10:15 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list. A copy of the meeting agenda is attached to the meeting summary. The following were present at the meeting:

Attendants:

The following Task Force members/resource persons were in attendance:
John Hardwick, Tim Burkman, Fred Jarvis, Jim Fitzer, Bob Schwartz, George Brown, Fred Plant, Amrou Atassi, Jim Pingatore, Steve Poulos, Kathy Luther, Daryl Brown and Eva Opitz. Contact information for the attendants is attached.

Materials Distributed during the Meeting:

- Agenda (attached)
- May 9, 2008 Meeting Summary
- Brochure on Watershed Planning from Save the Dunes Conservation Fund

Agenda Item 1 – Introductions and Today's Objectives

Jennifer Nebe of Save the Dunes was introduced as a guest speaker. She was invited to the meeting to make a presentation on the Rain Barrel Program.

The objectives of the meeting were:

- Recap the last (May 9, 2008) meeting
- Learn about the Rain Barrel Program from Jennifer Nebe of Save the Dunes
- Continue the discussion on water conservation measures and present CDM's findings on potential water conservation measures based on input from the Task Force provided in the completed survey.

Agenda Item 2 – Documents Distributed

Jennifer Nebe distributed copies of a Save the Dunes brochure entitled "Developing a Framework for Managing the Salt Creek Watershed".

Agenda Item 3 – Recap of Last Meeting

The meeting summary was quickly reviewed with the Task Force. There were no additional comments or changes.

The topic of revising the water bill to show how much water is being used in gallons (rather than cubic feet) and to add information about conservation was brought up for future discussions and considerations.

Agenda Item 4 – Rain Barrel Program

Jennifer Nebe first presented information from the Save the Dunes brochure on the Salt Creek Watershed Management Plan, and then she introduced the Rain Barrel Program. Jennifer demonstrated how a 55 gallon plastic rain barrel works and its associated environmental and water resources benefits. The drum can be placed under the gutter to collect rain water. Few of the benefits discussed include reduction in stormwater runoff (thus reducing sewer overflows), improving the environment, public education and involvement, and using stormwater for landscape irrigation. The cost of the barrel is $100.00 but Save the Dunes is only charging $10.00 due to a grant they have received. At this time they have over 200 people signed up to receive a rain barrel. Save the Dunes is interested in partnering with other organizations in order to be able to continue offering the Rain Barrel Program.

Agenda Item 5 - Water Conservation Measures

The Task Force continued the discussion of water conservation measures (Step 3 of the Program). Jim Pingatore collected the completed surveys filled out by the Task Force. CDM compiled the data and feedback to show interest on the different conservation measures and the results were presented to the entire group at the meeting. The water conservation task force questionnaire results and the Charlie Hauser telephone survey results were utilized to present a range of conservation programs, and to highlight customer survey insights. CDM also presented many examples of public information, education and awareness messages that are already available in a variety of conservation formats. A copy of CDM's entire presentation is attached to the meeting summary.

Agenda Item 6 – Action Items for Next Meeting

Fred Jarvis will report on the USEPA draft for water-efficient single-family new home specifications.

Fred Plant will report on the status of the "green" progress achieved by Valparaiso University.

Eva Opitz will give her perspective on the technology of conservation measures.

Agenda Item 7- Next Meeting

The next meeting is scheduled for August 8, 2008 at 8:30 a.m. THERE WILL NOT BE A MEETING IN JULY.

A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include continuing the discussion of water conservation measures.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	June 27, 2008	Jim Pingatore and Amrou Atassi
2	Review of Potential Conservation Measures	August 8, 2008	All
3	Prepare an agenda for the August 8th meeting	August 1, 2008	Jim Pingatore and Amrou Atassi
4	Attend next meeting	August 8, 2008 at 8:30 a.m.	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: May 9, 2008
Meeting Time: 8:30 a.m. to 10:00 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list. A copy of the meeting agenda is attached to the meeting summary. The following were present at the meeting:

Attendants:

The following Task Force members/resource persons were in attendance:
John Hardwick, Tim Burkman, Fred Jarvis, Michael Simpson, Bob Schwartz, George Brown, Fred Plant, Amrou Atassi, Jim Pingatore, Steve Poulos, Chuck McIntire, Daryl Brown, Jim Deardorff, Eva Opitz and Vince Griffin. Contact information for the attendants is attached.

Materials Distributed during the Meeting:

- Agenda (attached)
- April 11, 2008 Meeting Summary
- Research Report Executive Summary – Chauser Consulting
- Miscellaneous information on Indiana's drought planning and the Water Resources Committee

Agenda Item 1 – Introductions and Today's Objectives

Fred Plant, Executive Director of Facilities Management at Valparaiso University was introduced as the newest member of the Task Force. In a future meeting, Fred will provide the Task Force with an update of the sustainability and conservation measures recently implemented by VU.

The objectives of the meeting were:

- Recap the last (April 11, 2008) meeting
- Hear a report from Charlie Hauser to discuss the results of the phone survey focus groups; and
- Hear a report from Vince Griffin on Indiana's plans for drought planning and water conservation
- Collect the water conservation questionnaire/survey from all task force members

Agenda Item 2 – Documents Distributed

Charlie Hauser distributed copies of the research report containing the executive summary of his key findings from the telephone survey of 303 VCU customers.

Vince Griffin distributed copies of an Indiana Water History Brief; House Resolution No. 65; Water Resources Study Committee; and an article from Water & Wastewater News on *Water Looms as "The Next Oil".*

Agenda Item 3 – Recap of Last Meeting

The meeting summary was quickly reviewed with the Task Force. There were no additional comments or changes.

Agenda Item 4 – Water Conservation Focus Groups Results

Charlie Hauser reported that he facilitated two focus groups on May 8, 2008. The first group had nine participants and the second group had six. All participants were residential customers of VCU. CDM attended both focus group meetings.

Both focus groups are concerned with water quality and quantity, and conserving water to save money and the environment. Both groups prefer to receive information about water conservation from the Utility using information included with monthly bills. Both groups agreed that VCU is doing a good job in developing a trusted brand within the community. A report documenting the responses of the focus groups will be developed by Charlie Hauser.

Jim Deardorff suggested that the VCU water bill include a monthly and yearly comparison of water usage so customers can see the savings brought about by their conservation efforts.

Agenda Item 5- Water Conservation Measures

All Task force members should submit their water conservation questionnaire to Jim Pingatore by Friday, May 16th. Jim and CDM will compile the results of the questionnaire and share them with the group at the next Task Force Meeting.

A copy of the water conservation measures questionnaire is available for any member of the group that still needs to complete the form.

Agenda Item 6- Update on the State's Plans for Drought Planning and Water Conservation

Vince Griffin reported on a brief history of droughts in Indiana. In defining drought, he indicated that it is not just a shortage of water but the ability to process the water that is available for use.

House Resolution No. 65 has been introduced to establish an interim Water Resources Study Committee. Additional information on the State's plan for drought planning and conservation was provided by Vince.

Agenda Item 7- Action Items for Next Meeting

The next meeting is scheduled for June 13, 2008 at 8:30 a.m.. A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include continuing to review the results of the focus groups and to discuss water conservation measures.

Jim Pingatore will invite Christine Livingston of Save The Dunes to attend the next meeting to discuss the use and role of rain barrels in water conservation.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	May 16, 2008	Jim Pingatore and Amrou Atassi
2	Complete the Water Conservation Measures questionnaire	May 16, 2008	All
3	Focus Group results	May 23, 2008	CDM, Jim Pingatore and Charlie Hauser
4	Prepare an agenda for the June 13h meeting	June 6, 2008	Jim Pingatore and Amrou Atassi
5	Attend next meeting	June 13, 2008 at 8:30 a.m.	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: March 14, 2008
Meeting Time: 8:30 a.m. to 10:30 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list. A copy of the meeting agenda is attached to the meeting summary. The following were present at the meeting:

Attendants:

The following Task Force members/resource persons were in attendance:
Tim Burkman, John Hardwick, Fred Jarvis, Jim Deardorff, Bob Schwartz, George Brown, Marc Hancock, Amrou Atassi, Jim Pingatore, Eva Opitz, Steve Poulos, Chuck McIntire and Daryl Brown. Contact information for the attendants is attached.

Materials Distributed during the Meeting:

- Agenda (attached)
- January 11, 2008 Meeting Summary
- Water Loss Program ppt. Presentation
- Water System Profile ppt. Presentation

Agenda Item 1 – Introductions and Today's Objectives

Resource person attending today's meeting for the first time was Jim Deardorff, Director of Maintenance and Energy Manager for the Valparaiso Community Schools.

The objectives of the meeting were:

- Recap the last (January 11, 2008) meeting
- Conduct a conference call with Charlie Hauser to discuss the status of the phone survey
- Discuss the water loss program ; and
- Discuss the water system profile

Agenda Item 2 – Documents Distributed

Copies of the VCU Water Loss Program presentation and water system profile presentation were distributed to the group.

Agenda Item 3 – Recap of Last Meeting

The meeting summary was quickly reviewed with the Task Force members. There were no additional comments or changes.

Jim Pingatore gave a brief report on the AWWA Sustainable Water Sources Conference he attended in Reno, Nevada on February 10-13, 2008.

A newly formed water conservation group, Alliance for Water Efficiency, is located in Chicago, IL and there may be opportunities to work or learn from that group.

Agenda Item 4 – Water Conservation Phone Survey

Charlie Hauser participated via conference call to update the group on the status of the survey. Statistical Research Group has conducted 242 phone surveys to date, and they were hoping to finalize the goal of 350 by Easter weekend. Charlie will share the results of the survey with the group when the data is compiled by the end of March.

To discuss the more detailed water conservation questions, Charlie will develop focus groups within two weeks after the survey is concluded. The purpose of the focus groups is to collect more information and to develop the framework for public awareness. Within three weeks after the focus groups have concluded, Charlie will be ready to present the final research report.

Agenda Item 5- VCU Water Loss Program

VCU Distribution System Manager Chuck McIntire gave a presentation on the Department's water loss program as it relates to water meters, fire hydrants and flushing, water mains and replacement and corrosion studies.

The presentation highlighted VCU's efforts to protect the water in the system and minimize any losses in the distribution system by being proactive on maintenance and replacement of infrastructure. A copy of this presentation is available upon request.

Agenda Item 6- Water System Profile

CDM presented an overview of the VCU water system profile as it relates to water demand and production patterns. CDM will collect any missing data to finalize the water system profile analysis. A pdf copy of this presentation is attached.

Agenda Item 7- Action Items for Next Meeting

The next meeting is scheduled for April 11, 2008 at 8:30 AM. A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include reviewing the results of the phone survey, discussing the formation of the focus groups, and discuss/introduce water conservation measures.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	March 25, 2008	Jim Pingatore and Amrou Atassi
2	Phone survey results	April 1, 2008	CDM, Jim Pingatore and Charlie Hauser
3	Identify and invite someone from VU	April 1, 2008	Amrou Atassi
4	Prepare an agenda for the April 11th meeting	April 4, 2008	Jim Pingatore and Amrou Atassi
5	Attend next meeting	April 11, 2008 at 8:30	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Meeting Summary

Meeting Date: January 11, 2008
Meeting Time: 8:30 a.m. to 11:30 a.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list. A copy of the meeting agenda is attached to the meeting summary. The following were present at the meeting:

Attendants:

The following Task Force members/resource persons were in attendance: Tim Burkman, John Hardwick, Fred Jarvis, John Kendall, Kathy Luther, Bob Schwartz, George Brown, Marc Hancock, Amrou Atassi, Jim Pingatore, Eva Opitz, Mark Basch, Steve Poulos, Chuck McIntire and Michael Simpson. Contact information for the attendants is attached

Materials Distributed during the Meeting:

- Agenda (attached)
- Kickoff Meeting Summary
- Information from Hardness and Capacity Study
- 2005 Water Demand Profile
- Indiana's Water Shortage Plan Update Presentation Slides

Agenda Item 1 – Introductions and Today's Objectives

Members attending today's meeting for the first time were Mark Basch, George Brown, Chuck McIntire, Eva Opitz, Steve Poulos and Michael Simpson.

The objectives of the meeting were:

- Recap the last (kickoff) meeting
- Conduct a conference call with Charlie Hauser to discuss the phone survey
- Present an update of Indiana's Water Shortage Plan (by Mark Basch); and
- Discuss the water system profile

Agenda Item 2 – Documents Distributed

Sections distributed from the hardness and capacity study included the water demand and supply evaluation and water demand projections. These were the applicable

components of the hardness and capacity report. The entire report is available upon request.

Agenda Item 3 – Recap of Last Meeting

The meeting summary was quickly reviewed with the Task Force members. Task Force members attending the meeting for the first time were in consensus on the mission statement and the objectives of the water conservation plan. Input/feedback centered on the perceptions of our customers that water has always been an inexpensive and available resource.

Agenda Item 4 – Water Conservation Phone Survey

John Hardwick gave the background on the first telephone survey in 2001 that asked about hardness issues and customer service. Water conservation questions will be added this time. Charlie Hauser, who conducted the 2001 survey, participated via conference call to outline the process for the 2008 survey. Charlie shared his draft questions with the Task Force and members provided input and feedback. Customer education was identified as a critical issue that should be discussed.

Charlie, Amrou, Eva and Jim will finalize the water conservation questions included in the survey. The survey questions should be finalized in the next few weeks. This time there will be a newspaper release to announce the survey to the public.

To discuss the more detailed water conservation questions, such as education and others, focus groups (12 to 16 people) will be developed.

Agenda Item 5- Indiana's Water Shortage Plan

Mark Basch is the Head of the Water Rights/Use Section of the Division of Water of the Indiana Department of Natural Resources. Mark gave an overview slide presentation of Indiana's Water Shortage Plan and distributed copies of the Indiana Suggested Model Ordinance.

Agenda Item 6- Water System Profile

Eva gave an overview slide presentation of the process that will be utilized by CDM to develop a water system profile for the VCU. CDM will work with Jim and VCU to collect the water system profile data.

Agenda Item 7- Action Items for Next Meeting

There is a new resource person on the Task Force from the Valparaiso Community Schools. His name is Jim Deardorff and he is the Director of Maintenance and Energy Manager for the school system.

Kathy Luther will follow up on identifying and inviting a task force member from the newly formed Valparaiso University Sustainability Committee.

The next meeting is scheduled for February 8, 2008 at 8:30 AM. A copy of the agenda and other review information will be distributed one week prior to the meeting. Items to discuss at the next meeting include the water system profile and the VCU water loss program. Chuck McIntire will give the Task Force members an overview of the water loss program.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Prepare meeting summary and action items	January 22, 2008	Jim Pingatore and Amrou Atassi
2	Finalize phone survey questions	January 25, 2008	CDM, Jim Pingatore & Charlie Hauser
3	Identify and invite someone from VU (perhaps a member of the VU Sustainability Committee)	January 31, 2008	Jim Pingatore, Amrou Atassi & Kathy Luther
4	Collect information/data and develop the water system profile	February 1, 2008	CDM & Jim Pingatore
5	Prepare an agenda for the February 8th meeting	February 1, 2008	Jim Pingatore and Amrou Atassi
6	Attend next meeting	February 8, 2008 at 8:30	All

Valparaiso City Utilities
Water Conservation Plan
Task Force Kickoff Meeting Summary

Meeting Date: December 14, 2007
Meeting Time: 8:30 a.m. to 12 p.m.
Meeting Location: 205 Billings Street, Valparaiso, Indiana

This document presents a summary of the Water Conservation Plan Kickoff Meeting and highlights the key discussions/decisions made during the meeting. The items below correspond to the agenda list. A copy of the meeting agenda is attached to the meeting summary. The following were present at the meeting:

Attendants:

The following Task Force members/resource persons were in attendance: Tim Burkman, John Hardwick, Fred Jarvis, John Kendall, Kathy Luther, Bob Schwartz, Daryl Brown, Jim Fitzer, Marc Hancock, Amrou Atassi, Jim Pingatore, and Eva Opitz (participated via phone). Contact information for the attendants is attached.

Materials Distributed during the Meeting:

- Agenda (attached)
- List of task force/resource members
- CDM scope of work – Identifying project steps
- Proposed project schedule (attached)

Agenda Item 1 - Introductions

Jim Pingatore will be the contact person for the water conservation plan. Jim will coordinate all task force activities and will facilitate communication between task force members, CDM, Umbaugh, and resource personnel.

Jim Pingatore will distribute copies of agendas and meeting summaries for future meetings.

Agenda Item 2 - Background

John Hardwick discussed the background of why VCU is interested in water conservation, from the recommendation of the Hardness and Capacity Focus Group to Valparaiso's desire to continue to be a leader in the State of Indiana. VCU will also follow the recommendations of Indiana's Water Shortage Plan and the Great Lakes – St. Lawrence River Basin Sustainable Water Resources Agreement / Compact in regard to water conservation.

Other reasons for water conservation include: delay in capital expenditures, optimization of energy and chemical costs, protection of water resources to accommodate future growth in the City and many others.

Agenda Item 3 – Purpose of the Task Force

The purpose of the task force and resource group was explained and discussed. The purpose of the task force will be to promote water conservation in the community and to explain why/how/what is being implemented by VCU. Community feedback and input will be a critical responsibility of the task force members. See item 5 for further information.

VCU is currently looking to add a task force member from the Valparaiso Community School System. VCU will also be looking to add a task force member from the VU Sustainability Committee.

Agenda Item 4 – CDM Scope of Work

Amrou Atassi reviewed the five steps of the Water Conservation Plan:

1. Specify Conservation Planning Goals
2. Develop a Water System Profile
3. Identify Water Conservation Measures
4. Analyze Benefits and Costs
5. Develop Water Conservation Plan

The purpose of the kickoff meeting is to complete step 1, which is to specify the conservation planning goals and to define the mission statement of the task force.

Agenda Item 5- Task Force Discussions

The attendants were divided into three groups (3 groups of 3 – Amrou and Jim facilitated the group discussions) to discuss the following four areas:

1 – What are the objectives of the Water Conservation Plan?
2 – What is the mission statement of the task force?
3 – What areas of the community have the greatest potential for improvements in water use efficiency?
4 – What are some of the potential barriers to water conservation in the community?

Using flip charts, each group developed a response for each of the questions (1-hour exercise). The entire group then discussed each of the responses and developed an agreed upon response that is reflected in this summary.

A – What are the objectives of the Water Conservation Plan?

1. Implement comprehensive public education program for residential, commercial, and industrial users (It was also suggested to have the community schools integrate water conservation into the curriculum)
2. Control and reduce costs of municipal and industrial process water and commercial and residential potable water
    a. capital costs for water and wastewater
    b. Operations & maintenance costs, energy and chemical costs
3. Promote and allow for economic development opportunities with limited capital expenditures to attract industry and commerce to Valparaiso
4. Develop conservation friendly water and wastewater rates
5. Demonstrate that water conservation will work in the Great Lakes region
6. Develop City codes/incentives and policies to achieve goals

B – What is the mission statement of the task force?

Develop a Water Conservation Plan that increases public awareness, engages and motivates all VCU customers to participate in active water conservation, thus benefiting the users, providers and the environment

C – What areas of the community have the greatest potential for improvements in water use efficiency?

1. Utility operations & maintenance (hydrant flushing, filter back-washing and other process and in-house uses)
2. New construction best practices (residential, industrial, commercial, and public buildings)
3. High water users in all areas (Valparaiso University, Hospital, car washes, restaurants, professional buildings)
4. Residential plumbing systems; water saving devices and appliances (toilets, clothes washers, dishwashers); irrigation systems and practices; leaks (infrastructure and customer)

D – What are some of the potential barriers to water conservation in the community?

1. Ignorance, life style, perceptions
2. Costs:
    a. Costs to customers for upgrading systems and appliances;
    b. Costs to VCU for lost revenue
3. Inconvenience
4. Political and economic impact

Agenda Item 6- Next Steps

The task force agreed to meet on the second Friday of every month (for one year) at 8:30 am in the Board Room at 205 Billings Street. The next meeting is scheduled for January 11, 2008 at 8:30 AM.

Agenda Item 7- Schedule

A copy of a draft schedule was distributed. The task force should aim to complete the draft water conservation plan by end of 2008.

Agenda Item 8- "Parking Lot Issues"

A copy of "relevant" components of the hardness and capacity study will be distributed to the task force members.

John Hardwick asked that the parking spaces near the front entrance of the building be kept available for VCU customers.

Agenda Item 9- Task Force Logistics and Communication

All questions and correspondence related to the water conservation plan should be addressed to Jim Pingatore. Jim will also distribute agendas and meeting summaries for future meetings.

The next meeting is scheduled for January 11, 2008 at 8:30 AM. A copy of the agenda and other review information will be distributed one week prior to the meeting.

Action Items:

Item Number	*Description*	*Timeline for Completion*	*Responsibility*
1	Define the water conservation plan goals and task force mission statement	Done	Task Force Members
2	Prepare Meeting Summary and Action Items	December 20, 2007	Jim Pingatore and Amrou Atassi
3	Identify and invite a task force member from the Valparaiso Community School System.	January, 2008	Jim Pingatore and VCU

4	Identify and invite a task force member from the VU Sustainability Committee.	January, 2008	Jim Pingatore and VCU
5	Collect/develop information on water system profile	January 3, 2008	Jim Pingatore and Amrou Atassi
6	Distribute "relevant" components of the hardness and capacity study to the task force members.	January 3, 2008	Jim Pingatore
7	Prepare an agenda for the January 11, 2008 meeting	January 3, 2008	Jim Pingatore and Amrou Atassi
8	Attend next meeting	January 11, 2008 at 8:30	ALL

Appendix B
Benefit-Cost Analysis Spreadsheet

Valparaiso City Utilities
Water Conservation Plan
Benefit-Cost Analysis

Discount Rate = 5%

Water Savings, Costs, Benefits over Program Life	Education/ Information	Single-family indoor/outdoor water audits	Pre-rinse spray valve program	Hotel showerhead program	Washing machine rebate program	Residential shower giveaways	Water hose mechanical timer (giveaway)	Toilet Rebate Program	School Audits	Ordinance for Automatic Sprinker shut-off devices	Industrial Water Audits	Government Facility Audit and Toilet Replacement	ALL PROGRAMS
1. Water savings (ccf)	2,536,107	88,139	144,317	43,332	85,394	76,123	8,948	247,400	25,472	12,336	86,004	5,329	3,358,900
2. Program costs													
Implementation costs	$769,270	$62,560	$13,750	$9,440	$58,090	$5,530	$4,100	$134,110	$17,810	$6,240	$80,790	$10,670	$1,172,360
W & WW Revenue impact	$6,557,540	$208,110	$381,930	$114,930	$216,010	$226,320	$23,500	$677,920	$60,500	$27,980	$194,860	$15,160	$8,704,760
Present Value Costs	$7,326,800	$270,670	$395,680	$124,380	$274,100	$231,860	$35,220	$812,030	$78,310	$34,210	$275,650	$25,830	$9,884,740
3. Program benefits													
Reduced energy & chemical costs for water treatment (dollars per gallon)	$252,190	$7,440	$14,690	$4,420	$7,730	$8,100	$840	$24,250	$2,330	$1,000	$7,490	$580	$331,060
Reduced energy & chemical costs for ww treatment (dollars per gallon)	$285,250	$8,420	$16,610	$5,000	$8,740	$9,160	$950	$27,430	$2,630	$1,130	$8,480	$660	$374,460
Present Value Benefits	$537,440	$15,860	$31,300	$9,420	$16,470	$17,250	$1,790	$51,680	$4,960	$2,130	$15,970	$1,240	$705,510
Net Present Value	($6,789,360)	($254,810)	($364,380)	($114,960)	($257,640)	($225,330)	($25,800)	($718,050)	($73,350)	($32,080)	($259,680)	($24,580)	($9,179,230)
Benefit-Cost Ratio	0.073	0.059	0.079	0.076	0.060	0.074	0.051	0.064	0.063	0.062	0.058	0.048	**0.071**

BENEFIT COST ANALYSIS--SUMMARY ALL PROGRAMS

1. Water savings (ccf)	3,358,900
2. Program costs	
Implementation costs	$1,172,360
W & WW Revenue impact	$8,704,760
TOTAL Present Value Costs	$9,884,740
3. Program benefits	
Reduced energy & chemical costs for water treatment (dollars per gallon)	$331,060
Reduced energy & chemical costs for ww treatment (dollars per gallon)	$374,460
Benefit of elimin. elevated tank (2015)	$1,492,430
Benefit of elimin. water treatment plant expan	$1,492,430
Present Benefits	$3,690,380
Net Present Value	($6,194,360)
Benefit-Cost Ratio	**0.37**

Appendix C
Model Landscape Ordinance

Adopted: 04/08/08
Published: 04/23/08

ORDINANCE NO. 1932

AN ORDINANCE REQUIRING INSTALLATION AND MAINTENANCE OF A WORKING RAIN SENSOR DEVICE IN ALL AUTOMATIC IRRIGATON SYSTEMS INSTALLED OR LOCATED ON COMMERCIALLY DEVELOPED PROPERTY AND ALL SUCH SYSTEMS HEREAFTER INSTALLED ON RESIDENTIALLY DEVELOPED PROPERTY; AND PROVIDING PENALTIES AND OTHER SANCTIONS FOR VIOLATION.

BE IT ORDAINED by the Governing Body of the City of Derby, Kansas:

Section 1. Definitions. For the purposes of this section, the following words and phrases shall have the meanings respectively ascribed to them in this section:

a. "Automatic irrigation system" means a device or combination of devices having a hose, pipe or other conduit installed in the landscape and that automatically applies water to irrigate lawns, landscapes or greenspace.

b. "Rain sensor" means an electronic device that measures rainfall and overrides the irrigation cycle and turns off an automatic irrigation system when a predetermined amount of rain has fallen and is mounted according to the manufacturer's specifications outdoors in an open area, above ground and in an unobstructed location well suited for gauging rain.

Section 2. System and operating requirements.

a. Except as otherwise provided by section 7 hereof, all automatic irrigation systems shall be equipped with a properly installed, maintained and functional rain sensor.

b. All rain sensors required by this ordinance shall be set such that the irrigation system is turned off when 1/2 inch or more rain has fallen.

c. Neither a rain sensor nor automatic irrigation system to which such sensor is connected shall be set so that the rain sensor is not able to override and turn off the automatic irrigation system after 1/2 inch of rain has fallen.

Section 3. Responsibilities of owners of property served by automatic irrigation system.

a. Automatic irrigation systems connected to public water supply system:

1. It shall be the duty of each person owning property upon which is located an automatic irrigation system connected to the public water supply system to ensure that

each such system located is equipped with a properly installed and operational rain sensor.

2. Each person having an automatic irrigation system connected to the public water supply system shall be deemed to have consented to inspection of such irrigation system by a City code enforcement officer at reasonable times and upon reasonable notice; provided, notice of such inspections shall not be required if the customer cannot be located after reasonable effort or if there is a reasonable basis to believe that his or her automatic irrigation system is not equipped with a required rain sensor or, if so equipped, that the rain sensor is not properly set, has been disabled or is otherwise failing to function properly.

b. Automatic irrigation systems not connected to public water supply system:

1. It shall be the duty of each owner of property upon which is located an automatic irrigation system not connected to the public water supply system to ensure that each such system is equipped with a properly installed and operational rain sensor.

2. Any City code enforcement officer may, at reasonable times and upon reasonable notice, enter upon private property upon which is located an automatic irrigation system that is not connected to the public water supply system for the purpose of inspecting such system whenever there is a reasonable basis to believe that such system is not equipped with a required rain sensor or, if so equipped, that the rain sensor is not properly set, has been disabled or is otherwise failing to function properly.

Section 4. Violations. It shall be unlawful for any person to operate an automatic irrigation system without a properly installed and operating rain sensor.

Section 5. Penalties for violation. Any person convicted of violating this ordinance shall be punished by a fine of not less than $25 nor more than $500.

Section 6. Cessation of public water supply service. In addition to other penalties provided by this ordinance, the City may order cessation of public water supply service in the event a person whose automatic irrigation system is connected to the public water supply system fails or refuses to install a required rain sensor or to maintain such rain sensor in good operating condition. In the event public water supply service is discontinued pursuant to this section such person shall pay, in addition to any other charges authorized by City ordinance, the reasonable cost of discontinuing water service and resumption of water service following correction of all violations of this ordinance.

Section 7. Application to new and existing automatic irrigation systems. This ordinance shall apply:

a. from and after May 24, 2008, to all automatic irrigation systems installed or substantially replaced on or after that date; and

b. from and after July 1, 2009, to all other automatic irrigation systems.

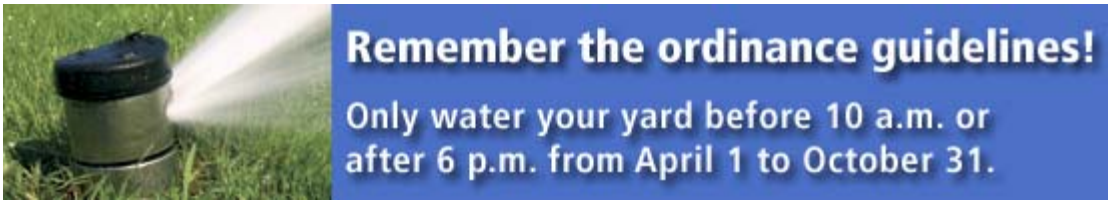
Section 8. Effective date. This Ordinance shall take effect and be in force from and after the sixty-first day following its publication once in the official City newspaper.

ADOPTED BY THE GOVERNING BODY this 8th day of April, 2008.

_____
Dion P. Avello, Mayor

ATTEST:

_____
Jean Epperson, City Clerk



WATER CONSERVATION ORDINANCE

The guidelines in the **Water Conservation Ordinance** are intended to conserve water and extend the life of existing infrastructure by minimizing the stress on the system caused by the peak demand of summer water usage. By using water wisely, we can help delay infrastructure expansion (primarily water treatment facilities and delivery systems) and the need f additional water resources (buying additional water rights to existing reservoirs or building new reservoirs). Outdoor water u can be more than 50% of our total summer water use. By controlling this use we can minimize its impact on our current infrastructure and future expansion.

The Conservation Ordinance Outdoor Watering Guidelines

- Hand water or use a soaker hose. Both are permitted at any time.
- Maintain your sprinkler system. Repair any broken, missing or misdirected sprinkler heads.
- Automatic sprinkler system owners are required to have rain and freeze sensors installed.
- Monitor your total water usage. If you use more than 15,000 gallons a month, you'll now pay a surcharge on the amount above 15,000.
- Don't water during any form of precipitation.
- Don't allow your sprinkler system to water driveways, sidewalks and streets.
- Don't waste water by allowing runoff onto a street or other drainage area when you're watering.
- Don't water your yard between 10 a.m. and 6 p.m. between April 1 and October 31.

Violations of these outdoor water guidelines can result in fines of $250 to $2,000 per incident. First offenses will be issued a warning.

Please be aware that all automatic sprinkler systems were required to be equipped with a rain and freeze sensor as of Jan 1, 2005.

Resources for Bringing Your Sprinkler System Up to Code

- **Approved Rain and Freeze Sensor List**
- **Where to Buy a Rain and Freeze Sensor**
- For a list of licensed irrigators, visit the **Dallas Irrigation Association** website or the **Texas Commission on Environmental Quality** licensed individuals search page.

Exemption (or Variance) from the Water Conservation Ordinance

MINI-CLIK SENSORS

HOME
INSTALLATION
LINKS
COMMENTS

Water Conservation:
Cities/States with Rain Sensor Ordinances

FLORIDA - HB 91 effective May 1, 1991, governing **all** new automatic sprinkler systems: "... shall install a **rain sensor device or switch** which will override the irrigation cycle of the sprinkler system when adequate rainfall has occurred."

Volusia County, Florida passed County Ordinance 2000-34 that requires **rain switches on pre-1991** irrigation systems by April 2002.

Hillsborough County, Florida (including the city of Tampa) passed County Ordinance 94-12 that requires **rain switches on all existing** irrigation systems by October 1, 1996.

NEW YORK - The Water Authority of Great Neck North (including the towns of Great Neck and North Hempstead), established the use of a **rain gauge or moisture detection sensors** as a requirement for all existing and new automatic irrigation systems, effective April 15, 1995. The penalty for non-compliance is a maximum fine of $250.00 for each violation.

NEW JERSEY - **Township of Cape May** has established an ordinance requiring the use of a **rain sensor** on all new systems. **Rain Sensor Law Passed in New Jersey -** New Jersey passed a rain sensor law on December 8, 2000 making it mandatory to have a rain sensor shut off on all new automatic irrigation systems in landscapes.

SOUTH CAROLINA - Hilton Head Island effective October 13, 1993: "All automatic irrigation designs shall include an electric sensoring device (**rain sensor**) that can be set to turn off the system under predetermined rain or soil moisture conditions set at 1/2 inch."

CALIFORNIA - The Water Conservation in Landscaping Act, referred to as AB 325. All California cities and counties were given the option of adopting the ordinance as is, or submitting their own by January 1, 1993. **Two hundred ninety five agencies require rain sensing devices to shut off systems during rain.**

NORTH CAROLINA - the town of Cary, North Carolina has mandated the use of rain sensors on all new irrigation installations as of August 14, 1997. In addition, rain sensors are required on all existing automatic irrigation systems on or before May 1, 1998.

MINNESOTA - Beginning July 1, 2003, all new irrigation systems must have a rain sensor installed.

TEXAS - the city of Dallas: Beginning January 1, 2002, all irrigation systems installed in the city of Dallas are required to have both a rain sensor and a freeze sensor device installed. All existing irrigation systems must be retrofitted with theses devices before January 2005.

CONNECTICUT - As of October 1, 2003, any residence, state agency or commercial enterprise installing a new irrigation system, will be required to use a rain sensor.

GEORGIA - On and after January 1, 2005, no person shall install within the Metropolitan North Georgia Water Planning District, any landscape irrigation system that does not have a rain shut-off switch.

Appendix D
State of Indiana Model Drought Ordinance (7/2/07)

Preamble

The Local Unit of Government recognizes that water is a scarce and valuable natural resource that should be used wisely by all residential, commercial, industrial, agricultural, and recreational consumers. Water is needed to maintain in-stream flows in rivers and creeks, provide aquatic habitat, and maintain the diversity of plant and animal species. Consequently, all citizens should practice wise water use during periods of water abundance and water shortage. Wise water use will enable the Local Unit of Government to maximize the many values that water provides to all users, while minimizing the frequency, duration, and severity of water shortages. The Local Unit of Government believes also that the best way to achieve wise water use among all consumers is to provide the information, incentives, and technical support needed to motivate adoption of desirable water management practices. The appropriate combination of information, incentives, and technical support shall be considered to be the Local Unit of Government "Water Management Strategy" that will be implemented in perpetuity, subject to modification through the legislative process, over time. The Local Unit of Government goal is to implement and promote a comprehensive plan that encourages wise water use in all years, regardless of whether annual or seasonal water supplies are abundant or scarce. Implementing the Local Unit of Government Water Management Strategy will:

1. Increase public awareness regarding the general scarcity and value of water resources,

2. Improve public knowledge and understanding of methods for using water wisely,

3. Provide economic incentives for all consumers to implement desirable water management practices,

4. Enhance the sum of net benefits (both financial and non-financial) obtained from the local and regional water resources,

5. Reduce the frequency, duration, and severity of seasonal and other short-term water shortages, and

6. Promote economic development that is consistent with the Local Unit of Government long-term water supply outlook.

The Local Unit of Government recognizes that seasonal and other short-term water shortages likely will occur in the future, with or without implementation of a Water

Management Strategy. When shortages occur, it may become necessary to implement measures that enable the Local Unit of Government to allocate scarce water supplies among competing users. For example, it may become necessary for the Local Unit of Government to ensure that hospitals and public safety agencies are given priority access to water supplies, while other users are given lower priority. It also may become necessary for the Local Unit of Government to impose restrictions on selected uses of water, such as irrigating lawns or washing cars. The Local Unit of Government also should seriously consider raising the price of water substantially during shortages to encourage meaningful reductions in water use.

This Ordinance describes a suite of measures including good management practices at all times, potential price increases for water during times of severe shortage, and enforced rationing during periods of extreme water shortage. While some of these measures may not apply in all locations or situations, the purpose of the measures is to encourage wise use of the resource and to minimize the negative impacts of seasonal or short-term water shortages. The Local Unit of Government's goal is to develop and implement a comprehensive Water Management Strategy that will minimize the need for more restrictive measures described in the Ordinance. The Local Unit of Government recognizes that information, incentives, and technical support are much more effective in encouraging wise water use than mandates regarding either voluntary or required changes in water use. Mandates will be implemented only as a last resort or temporary approach to allocating water during periods of severe water shortage. At all other times, the Local Unit of Government expects residents to use water wisely, and the Local Unit of Government will continually assist all water consumers in implementing desirable water management practices, as described in the Local Unit of Government's Water Management Strategy.

An ordinance for the effective management of water furnished by the Local Unit of Government

BE IT ORDAINED by the Local Unit of Government

WHEREAS, both natural and man-made conditions, may arise or occur which cause a temporary shortage of water; and

WHEREAS, such conditions may affect the Local Unit of Government public water system's ability to provide an adequate supply of water or where the public water supply may be unable to maintain adequate water pressure in the delivery system; and

WHEREAS, in such event it is imperative to the well being of the residents of the Local Unit of Government that uses of water not essential to the health, welfare and safety be restricted,

NOW THEREFORE, BE IT ORDAINED by the Local Unit of Government

Section 1. *Application.* This ordinance shall apply to all persons, firms, partnerships, corporations, company or organizations connected to the Local Unit of Government public water system or using water therefrom (hereafter, users).

Section 2. *Declaration of Need.* Upon determining that the Local Unit of Government public water system is in a condition of water shortage, the Local Unit of Government shall declare a water conservation emergency and establish the appropriate measures and the duration thereof.

Section 3. *Conservation Measures*. Practices that conserve water should be used at all times. Examples of conservation measures include:

a. Judiciously sprinkling, watering, or irrigating shrubbery, trees, grass, ground covers, plants, vines gardens, vegetables, or any other vegetation; Eliminating wasteful sprinkling of impervious surfaces, such as streets and sidewalks;
b. Limiting water use while washing trucks, trailers, mobile homes, railroad cars or any other type of mobile equipment;
c. Limiting water use while cleaning sidewalks, driveways, paved areas, or other outdoor surfaces;
d. Repairing or replacing leaking water fixtures and service lines;
e. Using appliances such as clothes washers and dishwashers only when they are full;
f. Turning off the water while brushing teeth or shaving;
g. Using a higher lawnmower setting to provide natural ground shade and promote the soil's water retention;
h. Washing cars with a bucket of soapy water and using a nozzle to stop the flow of water from the hose between rinsing;
i. Covering swimming pools when not in use to reduce evaporation.

Section 4. *Voluntary Conservation.* During moderate water shortages users shall be requested to reduce water consumption by practicing voluntary conservation. The Local Unit of Government shall identify reasonable and meaningful conservation techniques and provide such information to users. The Local Unit of Government may also implement conservation pricing and prohibitions to encourage water conservation.

Section 5. *Mandatory Conservation.* During severe water shortages users shall be prohibited from selected water uses subject to reasonable terms, times and conditions as the governing body shall adopt and append to this document.

Section 6. *Rationing.* In addition to mandatory conservation measures users shall be limited during extreme water shortage to water use by the following schedule:

a. Residential use shall be limited to _____ gallons per residential unit per day.
b. Business, commercial, agricultural, and industrial users shall be limited to the volume of water deemed to be essential.

Section 7. *Exceptions.* The Local Unit of Government shall establish rationing exemptions necessary to provide for the maintenance of adequate health, safety, and sanitary conditions.

Section 8. *Notice.* Notice of the need for voluntary conservation measures shall be issued in a local newspaper of general circulation or other means such as radio and television as deemed appropriate by the governing body. Notice shall be effective upon issuance.

Notice of mandatory conservation or rationing shall be by first class United States mail, or by other door to door distribution to each current user, and by electronic and print media. Notice shall be deemed effective at the conclusion of door to door distribution or at noon of the third day after depositing notice in the United States mail.

Section 9. *Enforcement.* Any user who violates Section 5 or 6 of this ordinance may be punished by a fine of not more than $2,500 (*see IC 36-1-3-8 (a)(10)(B)).* Each day of violation shall constitute a separate offense. In addition to, or in the alternative to, a fine, water service may be terminated for any user who violates Section 4 or 5 of this ordinance

Section10. *Effective date.* This ordinance shall be in full force and effect upon passage.

Passed and adopted by the Local Unit of Government on the ____ day of _____, 20__.

Appendix E
Memorandum on Water Conservation Measures

CDM TECHNICAL MEMORANDUM #1

WATER CONSERVATION MEASURES AND TECHNIQUES

Presented to:

Valparaiso Water Utilities

August 8, 2008

Contents

Section 1
Purpose and Objectives

As part of the initial development of a Water Conservation Plan (WCP) for the City of Valparaiso, Indiana, we have undertaken a review of demand management measures that could be considered for incorporation into the Plan.

The work tasks for the development of the Water Conservation Plan include the following:

1. Specify Conservation Planning Goals
2. Develop a Water System Profile
3. Identify Water Conservation Measures
4. Analyze Benefits and Costs
5. Develop Water Conservation Plan

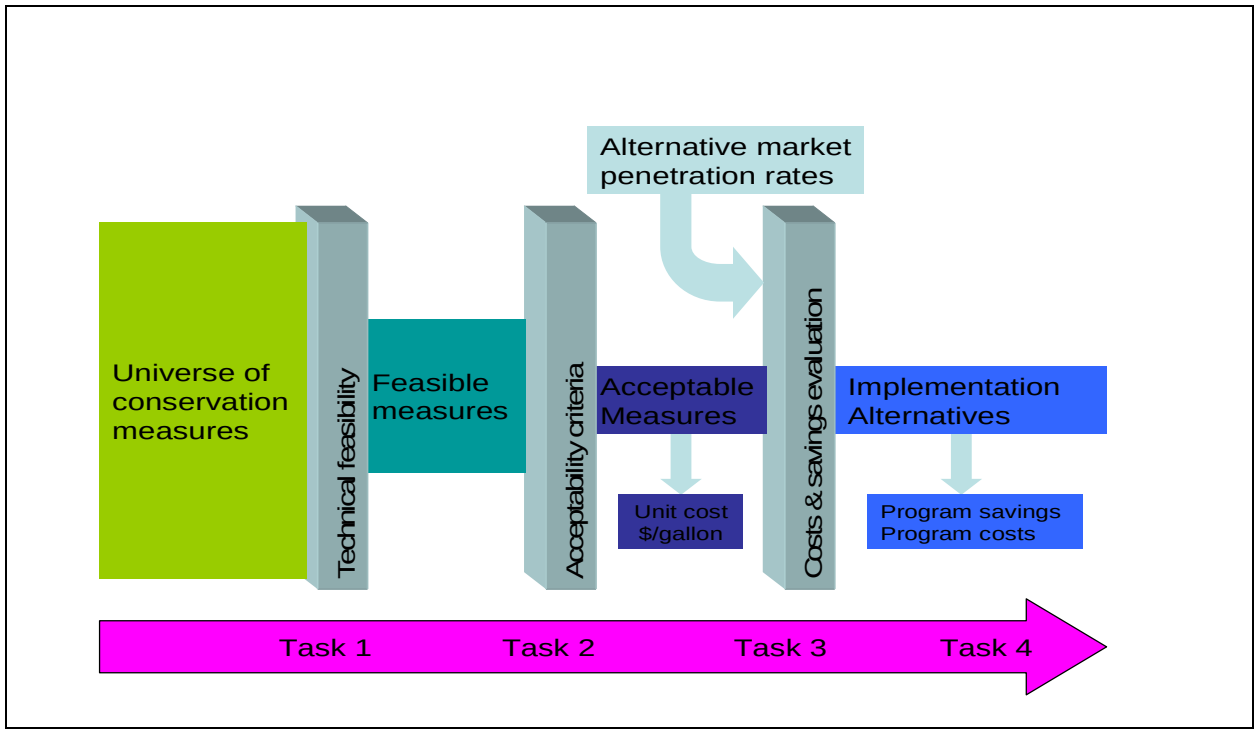


Figure 1.1: Water Conservation Program Assessment Process

This Technical Memorandum is part of the Task 3 effort to identify technically feasible water conservation measures for the WCP. This memorandum provides a review of data from literature resources, and other projects to identify a menu of water conservation options that could be expected to result in measurable water savings if implemented.

The task begins with compiling a comprehensive list of possible water conservation actions, or measures. The objectives of Task 3 are to develop a list of measures for further evaluation, and to provide information on those measures that can be used in the next evaluation.

The review of available data and literature for each conservation measure is summarized in this memorandum. Some measures such as toilets, clothes washers and cooling towers are well documented, while little information is available on other measures such as faucets and industrial processes. Where information was found on previously estimated water savings for a given measure, the information is included in this documentation.

Section 2 provides a description of conservation measures that impact water use across all water users, such as education, metering and pricing. Sections 3 and 4 address water conservation measures that affect residential indoor and outdoor use, respectively. Section 5 and 6 discuss indoor and outdoor water conservation, respectively, for the commercial, industrial, and institutional (CII) sectors.

Section 2
General Conservation Measures

General conservation measures include actions that may affect more than one customer sector and multiple end-uses of water. These actions require funding to be implemented although the water conservation savings attributed to these actions may be difficult to isolate and quantify. In addition, these measures are typical key components of a successful demand management program. These measures include:

- Public information, education and awareness
- Distribution system management
- Pricing

PUBLIC INFORMATION, EDUCATION & AWARENESS

Public information, education and awareness are important aspects of any water conservation program. These types of activities are typically in the forefront of any water conservation effort and are essential in bringing public awareness to conservations programs and promoting water conservation goals in the community or region.

Studies in the sociology of the adoption of new behaviors and technologies indicate that information is one of three key components to the adoption of technology, along with the availability of the technology and an incentive to change. Information provides an awareness of the availability of the new technology, awareness of the need to change, and information on how to implement the change. Thus, a water conservation information campaign should be an integral part of any water conservation program.

Good public information, education and awareness programs encourage water users to implement specific water saving measures. Some commonly identified water conservation information, education and awareness actions include:

- School education materials
- Public speakers program
- School programs and exhibits
- Customer assistance hotline
- Conservation pamphlets, bill inserts and newsletters
- Radio, TV and newspaper messages
- Billboards, bus, and subway messages
- Property manager workshops
- Residential landscape workshops
- Trade association irrigation and landscape workshops (serving residential and nonresidential customers)

Reports by Nadel (1990) and Maddaus (1987) suggest that residential educational programs reduce annual water usage from 0 to 5 percent. An analysis of historical water demand for the City of Albuquerque indicated their summer education program had impacts of 7 to 10 percent reduction in summer monthly water use in the residential sector after accounting for effects of weather, price of water, income, housing density, and other concurrent conservation programs (Davis *et al.*, 2002). This reduction

is specifically in residential summer water use. The impact of public education programs on annual water use would be a lower percent reduction.

Given that not all households will respond by adapting water conserving behaviors and that water conservation marketing is generally more heavily emphasized in summer, it may be assumed that water conservation education programs can reduce residential water use by about 2 percent. An education program may encourage participation in other conservation programs thus further increasing its impact and providing the impetus for the adoption of technologies made available through other programs.

DISTRIBUTION SYSTEM MANAGEMENT

Real (physical) water loss in distribution systems can be addressed through leakage management. Leakage management includes the repair of reported leaks, leak detection and repair, system rehabilitation (line and meter replacement), and pressure reduction. Real water loss is classified into three categories of water loss: reported, unreported and background loss. Reported water loss tends to be major water line breaks reported by the public and repaired in a timely manner. Reported water losses tend to be of large volume with relatively short duration. Unreported water losses tend to be leaks of lower volume with longer duration that are identified for repair through leak detection programs. Background water loss consists of small leaks at joints and fittings that generally go unnoticed and do not warrant repair. Background leakage is only eliminated when lines and meters are replaced, although background water loss can be reduced through pressure reduction and control, such as reducing system pressure during nighttime hours.

The Valparaiso City Utilities has had a fairly aggressive program in place to minimize water losses from the distribution system. In 2000/2001, a meter change-out program was implemented, and all meters in the system were replaced. In 2005, VCU implemented a 1% testing program, where 1% (Needs confirmation) of the residential meters were tested for accuracy each year. In 2001, VCU built a bulkwater ATM that discourages landscapers, drilling companies, farmers and pool facilities from using fire hydrants. In 2008, the system started a new fire hydrant flushing program, called unidirectional flushing, which will ultimately use less water and clean water mains more effectively, which will allow an more extended cycle for hydrant flushing. As part of its ongoing Capital Budget Program, VCU will be initiating a water main replacement program. In an initial analysis of total water production (total water into the system) and water sales for the period December 2005 to December 2007, it appears that nonrevenue water for the VCU system is less than 10 percent.

PRICING

Water rate structures are established to generate sufficient revenues for the utility to cover its costs, to allocate the costs among its different customers, and to provide an understandable price signal to its customers that serves as an incentive to use water efficiently. In addition, wastewater rates are typically linked to water service charges, as either a percent of water service charge or based on water usage, and thus provide an indirect signal to water customers.

Water rate structures designed to promote water use efficiency include increasing block rates, seasonal rates, excessive use surcharges, and water budgets. Increasing block rates have two or more “blocks” of volumetric use (e.g., 0-300 ccf, over 300 ccf) with an increase in the unit rate for each successive block. The intent of an increasing block rate structure is that the higher-volume users pay a higher unit rate than lower volume users. Seasonal rate structures vary the per unit rate for defined seasons, typically with a higher per unit rate in summer, or peak use months. Excessive use surcharges are structured similar to increasing block rates, but are typically based on a historical average rate of use for the customer, or

customer class. Higher per unit rates are charged in billing periods in which the billed consumption exceeds a set percent (e.g., 150 percent) of average use. Water budgets are billing structures based upon characteristics of the property such as number of fixtures, persons per household and irrigated area. The water budget billing system establishes an estimated use for each account and surcharges are assessed for use in excess of the estimated usage.

The current decreasing block rate structure could be converted to an increasing block rate structure in an effort to promote water efficiency, particularly among high-volume users. However, an extensive rate analysis would be required to assure that the conversion would remain revenue neutral. Similarly, excessive use surcharges could be implemented.

Section 3
Residential Interior

TOILETS

Because toilet water use is considered to be the highest water use inside a household, conservation measures centered on the toilet fixture play a significant role in most residential interior water conservation programs. Conservation measures centered on the toilet include the following:

- Toilet leak detection and repair (leakage)
- Flapper valve replacement (leakage)
- Fill valve replacement (leakage)
- Toilet displacement devices (bags, dams, bottles)
- Early closure flapper valves
- Fill-cycle regulator
- Low-consumption (1.6 gpf) toilets
- Flapperless toilets
- High-Efficiency toilets (HETs)
  - Pressure assist toilets
  - Dual-flush toilets
- Toilet testing and specifications
  - Maximum Performance Testing (MaP)
  - Los Angeles Supplementary Purchase Specification (LASPS)
  - Uniform North American Requirements (UNAR) for Toilet Fixtures

Low-Consumption (1.6 gpf) Toilets

Since the National Energy Policy Act of 1992 new toilets have been required to meet a national standard of 1.6 gallons per flush (gpf). The standard prior to 1992 was 3.5 gpf. Toilets designed to operate at 1.6 gpf are often referred to as low-consumption toilets, although actual operation may increase to 2.0 gpf or higher due to improper maintenance or deterioration of the flapper valve. The national standard only applies to new fixtures; toilets that use greater than 1.6 gpf are allowed to remain in service throughout their useful life. The useful life of a toilet, on average, ranges from 20 to 30 years (California Urban Water Conservation Council (CUWCC), 1992). Therefore 100 percent saturation of low-consumption toilets may not occur through natural replacement until 2024. Rather than rely on natural replacement to realize conservation savings, many water agencies offer incentives to customers who buy low-consumption toilets that replace toilets using greater than 1.6 gpf.

Flapperless Toilets

Water conservation potential is often lost to a flapper valve that is not functioning properly. Furthermore, if and when the flapper is replaced the wrong part may be used, or a generic flapper may be installed. The flapperless toilet was designed to eliminate water loss from failing flappers. Flapperless toilets have a trough like water container (referred to as the dump bucket) in the tank that is dumped when the toilet is flushed. This technology ensures the water use of a toilet is consistent throughout the useful life of the fixture.

High-Efficiency Toilets

Toilets are readily available that use less water than the standard 1.6 gpf low-consumption toilet. These toilets that go beyond the current standard and save additional water are generally referred to as High-Efficiency Toilets (HETs). High-Efficiency Toilets by definition save at least 20 percent more water than a 1.6 gpf toilet. This equates to a maximum 1.28 gpf volume. High-Efficiency Toilets are typically either a pressure assist or dual flush toilet. Some water agencies that administer toilet rebate programs offer higher incentives to customers for purchasing an HET. Some agencies only offer incentives for HETs and no longer offer incentives for low-consumption toilets. There are a variety of dual flush and pressure assist toilets to choose from and many have been tested to insure they function properly. Moreover, including HETs in an incentive-based toilet replacement program may reduce lost savings from free-riders, because these toilets save more water than toilets mandated by the federal standard[1].

Pressure Assist Toilets

Pressure assist toilets contain a sealed plastic tank inside the usual porcelain tank. The seal tank pressurizes using the water line pressure. When the toilet is flushed the pressure pushes waste out of the bowl and into the sewer line. This process requires less water than a conventional gravity flush toilet. One caveat regarding pressure assist toilets is that older high-rise buildings may not have sufficient pressure on the upper floors to enable pressure assist toilets to function properly. It is important that the indoor water pressure where the toilet will be installed is 25-40 psi minimum (Denver Water, 2004).

Dual-flush Toilets

Dual flush toilets have two flush options; one for liquids and one for solids (i.e., 1.6 gpf for solids and 0.8 gpf for liquids). These toilets on average save more water than a 1.6 gpf toilet and are considered to be HETs. Similar to pressure assist toilets there are water agencies that provide incentives for the purchase of dual flush toilets.

Toilet Testing and Specifications

When low-consumption toilets were first introduced many of the models did not function adequately. For example, there were complaints that some models were unable to dispose of solid waste with a single flush. If a toilet requires multiple flushes it reduces or eliminates the savings. Inferior models may also leak, or have flush volumes greater than 1.6 gpf causing excess water to be wasted. To combat this problem the Maximum Performance Testing (MaP), Los Angeles Supplementary Specification (LASPS), and the Unified North American Requirements for toilet fixtures were developed. These resources are of great value to water agencies that are designing a toilet program.

Maximum Performance Testing (MaP)

The Maximum Performance testing of toilets is a cooperative effort between American and Canadian partners and has set a standard for testing low-consumption and High-Efficiency Toilets. The testing effectively analyzes a toilet's capability to flush solid waste by using encased soybean paste. The MaP Testing report is now in its 6th edition and contains results for 213 tested toilets. Each toilet is scored in regards to flushing ability and the flush volume is assessed. The report also indicates if a toilet is certified under the LASPS.

Los Angeles Supplementary Purchase Specification (LASPS)

The LASPS sets requirements for flappers and flush volume under maximum adjustment settings and ensures the water savings from toilets is long-lasting. The use of bleach or toilet cleaning products can cause the flapper to deteriorate and fail, the LASPS only certifies chemical resistant flappers. As of

[1] Free-riders are program participants who would have replaced their toilets even if there was no incentive.

February 2006 the interior of the toilet tank is to be marked with the flapper replacement part number to prevent flappers from being improperly replaced. There will also be a new requirement for fill-valves.

Unified North American Requirements for Toilet Fixtures (UNAR)

The Unified North American Requirement for toilet fixtures is an effort to standardize a toilet qualification system for water agencies wanting to achieve water conservation through toilet replacement programs. The Unified North American Requirement for toilet fixtures incorporates MaP testing and the LASPS and has two performance levels, UNAR and UNAR HET. A list of qualified toilets may be downloaded for UNAR and UNAR HET. The standard UNAR list currently has 87 toilets and the UNAR HET list contains 23.

Further Discussion

Design for toilet replacement programs varies from agency to agency. Incentives may be awarded as a cash rebate, bill credit, point of purchase voucher, and some agencies give away free toilets or charge a nominal fee. Toilet distribution and installation are also design features that vary. Some agencies simply allow the customer to buy the toilet at a home improvement or hardware store, mail in the receipt for a rebate with no questions asked. Others require a professional plumber to install the low-consumption toilet or some provide the toilet and directly install it. Professional installation ensures the toilet is functioning properly. Other distribution methods include depot style toilet sales or giveaways and the use of community based organizations to distribute new toilets.

During the fall of 2005 CDM reviewed toilet rebate programs across the United States. The average rebate for 30 residential toilet rebate programs was found to be $103, and for the 22 commercial programs reviewed the average was $117. Twelve of the agencies CDM reviewed offer an incentive for or publicize HETs.

In analyzing toilet replacement programs, the following are some assumptions that have been used in previous analyses:

- Average residential flush rate of 12.4 flushes per day
- Replaced toilets use 5 gallons per flush
- Average commercial flush rate of 25 flushes per day
- New gravity-flush toilets use 2.0 gallons per flush
- $100 rebate, plus 7% administrative costs, for gravity-flush toilets
- New high-efficiency toilets use 1.4 gallons per flush
- $200 rebate, plus 7% administrative costs, for high-efficiency toilets
- High-efficiency toilets in new construction save 0.6 gallons per flush
- $100 rebate, plus 7% administrative costs, for high-efficiency toilets in new construction
- New commercial flushometer toilets replace 4.5 gallon per flush with 1.6 gallon per flush
- $200 rebate, plus 7% administrative costs, for commercial flushometer toilets

Based upon the premise that older homes are more likely to have less efficient toilets, any toilet replacement program in the City of Valparaiso should target the older homes (most likely by targeting older neighborhoods. As shown on Table 3.1, approximately 77 percent of housing in the City and County (as of 2000) were built in 1989 or prior. Although it appears that the region has achieved substantive growth since 2000, there are still a substantive number of homes that could be targeted for toilet replacements

Table 3.1 Number of Housing Units by Year Structure Built (2000)					
		Porter County, IN		Valparaiso, IN	
Year Structure Built	Total:	57,616		11,659	
	Built 1999 to March 2000	1,620	2.8%	418	3.6%
	Built 1995 to 1998	5,670	9.8%	1,196	10.3%
	Built 1990 to 1994	6,136	10.6%	1,024	8.8%
	Built 1980 to 1989	7,204	12.5%	1,240	10.6%
	Built 1970 to 1979	14,851	25.8%	2,241	19.2%
	Built 1960 to 1969	8,909	15.5%	1,724	14.8%
	Built 1950 to 1959	5,440	9.4%	1,271	10.9%
	Built 1940 to 1949	2,527	4.4%	656	5.6%
	Built 1939 or earlier	5,259	9.1%	1,889	16.2%
	Built 1989 or prior	44,190	76.7%	9,021	77.4%

Table 3.2 summarizes reported water savings for various types of equipment.

Table 3.2. Toilet Water Savings			
Toilet Options	Flow Rating	Device Life (yr)	Potential Water Savings (gal/cap/day)
6-Liter toilets	1.6 gal/flush	20-30	10.4
New ballcock and flapper	NA	NA	5+
Early closure device	0.5 to 0.7 gal/flush	5	2-3
Dual flush toilets	3 to 6 liters/flush	-	-
Source: AWWA, 2006			

SHOWERS

Water conservation measures that focus on restricting water use from residential showerheads include the introduction of:

- Low-flow showerheads
- Shower-flow restrictors
- Shut-off valves

Federal legislation passed in 1992 requires that showerheads have a maximum flow rate of 2.5 gallons per minute. However, showerheads are available in the marketplace that do not conform to this standard. In December, 2005 the City of Seattle and the California Urban Water Conservation Council (CUWCC) put out a press release announcing that they are seeking sanctions against the manufacturers of said showerheads. Some of the showerheads in violation exceed the standard by as much as five times. Together the City of Seattle and the CUWCC are notifying the United States Department of Energy (DOE) of results from showerhead testing, in hopes that the manufacturers will halt production of these water-wasting showerheads. The DOE is responsible for enforcing the national standard.

It is common for water utilities to provide free water conserving showerheads to customers. These showerheads are often available to be picked up at the water utility's office location; sometimes it is required that the old showerhead is brought in for an exchange. Table 3.2 show reported water savings from showers.

Table 3.2. Potential Shower Water Savings

Toilet Options	Flow Rating	Device Life (yr)	Potential Water Savings (gal/cap/day)
New showerhead	2.5 gpm	5-10	2.3 (~21%)
Shower flow restrictor	2.5 gpm	10	(~21%)
Source: AWWA, 2006			

FAUCETS

Conservation measures targeting residential indoor faucet flows include the following:

- Low-flow faucets
- Faucet aerators
- Replacement of faucet washers (leakage)

Faucets are required to meet flow rate standards passed in the Energy Policy Act of 1992 (EPAct). Kitchen faucets are not to exceed 2.5 gallons per minute (gpm) and restroom faucets are not to exceed 2.2 gpm. These flow rate standards improve indoor residential water use efficiency. Faucet aerators also reduce faucet flow rates by introducing air into the water flow.

Typically, faucet aerators are installed as part of a residential survey or provided in water saving kits provided by water utilities. Water utilities ordinarily provide faucet aerators free of charge to water customers. Savings for faucet aerators alone are difficult to quantify and their savings are usually included in the sum of savings estimates for a residential survey or audit. It is estimated that faucet aerators can save 0.3 gcd

CLOTHES WASHERS

Clothes washer technology is constantly evolving and the machines that are currently available use far less water than washers sold in the recent past. Many water agencies promote the use of water efficient clothes washers by offering incentives for their purchase. Unlike water efficient toilets which offer a relatively consistent savings per fixture, clothes washers may vary greatly in regards to their water use. Clothes washer water efficiency is measured by the water factor. The water factor is the amount of water used per cubic foot of capacity. As the water factor value decreases water efficiency increases.

Water agencies offering rebates typically use the water factor as the eligibility requirement. The American Council for an Energy Efficient Economy (ACEEE) and the Consortium for Energy Efficiency (CEE), two non-profit agencies that promote energy-efficient products, both publish lists of efficient clothes washers. They provide these lists to promote clothes washers that meet specific efficiency standards. Water agencies can in turn use these lists as a reference. The CEE list is used often to designate qualifying clothes washers for incentive programs.

Further Discussion

When designing this program it is very important to note the changes were made to Federal, CEE for Energy Efficiency (CEE), and Energy Star standards in 2007. Federal standards have required that all commercial family-sized clothes washers have a modified energy factor of 1.26. The modified energy factor is a measure of energy efficiency. The higher the energy factor value the more efficient the machine.

The water use factor is the number of gallons needed for each cubic foot of laundry. A lower number indicates lower consumption and more efficient use of water. The CEE also provides Tiers which represent varying levels of efficiency, although CEE notes that all of the washers it lists are efficient. In considering

Initiated in 2007, in order for a clothes washer to receive the Energy Star label in 2007 it must have a water factor of 8.0 and a modified energy factor of 1.72.

One option for to addressing clothes washer use is to consider the implementation of an incentive program (which meets a specific water factor/energy factor requirement). Separate implementation conditions would need to be developed for the single-family and multifamily sectors. These two sectors will require different program design and result in different savings and costs. Estimated costs and savings can be derived from the following assumptions, and differentiate between a program requiring different CEE Tier machines as the minimum standard for a program.

- Replaced washers have average water factor of 13.3
- $300 rebate, plus 7% administrative costs
- 250,000 private home washers replaced
- 30% free-rider on private home rebates
- 100,000 common area washers replaced
- Apartment washers are used 5 times per day
- New washers are CEE Tier 3A with water factor of 7.5
- Or, new washers are CEE Tier 3B with water factor of 5.5

An efficient clothes washer installed in an apartment building common area laundry room saves more water than an efficient clothes washer installed in a private home simply because it is used more frequently. A clothes washer in a private home is estimated to be used 392 times per year (DOE, Office of Energy Efficiency and Renewable Energy). A clothes washer in an apartment building common area laundry facility is estimated to be used 3 to 5 times per day or 1,095-1,825 times per year (CEE, 1998). Strategically replacing washers that are used with a higher frequency will achieve greater water savings. Total water savings would be higher and the cost of conserved water would be less in apartment building common laundry areas than it would be in private homes. This is assuming the rebates and water factor requirements for the two sectors are equal.

Based upon the a project called The High Efficiency Laundry Metering and Marking Analysis (THELMA) which involved lab testing and field testing in 26 locations in the West, average water savings from replaced clothes washers were 98 gallons per week per home. A study by the Oak Ridge National Laboratory found higher efficiency washing machines can save of 38 percent over lesser efficient units.

DISHWASHERS

The following discussion pertains to residential dishwashers. Currently there are no water efficiency standards in place for dishwashers. Unlike other water using fixtures, dishwashers are not labeled with a water use measurement. Toilets are measured using gallons per flush, clothes washers via a water factor, and faucets and showerheads by a gallon per minute rating. Energy efficient dishwashers are being promoted via the EPA's Energy Star program, and some power utilities are offering rebates for efficient models. Dishwashers promoted by those programs are assessed by an energy factor. There is a Federal standard for dishwasher energy factors. In order for a dishwasher to carry the Energy Star label it must have an energy factor that is 25 percent greater than the standard. Compact dishwashers are not eligible for the Energy Star program.

Since most of the energy used by a dishwasher pertains to heating water it is a safe assumption that the more energy efficient the dishwasher, the less water it uses (CEC). However, there is no direct correlation between a dishwasher's energy factor and its water use. This makes it difficult to estimate savings for a potential dishwasher replacement program.

Furthermore, residential dishwashing only accounts for an estimated 1.4 percent of total residential indoor water use (Mayer *et. al.*, AWWA, 1999). This combined with the uncertainty of water use for individual dishwashers makes it a poor candidate for a residential incentive program. Perhaps an awareness campaign that outlines the availability of efficient washing machines and things people can do to use less water in the dish washing process would be more worthwhile. This includes minimally rinsing dishes prior to placing them in the dishwasher, using water saving settings when available, and running the dishwasher only when it is full.

General dishwasher information is available on AWWA's website courtesy of Denver Water (AWWA). Water use of eight domestic and eight imported dishwasher models is provided along with other assumptions about dishwashers that can be used to estimate savings of dishwasher replacement. This information is summarized in Table 3.4.

According to the AWWA website the average dishwasher uses between 9 and 12 gallons of water per load. Flex Your Power, a California energy efficiency outreach campaign estimates newer dishwashers average 9 gallons per load (gpl) and Energy Star dishwashers average 6 gallons per load. Energy Star estimates 215 wash cycles per year per dishwasher.

One thing to note is that given the water hardness issue with VCU and its reported impacts on dishwashers, a dishwasher program should not be given a high priority.

OTHER INDOOR

Several other residential indoor water conservation measures are available for review. These include:

- Residential indoor audit
- Replace self-regenerating water softeners
- Point-of-use water heaters
- Hot water system recirculation
- Pressure regulator

Residential Indoor Audits

Typical audits identify water leaks in toilets and faucets, and offer replacement flapper valves, low-flow showerheads, and faucet aerators. Auditors also review water use patterns with residents, such as clothes washer settings and dishwashing techniques to identify more water efficient practices.

Hardware distributed by the auditor such as toilet displacement devises, early closure devises, faucet aerators and showerheads may be purchased in bulk quantities. Audit recommendations may include water-using fixture replacement or customer purchase of materials other than items distributed by the auditor. In some cases, customers may require a professional plumber to fix leaks and install recommended fixture replacement.

For comparison purposes, an analysis of the Portland, Oregon audit program is presented.
This program targeted all residential (single-family and multifamily) accounts with high volume water use, or sudden increases in water consumption. The evaluation assumed that the program would target the top 20 percent of accounts. Average water use for theses accounts was assumed to use twice that of average account water use. Water providers were expected to contribute staff time in order to identify high water users from provider customer records. This staff time was to be in addition to the regional staff costs assumed for this program.

The expected cost of an audit program in Portland, Oregon assumed $75 per audit for materials and labor. Participants were assumed to pay an average of $50 to implement audit recommendations. Two scenarios were considered: one where the participant pays the $50 cost of implementing audit recommendations, and the other where the participant receives a $50 rebate for cost of implementing recommendations.

Based on the Portland analysis, indoor audits are assumed to reduce indoor use by 25 percent among participating high water use households. A five-year savings life was assumed.

Section 4
Residential Outdoor

LANDSCAPE IRRIGATION

There are several landscape irrigation oriented conservation measures that can be implemented to make residential outdoor water use more efficient. The list below provides some technically feasible measures that are available:

- Adjust irrigation timers
- Drip irrigation systems
- Bubble/soaker irrigation systems
- Irrigation ET controller
- Soil sensors
- Rain/moisture sensors
- Water efficient landscape materials
- Landscape and irrigation system rebate
- Landscape ordinances - Residential
- Water budgets for landscape irrigation
- Turf replacement/removal incentives

OTHER OUTDOOR

Aside from conservation measures targeting landscape irrigation, other residential outdoor conservation measures are available. These include:

- Residential outdoor audit
- Water waste prohibition (ordinance targeting over-watering and leakage)
- Swimming pool/spa covers

Residential Outdoor Audits

Typical outdoor audits identify water leaks in irrigation systems and recommend replacement of broken or inefficient systems. Auditors also review irrigation patterns with residents, and other outdoor water uses to identify more water efficient practices. Monitoring and resetting of automatic timers is reviewed with the homeowner. Materials are provided explaining the use of low-water use landscape plants and materials.

As an example, a residential outdoor audit program was evaluated for water providers in Portland, Oregon. The program targeted outdoor water use among the top 20 percent of single-family accounts with a high summer to winter use ratio. Targeted accounts were also assumed to have average outdoor water use that is 1.5 times that of average accounts. The Portland program evaluation assumed a cost of $65 per audit. An incremental cost of $80 to the consumer above routine maintenance costs was estimated. One scenario assumed no rebate to offset this customer cost, while the second scenario assumed an $80 rebate to offset the cost to customer above routine maintenance cost. This evaluation assumed a 15 percent reduction in summer use among participating households. The savings life was assumed to be five years.

In another study, the Regional Municipality of Durham (Toronto) used college-aged students to provide lawn and gardening information to residents, discuss watering habits and misconceptions, and explain the societal benefit of reducing water use for lawn irrigation. The average cost was $45/household, 1,400 households participated in the program and the average irrigation reduction was 32 percent (Pleasance, 2002).

Water Waste Prohibition/Landscape Water Ordinances

We will further explore water waste and landscape water ordinances from other communities.

Swimming pool/spa covers

The use of swimming pool and spa covers is also a technically feasible method of conserving water. In neighborhoods where swimming pools and spa water use is a notable factor in overall water use, the implementation of swimming pool/spa covers could help reduce water losses. Typically, pool and spa covers provide the most benefit in dry climates where evaporative loss is high. Pool and spa covers could provide marginal benefits in during the summer months.

Section 5
Commercial, Industrial, and Institutional (CII) Indoor

Commercial, Industrial, and Institutional (CII) indoor water use includes water used for domestic purposes such toilets, urinals, showers, faucets, and also for commercial clothes washers, dishwashers, cooling, and other CII indoor purposes. Conservation measures that target indoor water end uses in the CII establishments could play a significant role in reducing water demand in the City of Valparaiso.

A wide range of indoor conservation measures apply to CII establishments. Indoor conservation measures in the industrial sector are often related to engineering modifications of site-specific water uses such as process water use and cooling water use to bring about improvements in water use efficiency. Water efficiency improvements in the commercial and institutional sectors are typically associated with replacement of plumbing fixtures, improved cooling water use and leak reduction.

Case studies and water-efficiency audits looking at overall water use at CII facilities have reported water savings from conservation measures that range from a low of 10 percent to a high of more than 90 percent of previous water use. Some studies have estimated average potential demand reduction to range from 15 to 50 percent, with 15 to 35 percent being typical (Vickers, 2001). A 1997 study of 902 CII facilities in Southern California estimated a 29 percent average potential water savings at surveyed sites. Savings were related to reduction of domestic water use, more efficient industrial processes and improved landscape irrigation (Sweeten *et al.*, 1997). According to a study by the North Carolina Department of Environment and Natural Resources (NCDENR), water conservation measures can readily produce a 25 to 30 percent savings in CII domestic water usage (NCDENR, 1998). A study that relied on water conservation audits in Albuquerque, New Mexico reported that on average, approximately a 40 percent reduction in CII water use was possible in that region of the country (Smith and Yuhas, 2004).

Potential savings from CII water conservation and efficiency improvements have also been reported on an industry-by-industry basis in California. According to Gleick *et al.*, commercial laundries could save up to 50 percent through the adoption of more efficient commercial washers. Schools were estimated to have a savings potential of up to 44 percent mostly through toilet and landscape improvements (Gleick *et al.*, 2004).

The following section reviews potential water conservation options in different CII indoor water use categories. Landscape and irrigation-related conservation measures are discussed in the CII Outdoor section of the report.

TOILETS

The CII sector does have potential for savings in regards to a toilet replacement program, but the frequency of use for toilets in the CII sector varies greatly. Thus, savings are not as consistent and reliable as the residential sector.

In California many water agencies target the CII sector with low-consumption and high-efficiency toilet replacement. In fact it is part of CUWCC BMP 9, Conservation Programs for Commercial, Industrial, and Institutional (CII) Accounts. However, many toilet replacement programs in California have been in effect since the mid 1990s and much of the residential sector has been saturated with low-consumption

toilets. In locations where the residential sector has not been saturated, a toilet replacement program in the CII sector is a less viable option.

If the City of Valparaiso chooses to pursue the CII sector with a toilet replacement program, it should employ a methodical approach that targets the market segment with high frequency toilet use. Furthermore, the WCP should consider targeting the CII sector only after the residential sector has been saturated.

URINALS

Water conserving urinals represent an opportunity for water savings in the CII sector. The current standard for urinals allows a maximum of 1.0 gpf (CUWCC, 2005). Water agencies may provide an incentive for urinals that use less than 1.0 gpf, or like many toilet incentive programs they may offer incentives for urinals that meet the current standard in order to accelerate the replacement of older urinals.

Non-flush urinals do not use any water (we need to investigate whether there is any state or local laws that may prohibit non-flush urinals). Instead, they rely on a trap filled with a fluid that blocks sewer gases from entering the restroom but allows urine to pass through. These urinals can be installed directly into a flush urinal waste line. Non-flush urinals have been installed throughout the world and water agencies in California, Arizona, and North Carolina are offering incentive programs for them. Maintenance procedures are different for non-flush urinals and they may be best utilized in facilities that have a full time maintenance staff. Non-flush urinals have been installed in high traffic public areas such as the Rose Bowl, the San Diego Zoo, and London's Heathrow Airport. Moreover, non-flush urinals have been installed in institutional settings such as the Presidio of Monterey, San Diego Schools, and IBM corporate offices.

Urinals that have a flush volume of 0.5 gallons may be more suitable than non-flush urinals in some circumstances. Restaurants, bars, retail stores, and small businesses may not be able to properly maintain non-flush urinals, but can still reduce water consumption with the installation of 0.5 gpf urinals. Therefore both non-flush and 0.5 gpf urinals were evaluated in this analysis.

The following assumptions have been used in previous analyses of potential water savings:

- Replaced urinal uses 1.0 gallon per flush (gpf)
- Average fixture use is 25 uses per day
- $50 rebate for 0.5 gpf urinal, plus 7% administrative costs
- $100 rebate for non-flush urinal, plus 7% administrative costs

SHOWERS

Hotels are one of the only commercial account categories that hold potential for notable water conservation savings through a low-flow showerhead program. Institutional accounts such as schools may also be good targets for a showerhead replacement program. A showerhead replacement program targeting hotels could potentially achieve sizeable water savings. It is recommended that a CII showerhead replacement program targeting hotels be evaluated more extensively to assess potential costs and savings.

FAUCETS

Faucets in the CII sector are required to meet the same 1992 EPAct standards as residential faucets. The CII sector offers additional savings measures beyond low-flow faucets and faucet aerators that may not be applicable in the residential sector. These include:

- Motion sensors that activate the faucet when motion is detected beneath the faucet and turn off when hands are removed.
- Metered valve faucets that deliver a preset amount of water to the user.
- Self-closing faucets that are spring loaded and shut off a short time after they are turned on (Whole Building Design Guide).

These technologies are ideal in high traffic restrooms and prevent faucets from being left on and wasting water. While these devices do save water, they are primarily installed for sanitary reasons. The side effect of this is natural water savings.

CLOTHES WASHERS

The CII sector has two distinct subsectors that are candidates for water conservation, Laundromats and facilities such as hotels, hospitals, and commercial laundry services. Laundromats often use commercial family-sized washers while hotels, hospitals, and commercial laundry services use large industrial equipment.

Laundromats

Laundromats offer similar savings potential to that of multifamily common area laundry facilities. Savings estimates for washer replacement in laundromats are higher than multifamily common areas due to the assumption that a washing machine in a laundromat has an assumed higher frequency of use. Washers found in Laundromats are estimated to be used 6 to 8 times per day compared to 3 to 5 times per day for multifamily common area washers (Consortium for Energy Efficiency (CEE), 1998).

Note that the assumptions and program design are the same as the multifamily common area laundry program, with exception to the number of uses per day per machine.

- Replaced washers have average water factor of 13.3
- $300 rebate, plus 7% administrative costs
- Laundromat washers are used 8 times per day
- New washers are CEE Tier 3A with water factor of 7.5
- Or, new washers are CEE Tier 3B with water factor of 5.5

A rebate program that targets laundromats may have a heavier administrative burden than a multifamily common area program. However, cost effective water savings could still be achieved and it is recommended this program be considered for further review.

Large Commercial Washers

Large laundering operations, whether it is a hotel, hospital, or commercial laundry service, typically use large industrial washing machines. These machines are not designed like a residential clothes washer and are capable of washing large batches of goods. A typical industrial washer/extractor utilizes a single chamber that empties and fills during each wash cycle. There are options for improving water efficiency compared to these standard washer/extractor machines. These options include:

- Continuous Batch Washers - continuous batch washers move the goods being washed through a tunnel from one cycle to the next. The water used in the process flows countercurrent to the goods. This process is estimated to save up to 70 percent more water than a conventional washer/extractor (Hampton Roads Water Efficiency Team).
- Closed-loop Laundry Systems - these systems recycle spent water using membrane filtration**.** The filtration system is capable of recycling 80 to 90 percent of spent water (Pacific Institute, 2003).
- Ozone Cleaning Systems - ozone cleaning systems use ozone gas in the wash cycle which allows laundry to be cleaned at lower temperatures. This reduces, or may even eliminate the need for steam and hot water. An ozone cleaning system may use 30 percent less water than a conventional (Hampton Roads Water Efficiency Team).

Water conservation opportunities for large commercial washers are available. However, due to the heterogeneity of the market it is not an ideal target for a general retrofit or rebate program. Unlike residential washing machines, the washers used in the CII sector may vary greatly in design. Promoting education and awareness in regards to water saving potential to users of industrial washing equipment in this sector is a worthwhile endeavor. A rebate or financial assistance program for accounts using industrial washing equipment may be more complex than a residential washer program, but will likely yield considerable water savings. It is recommended that a program such as this be further assessed in terms of program design, cost, and savings.

COMMERCIAL KITCHEN EQUIPMENT

Commercial kitchen equipment use vast quantities of water and present opportunities to conserve water. For example, an examination of 605 industrial water efficiency programs in California found that these programs were able to cut kitchen and cafeteria water use by 32 percent, yielding a savings of nearly 100,000 ccf of water per year (NCDENR, 1998). The levels of savings of any water conservation program will obviously depend on the water efficiency of equipment that was already in use and operation practices prior to the adoption of the new conservation measures. Some common commercial kitchen equipment that are typically targeted for conservation measures include:

- Dishwashers
- Pre-rinsing spray valves
- Garbage grinders
- Ice-making machines

The California Urban Water Conservation Council (CUWCC) estimates that the dishwashing operation of a typical restaurant consumes over two-thirds of all of the water used by that establishment. In some cases, it is reported that nearly half of the water used in this process is used during pre-rinsing activities to remove food from dishware and utensils prior to placing them into the dishwasher (Koeller and Dickenson, AWWA, 2003). As well as dishwashers and pre-rinsing spray valves, garbage grinders and ice-making machines can be large water users in commercial kitchen facilities.

Given the commercial development in the City of Valparaiso, a program to promote water use efficiency in commercial kitchens could be further investigated. This section describes conservation measures for commercial dishwashers, pre-rinsing spray valves and garbage grinders. Conservation measures for ice-makers are discussed separately under the Cooling section.

Dishwashers

High water volume dishwashers can be targeted for replacement in conservation programs. General categories of commercial dishwashers include:

- Undercounter-types
- Door-types
- C-line conveyor, rack-types
- Flight-types

Based on descriptions provided in the NCDENR report, undercounter dishwashers are the smallest commercial dishwashers and are suitable for establishments catering to about 60 people. Such establishments include nursing homes, churches, small food service areas, and office buildings. Undercounter dishwashers are reported to use the most water per rack of all commercial dishwashers. Water use for undercounter dishwashers ranges from just over 1 gallon per rack to just over 2.5 gallons per rack (NCDENR, 1998).

Door-type dishwashers are described to be suitable for establishments catering to 50 to 200 people and are described to be the most widely used of commercial dishwashing machines. Door-type dishwashers can be found in schools, hospitals, churches, and restaurants. Estimated water use for door-type dishwashers is reported to range from just less than 1 gallon per rack to approximately 2.5 gallons per rack (NCDENR, 1998).

C-line conveyor, rack-type dishwashers use a conveyor belt to move dishware loaded on racks through for washing. These types of dishwashers are described to be suitable for establishments catering to more than 200 people such as large hotels, large restaurants, schools, and hospitals. Conveyor-type dishwashers can use anywhere from roughly 0.8 to 1.6 gallons per rack (NCDENR, 1998).

Flight-type dishwashers are similar to conveyor-types in that they also use a conveyor belt to move dishes through the washer. However, unlike conveyor-types, dirty dishware in flight-type dishwashers is placed directly onto the conveyor belt rather than on racks. Flight-type dishwashers are described to be suitable for establishments processing very large quantities of dishware. Water use in flight-type dishwashers is reported to range from approximately 0.8 to 2.5 gallons per rack (NCDENR, 1998).

Information provided in the NCDENR report shows that potential water savings from implementing measures to promote more water efficient dishwashers could be as high as 1.5, 1.5, 0.8, and 1.7 gallons per rack respectively for undercounter, door, conveyor, and flight-type commercial dishwashers. Water use and potential savings information from the NCDENR report is summarized in Table 5.1 below.

Table 5.1: Summary of Typical Water Use Ranges for Each Type of Dishwasher

Dishwasher type	**Minimum water use** (gallons/rack)	**Maximum water use** (gallons/rack)	**Difference water use** (gallons/rack)	**Potential savings** (percent)
Undercounter-types	1	2.5	1.5	60%
Door-types	1	2.5	1.5	60%
C-line conveyor, rack-types	0.8	1.6	0.8	50%
Flight-types	0.8	2.5	1.7	68%

Source: NCDENR, 1998.

A report by the Pacific Institute provides useful information about dishwasher use frequencies (Pacific Institute, 2003). This information along with water use estimates for efficient and inefficient dishwasher types is provided in the Table 5.2.

Looking at the potential savings columns on the far right of both tables 5.1 and 5.2, it is reasonable to assume that a water conservation program targeting commercial dishwashers is likely to reduce water use from dishwashing by approximately 50 percent per rack wash. The actual percentage of water saved at any specific establishment will depend on the efficiency of the dishwashers that were already in use prior to implementing the program and ultimately on the efficient water use practices of dishwasher operators at the specific establishment.

Table 5.2: Dishwasher Use Frequencies and Efficient and Inefficient Water Use Estimates

Type of Dishwasher	**Racks/ Day**	**Efficient average water use** (gallons/rack)	**Inefficient average water use** (gallons/rack)	**Potential savings** (percent)
Rack/undercounter	100	1.1	2.1	48%
Flight or conveyer	330	0.5	1	50%
Source: Pacific Institute, 2003				

Pre-rinsing spray valves

Pre-rinsing spray valves in commercial kitchens are typically used for pre-rinsing activities prior to placing dishware and kitchen utensils in the dishwashing machine and also for manual cleaning of dishware and other food apparatus in commercial kitchen type environments. As mentioned earlier, in some cases nearly half of the water used in dishwashing activities can be attributed to pre-rinsing activities performed to remove food from dishware and utensils prior to placing them into the dishwasher. A conservation program to replace less efficient pre-rinsing spray valves with more efficient high pressure/low volume spray valves offers an opportunity to reduce water use in commercial kitchens. It is recommended that a water conservation program targeting pre-rinsing spray valves be considered for further evaluation.

An example of a program promoting the use of more efficient high pressure/low volume spray valves in commercial kitchens is the one offered by the California Urban Water Conservation Council. This program is a multiphase program which is currently in Phase II implementation. Phase I of the program was implemented from October 2002 to December 2003. In Phase I of the program the goal was to replace approximately 16,900 pre-rinse spray valves and in turn save heating energy and water. Projected annual energy savings from Phase I implementation was estimated at 7.4 million therms while projected savings were projected at 3,400 acre-feet annually (3.04 mgd) (Koeller and Dickenson, AWWA, 2003). The program predominantly targeted small food service facilities using direct mail followed by door-to-door canvassing. Efficient pre-rinse spray valves were offered and installed for customers for free.

Whereas the common pre-rinsing spray valve uses up to 3 gallons per minute, CUWCC defines an efficient spray valve as one that uses 1.6 gallons or lower while maintaining the same cleaning capabilities of the higher water using spray valve.

Table 5.3 presents total estimated savings and other useful information about pre-rinsing spray valves in the food service operations in the State of California.

Table 5.3: Total Estimated Savings and Other Useful Information about Pre-Rinsing Spray Valves

Food Service Category	Population of Pre-rinse valves*	Hours of usage per day	Water savings per valve (gallons/day)	Gas savings per valve** (therms/day)	Total gas savings (therms/ year)	Total water savings (ccf/year)
Medium	15,000	6	300	2	11,000,000	2,200,000
Small	35,000	4	200	1.3	16,600,000	3,400,000
Very small	25,000	2	100	0.7	6,400,000	1,200,000
Total	75,000				34,000,000	6,800,000

** Based on National Association of Food Equipment Manufacturers (NAFEM) inventory of California installed dishwashing machine populations and types.*
***Assumes a Water heating efficiency of 70% and 55 degrees F temperature rise.*
Source: Koeller and Dickenson, AWWA, 2003.

Using the most recent information obtained from the CUWCC website, it can be assumed that each efficient spray nozzle installed would have a lifetime (5 years) savings estimate of 0.76 acre-feet (136 gpd) of water. Savings estimates obtained from the website are derived from field measurements at 19 existing food service facilities in California. The Rinse and Save program water savings assumptions are summarized in Table 5.4.

Table 5.4: Rinse and Save Program Water Savings Assumptions

	CCF	Gallons	Acre-feet
Annually	66.4	50,000	0.153
5-Year Life of Spray Nozzles	332	250,000	0.765

Source: CUWCC.

Alternative annual estimates of savings from a program to install efficient high pressure/low volume spray valves in commercial kitchens are provided by the Metropolitan Water District of Southern California (MWD) and are summarized in Table 5.5. MWD estimated annual savings per kitchen sprayer at 75,000 gallons. MWD also offers $50 rebate to cover the cost of a new rinsing sprayer.

Table 5.5: Estimates of Savings from Installing Efficient Spray Nozzles in Commercial Kitchens by Metropolitan Water District				
Usage per day	**water savings per day**	**Wastewater savings per day**	**Gas savings therms per day**	**Annual dollar savings**
2 hours	100 gallons	100 gallons	0.07 therms	$300-400
4 hours	200 gallons	200 gallons	1.3 therms	$700-900
6 hours	300 gallons	300 gallons	2.0 therms	$1,000-1,300
Source: MWD. http:www.mwdsaveabuck.com/sprayer.htm.				

Garbage Grinders

Garbage grinders also commonly known as garbage disposers have been a stable in many commercial kitchen environments over the years. However, the increasing awareness about the importance of conserving water has lead to the identification of water use for garbage grinders as an area of opportunity in conserving water. Garbage grinders can be significant water users in commercial kitchens and as such, they should be evaluated for their potential to in reducing the amount of water used in commercial kitchens.

The basic purpose of the conventional grinder is to dispose of food waste and other organic garbage resulting from food preparations, restaurants, dinning halls and cafeterias. The grinder disposes the food-based garbage by grinding it into a sludge mixer with running water that facilitates its transfer to the sewer system. Typical commercial garbage grinders are reported to use 2.5 to 10 gallons of water per minute and can use as high as 15 gallons a minute for sluice trough systems (Gregg *et. al.*, AWWA, 2006).

Some water conservation programs offer rebates to replace the garbage grinder with a restrainer basket. Not only does removing the grinder eliminate most of the water use for garbage disposal, it also saves energy (2 to 10 horsepower) and reduces the waste load on grease traps and sewage systems (Gregg *et. al.*, AWWA, 2006).

In certain situations where sluice trough systems are used, it may not be feasible to completely replace the sluice trough system. For example, some institutional dinning cafeterias rely on a conveyer belt and sluice trough system to collect and transfer dirty trays and plates from the dinning area to the kitchen. Food waste is dumped into the sluice trough system as the plates are collected. As an alternative to entirely replacing the sluice trough system, some establishments have opted to adopt more water efficient sluice trough systems. An example of a water efficient sluice trough system is the SOMAT disposal system.

As reported by Davis and Kiefer, the SOMAT system is a food waste pulping and dewatering system that replaces the scraping trough (scullery) and garbage disposal system in kitchens (Davis and Kiefer, 2004). The basic design of the SOMAT includes pulpers, which convert solid food waste into a slurry, and a water extractor (Hydra-extractor), which removes the water and produces an odor-free, semi-dry pulp. The dry pulp is discarded while the extracted water is recirculated to form a closed-loop cycle. A small amount of water is bled off and replaced with make-up water to prevent water from becoming too thick from constant reuse. The quantity of water that is bled off as well as make up water will depend on the model installed and use intensity. It is estimated the make-up water could be as low as 1-3 gallons per minute depending on the model and use intensity.

The Presidio of Monterey is an example of a location where the SOMAT system was implemented. Standard sluice trough garbage disposal systems in two dinning halls at the Presidio of Monterey were replaced with SOMAT systems. A post installation analysis of savings indicated that prior to installing the SOMAT system, garbage disposal flow was 5 gallons per minute. After installing the SOMAT garbage disposal flow was 2.5 gallons per minute. Total garbage disposal system operation time dropped from 7 to 3.5 hours per day. Annual water use for garbage disposal at the Presidio of Monterey dropped from 3,372,600 gallons to 766,500 gallons. This represented approximately a 23 percent reduction in water use (Davis and Kiefer, 2004).

For evaluation purposes, it can be assumed that replacing a standard garbage grinder with a restrainer basket would essentially eliminate water used for disposing food waste. Replacing a sluice trough garbage disposal system with a water-conserving recirculating system such as the SOMAT system would reduce water use for food waste garbage disposal by approximately 23 percent.

COOLING

Cooling represents one of the higher water end uses at CII facilities. Generally, water is used as a means of removing excess heat from air conditioning systems and other industrial equipment. Cooling systems that use water at CII facilities can be classified into the following common categories:

- Single-pass cooling based air conditioning
- Recirculation cooling tower based air conditioning
- Equipment cooling systems

As cool water moves over a heat source, the excess heat is transferred to the water and transferred away. The most common cooling technology relies on the cooling effect produced by water's evaporative property to dissipate heat from a heat source. Several measures can be adopted to reduce the amount of water used for cooling purposes. These measures are not limited to one specific cooling fixture but rather on the whole spectrum of CII fixtures that use water for cooling purposes. This section discusses each of the cooling systems listed above and associated water-saving measures.

Single-Pass Cooling Based Air Conditioning

In single-pass or once-through cooling technology, heat is transferred from the equipment to the water and the water is subsequently lost down the drain rather than being recycled. This cooling system process wastes much water and should be avoid wherever possible. Several conservation measures targeting single-pass cooling systems are available:

- Prohibit/eliminate single-pass cooling ordinance
- Retrofit single-pass cooling systems into closed-loop systems
- Install automatic shut-off valves
- Reuse single-pass water for other purposes

Prohibit/Eliminate Single-Pass Cooling Ordinance

This conservation measure targets CII establishments using single-pass technology and requires that this cooling system technology be replaced with one that does not use as much water.

Single-pass flow rates for air conditioning condensing water were reported to range from 0.13 to 3.8 gallons per minute per rated ton of cooling for a student building air conditioning unit in Seattle. These

flow rates were obtained from obtained from a study that evaluated Seattle's Water Smart Conservation Program (Schuldt et. al., AWWA, 2003). Based on case studies referenced by Amy Vickers, replacing single-pass cooling systems generally has short payback period. In one example, an ink manufacturing company replaced its single-pass cooling system with a used cooling tower that cost about $5,000 to purchase and install. The manufacturer is reported to have reduced its water use by nearly 80 percent and saved about $14,000 in annual water and sewer bills. This represents a payback period of less than five months. In another case study, a hospital morgue is reported to have replaced it single-pass refrigeration system with a recirculation system. The payback for this was close to five months (Vickers, 2001).

A survey of a sample of business, industry and government (BIG) customers found that water use for single-pass cooling was 19.6 percent of water use among CII customers in Portland, Oregon. Therefore from a Portland perspective, a conservation measure that restricts single-pass cooling would save close to 19 percent of existing water use among CII customers in Portland (Black and Veatch, 1998).

Retrofit single-pass cooling systems into closed-loop systems

Single-pass cooling systems can be retrofitted into a closed-loop system so that water is recycled back for reuse. The cooling water must be drained off and replaced periodically to maintain the proper water quality. Rebates are often available to offset the cost of retrofit. Though this remains a practical option for existing single-pass cooling systems, the implementation of ordinance that prohibits or eliminates single-pass cooling systems is the preferred conservation measure.

Install automatic shut-off valves

Installing automatic shut-off valves is one of several ways that water flows for single-pass cooling can be controlled so that water is not used when cooling is not needed, this could be the case during non-operating hours. Automatic shut-off valves are feasible conservation measures but the implementation of an ordinance that prohibits or eliminates single-pass cooling systems is the preferred conservation measure.

Reuse of single-pass water for other purposes

By simply connecting the single-pass cooling system's out line to a recirculation cooling system or other systems that can reuse water, water that was going to be lost through the drainage system is put to good use. This measure is particularly attractive when the single-pass cooling system is adjacent to other systems that are able to use water after it has passed through the cooling system. Unless if the single-pass water can be diverted to good use, the implementation of ordinance that prohibits or eliminates single-pass cooling systems is the preferred conservation measure.

Recirculation Cooling Tower Based Air Conditioning

As an alternative to single-pass based air conditioning where water is dumped into the drainage system, cooling towers are designed to reuse water through a recirculation scheme. Recirculation cooling water systems save water because cooling water can be used several times over instead of just once as is the case in single-pass cooling systems. The recirculation cooling process usually involves warm water continuously being pumped away from the heat source to cooler parts of the cooling tower. The warmer water is typically re-cooled by distributing it over thin sheets of material with large surface areas within the towers while air is allowed to flow over the sheets. Cooling during this process occurs as a result of evaporation and the loss of heat to the air. The cooled water is then returned back to the heat source where it is reused for further cooling.

The substitution of single-pass cooling with recirculation cooling water systems is a good initial measure to reduce cooling water demand. However, even with recirculation, cooling towers can consume 20 to 30 percent of a facility's water use (NCDENR, 1998). Additional conservation measures can further reduce water use in cooling towers.

- Reduction of "blowdown"
- Cooling tower conductivity controllers
- Submetering of "blowdown" and make-up feed lines
- Drift loss reduction
- Evaporative transfer efficiency

Equipment Cooling Systems

The challenge in evaluating water conservation measures to reduce water demand from equipment cooling processes is how establish measures that would be broad enough to encompass the wide range of equipment found in the CII sector. The diverse nature of the equipment and process applications also makes it difficult to develop broad all-encompassing estimates of savings.

Water conservation measures for equipment cooling include the adoption of efficient recirculation water systems and the use of air-cooling technology. This section addresses measures that promote the adoption of air-cooling technology to replace water-cooling technology for equipment cooling systems. The following are some available air-cooling measures for consideration:

- Air-cooled ice-makers
- Air-cooled HVAC systems
- Air-cooled chillers
- Air-cooled pumps
- Air-cooled compressors

Air-cooled ice-makers

As defined by the Air-Conditioning and Refrigeration Institute (ARI), an automatic commercial ice-maker is a factory-made assembly consisting of a condensing unit and ice-making section operating as an integrated unit, with means for making and harvesting ice (ARI, 2006). The condensing component of the ice-maker is used for cooling the unit. Two general types of condensing technologies are used: air cooled and water cooled. The type of technology used by the condensing unit has a significant impact on the ice-maker's per unit water use. Some studies have shown that water-cooled machines use ten times as much water as air-cooled machines and that water is rarely recirculated (NCDENR, 1998). Based of these general estimates, a conservation program that would promote air-cooled ice-makers is likely to provide significant water savings. It is recommended that this type of program be considered for further evaluation and implementation.

When evaluating an air-cooled ice-maker program one of the issues to consider is the trade-off between water efficiency and energy efficiency. Air-cooled ice-makers use up to ten times less water than their water-cooled counterparts but air-cooled ice-makers are generally known to be less energy efficient (Federal Energy Management Program, 2000).

A conservation program focusing on promoting air-cooled ice-makers may want to target specific establishment types. An evaluation by the Consortium for Energy Efficiency (CEE), found that hospitals account for 39.4 percent of all commercial ice-maker purchases, followed by hotels (22.3 percent), restaurants (13.8 percent), retail outlets (8.5 percent), schools (8.5 percent), offices (4.3 percent) and

grocery stores (3.2 percent) (CEE, 1998). Based on these reported statistics it may be more cost effective to target hospitals, hotels and restaurants with an air-cooled ice-maker program. These three categories of CII facilities accounted for approximately 75 percent of all commercial ice-maker purchases.

Air-cooled HVAC systems, Chillers, Pumps, and Compressors

Similar to ice-making machines – air-cooled heating, ventilation and air-conditioning (HVAC) systems, chillers, pumps, and other compressors use air-cooling technology to dissipate excess heat. Similarly, conservation programs encouraging the use of air-cooling technology for these systems can help conserve water. For most systems newer technologies have become available that eliminate the use of water for cooling. The water savings are dependent upon the type of system that the air-cooling technology replaces and are site-specific.

OTHER INDOOR

In addition to CII indoor conservation measures described above, several other indoor measures are available:

- CII indoor audit
- Hotel/motel information cards to reduce laundering
- Reduction of "blowdown" on boilers
- Process modifications
- Efficient/recirculating laboratory and medical equipment
- Efficient/recirculating film processing equipment
- Equipment metering for leak detection
- Cost-sharing for water efficient modifications
- Closed loop heat exchangers
- Steam condensate return systems

CII indoor audit

A CII indoor audit program has universal application across all CII sectors. The CII indoor audit program targeting top users within each CII sector could be implemented.

A study evaluating a proposed audit program in Portland, Oregon assumed an average audit cost of $1,000 per audit. An average implementation cost to customers of $500 was also assumed. Two scenarios were considered: one scenario assumed no rebate and an average customer cost of $500, while the other scenario assumed a $500 rebate to offset the customer cost.

The Portland, Oregon analysis assumed a 20 percent reduction in indoor water use as a result of the indoor audit program. A 5-year life was assumed on implemented audit recommendations.

Hotel/motel information cards to reduce laundering

Through its member agencies, Metropolitan Water District of Southern California supplies free towel rack hangers and bed cards that ask guests staying at the hotel for more than one day to consider using towels and linens more than once before having them washed. It is customary for hotels to wash towels and linens daily. Procedures may vary, but typically the guest places the bed card on the bed to indicate that the linens are not to be washed and hanging up the towels in the bathroom usually indicates the towels are not to be washed. This gives the guest awareness and the option to conserve water.

Albuquerque passed an ordinance in 2001 requiring hotels to provide placards for guests to request bed linens not be washed and not wash towels if a guest hangs them on the towel rack (U.S. Water News Online, 2001).

Cost-sharing for water efficient modifications

The Metropolitan Water District of Southern California (MWD)'s Industrial Process Improvement Program can be considered as a form of cost-sharing program to promote water efficient modifications. MWD's program offers financial assistance to local industries to encourage investment in water saving process improvements. According to the program description, the program is open to all public and private commercial and industrial users and is for documented water savings derived from projects implemented under the program that meet the minimum qualifying criteria (MWD, Industrial Process Improvement Program).

Typical projects that qualify for this assistance include installing projects that will capture, treat and reuse water that would other wise be discharged to the sewer. Depending on project costs and water savings, MWD would pay the lesser of (A) $2.36 per 1,000 gallons of actual water saved for a one year monitoring period; (B) fifty percent of the project's water-related process improvement costs; or (C) buy down of project costs to reduce the simple pay back period to two years (project costs minus twice the estimated annual water and wastewater savings).

Efficient/recirculating laboratory and medical equipment

The culture of water efficiency and recirculation of water can be encouraged in many laboratory and medical equipment. This section only addresses conservation opportunities from steam sterilizers as an example of equipment where technological modifications can offer more efficient ways of using water. Steam sterilizers are used to disinfect and kill germs of medical and laboratory apparatus. Though several types of steam sterilizers exist, they all generally operate following the same concept. Water is used for cooling in the jacket and chamber trap and to create a vacuum in the ejector.

Conservation measures typically target reduction in water use through a modification to the jacket and chamber cooling system as well as modifications to the ejector. Koeller and Company list two examples of retrofitting technology for the jacket and chamber cooling system. These are the Water Mizer that can be retrofitted onto almost any sterilizer for jacket and chamber condensate cooling; and the trap cooling technology offered by ARS, a steam sterilizer manufacturer (Koeller and Company, 2004). The Water Mizer is estimated to reduce condensate cooling water flow by approximately 90 percent while the trap cooling technology offered by ARS offers similar capabilities but mainly in highly customized sterilizers. Getinge-Castle, a sterilizer manufacturer focuses rather on reducing ejector water consumption through its MP-129 Modernization Package. The Modernization Package is reported to reduce ejector water consumption by 75 percent.

Based on the analysis performed by Koeller, it is assumed that average cooling water flow rate is 2.4 gallons per minute and the sterilizer operates for 12 hours and up to 24 hours a day for 250 days a year. Based on these assumptions the Water Mizer is estimated save anywhere from 259,000 to 648,000 gallons per year depending on operating assumptions (operating range of 12 to 24 hours a day, respectively). The expected useful life is 20 years. (Koeller and Company, 2004).

Water saving estimates were calculated for several models of the MP-129 Modernization Package. According to results from Koeller and Company, ejector water savings range from a low 148,000 gallons a year to a high 1,113,750 gallons a year, depending on model type and specific utilization assumptions. The expected useful life of the MP-129 Modernization Package is also 20 years. (Koeller and Company, 2004).

Efficient/recirculating film processing equipment

X-ray film processing uses a substantial amount of water and presents an opportunity to conserve water. The largest users of X-ray film processors are hospitals, which would normally have X-ray processors operating continuously throughout the year (Koeller and Company, 2004). Water is used to develop the film and also to cool the equipment. Upon use, the water is typically lost to the drainage system. Published flow rates provided by Irvin Ranch Water District and reported by Koeller and Company range from 0.25 to 2.5 gallons per minute.

Water can be saved if current film processors are retrofitted to recalculate water. Technology has been developed that allows customers to retrofit their existing film processing equipment so that water is recirculated. An example of such technology is the Water Saver/Plus (patented by C&A X-Ray) (Koeller and Company, 2004). The Water Saver/Plus is mainly marketed to large hospitals and has since been adopted at least 45 hospitals in several California locations. Post-installation evaluations to estimate savings were performed on each of the 45 hospitals. The overall weighted average savings from all 45 hospital installations was 2.57 acre-feet (837,000 gallons) of annual savings for each metered retrofit (Koeller and Company, 2004).

Though the useful life of the Water Saver/Plus is reported at 10 years, Koeller and Company recommend conducting any economic analysis based on a 5-year life cycle due to the impending transition to digital film processing. Conservation programs promoting the retrofit of film processors have been found to be cost-effective over a 5-year useful life.

Equipment metering for leak detection

Submetering of water-using equipment such as boiler, cooling towers and process equipment provides sit-specific information to facility managers and operators. Monitoring the water use levels of such equipment provides information leading to rapid detection leaks and other inefficiencies.

Process modifications

Process modification measures are usually targeted to industrial and manufacturing types of establishments that use large quantities of water in their industrial or manufacturing processes. Process modification measures generally require detailed site-specific water use audit by qualified personnel in order to be able to recommended site-specific modification that would lead to cost-effective water conservation measures. See discussion of CII indoor audits.

Section 6
Commercial, Industrial, and Institutional (CII) Outdoor

LANDSCAPE IRRIGATION

In regions of the country where landscape irrigation accounts for a significant percent of total CII water use, water conservation measures that focus on outdoor landscape irrigation can effective in reducing overall water use. Conservation programs can target CII accounts with high summer to winter water use ratios and those that are known irrigators such as golf courses, parks, and schools. Some conservation measures that could be implemented to target CII outdoor landscape irrigation include the following:

- Large landscape audit
- Adjust irrigation timers
- Drip irrigation systems
- Bubble/soaker irrigation systems
- Irrigation ET controller
- Soil sensors
- Rain/moisture sensors
- Xeriscaping and efficient landscape materials
- Landscape and irrigation system rebate
- Landscape ordinances - CII
- Water budgets for landscape irrigation
- Turf replacement/removal incentives
- All-weather artificial surfaces

Most CII outdoor landscape irrigation conservation measures identified above are technically feasible. We need to further investigate whether outdoor landscape irrigation represents a significant proportion of total CII water use.

OTHER OUTDOOR

The list below identifies other outdoor water conservation measures that can be considered:

- Water waste prohibition ordinance
- Hose shut-off nozzles
- Pressurized brooms
- Swimming pool/spa covers
- Recirculating fountains
- Car wash efficiencies

Car wash efficiencies

According to the International Car Wash Association and as referenced in a report by Chris Brown Consulting, car washes are of three general types. Conveyer types use a tunnel with fixed wash apparatus where the vehicle is drawn through the car wash by a chain. In-bay automatic types require the car to be driven into position where the machine maneuvers around and over the car to perform the wash. Finally,

the self-service car wash is where the customer manually washes the car using a wand and sometimes a brush (Chris Brown Consulting, AWWA, 2006).

Water use at car washes vary depending on the type of car wash and also depending on the types of car wash option selected. Water conservation measures focusing on car wash facilities include the following:

- Low volume car washers
- Recirculating car washers

Low volume car washers are generally associated with low flow nozzles, proper timing, maintenance, and the use of efficient equipment throughout the wash facility. Recirculating car washers reclaim rinse and wash water through a filtering process and recycle it for additional washing use. Table 6.1 summaries expected savings when wash water is recirculated. Additional car wash types can include bus washes and commercial or industrial truck washes. Estimates in the Table 6.1 do not include bus washes and commercial or industrial truck washes.

Table 6.1: Summary of Expected Savings When Wash Water is Recirculated
(gallons of freshwater per vehicle)

Type	Range Reported by Manufacturers*	Average Use - Field data	Average Use With Reclaim**
Conveyor	8 - 85	34.0 +/- 15	25.9 +/- 10
In-Bay	8 - 60	42.9 +/- 26	30.5 +/- 13
Self-Serve	15	15.0 +/- 3	NA

** Water Conservation in the Professional Carwash, ICA, 2000*
*** Water Use and Water Quality in the Professional Car Wash, ICA, 2003.*
Source: Chris Brown, AWWA, 2006

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Appendix F
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