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## Results and Recommendations of Water and Wastewater Affordability Study

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# **Results and Recommendations of Water and Wastewater Affordability Study**

Prepared for the  
City of Kalamazoo Department of Public Services

November 15, 2004

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## **Contents**

<b>Executive Summary</b>	<b>i</b>
<b>Affordability</b>	<b>1</b>
<b>Policy Options</b>	<b>9</b>
<b>Demand-side management</b>	<b>19</b>
<b>Recommendations</b>	<b>24</b>
<b>Appendix A: Additional Tables</b>	<b>26</b>
<b>Appendix B: Eligibility Methodology</b>	<b>29</b>
<b>Appendix C: Traditional Assistance Programs</b>	<b>31</b>
<b>Appendix D: Monthly Billing</b>	<b>34</b>
<b>Appendix E: Conservation Calculations</b>	<b>36</b>
<b>Notes</b>	<b>38</b>
<b>References</b>	<b>40</b>

## Executive Summary

Water and wastewater services are essential to modern life and a minimum standard of living to which all are entitled. Access to safe water and sanitation may be basic human rights and essential to life, but despite their public good characteristics, these services are and cannot be free. Members of the Kalamazoo City Commission have recently expressed concerns about the affordability of local water and wastewater services to the economically disadvantaged members of the community. In response, the Department of Public Services asked the Upjohn Institute to examine this issue and identify various approaches that might be adopted to ensure that all can afford and enjoy these essential basic services.

The following is an overview of the author's findings:

- **There is no evidence of a system-wide affordability problem.** Water and wastewater services are affordable for the vast majority of customers. Rates inside and outside the city are below national averages and are among some of the lowest in the state. City rates are likely some of the lowest in the nation.
- **Still, some customers struggle to pay for water and wastewater services.** Those with incomes lower than 100 percent of the federal poverty guidelines are especially vulnerable to problems with affordability. Affordability problems that do exist are more prevalent for non-city residents than city residents, due to higher rates charged to this class of customers. Customers with a combination of low-income and high consumption are susceptible to unaffordable bills. High water consumption can be caused by both large household size and waste. For an assistance program to be effective it must address both water and wastewater charges, since either of these services can contribute to unaffordable bills.
- **Traditional assistance programs do not benefit tenants who are indirect customers.** Nearly half of the City's low-income customers are tenants, the majority of which pay for service indirectly through monthly rental payments. As such, a comprehensive approach to addressing the issue of affordability must include a provision for tenants.
- **Many customers that struggle with the affordability of services are facing only a temporary crisis.** The Family Independence Agency and Salvation Army both have resources to provide crisis assistance.
- **Low-income customers likely live in aging housing stock with old plumbing and inefficient fixtures that may leak.** It is probable that this is a large source of wasted water causing affordability problems and is easily addressed through demand-side management.

- **A flexible menu of alternative assistance options could be tailored to best suit individual needs.** These options may include a plumbing assistance fund, monthly billing arrangements, the provision of crisis assistance, or demand-side management.
- **Demand-side management is an attractive method of increasing affordability.** It does not distort prices and maintains the incentive to conserve. Unlike other forms of assistance, the benefits are related to household size. Most importantly, it is not a need-based assistance program. Thus, participation in it is less likely to be limited due to negative connotations commonly associated with such programs.
- **Low-income customers stand to reap the largest benefits from conservation since they are more likely to live in older housing stock equipped with inefficient fixtures, which may leak.**
- **Summary of policies analyzed:**

Level of policy action	Form of Assistance
Minimal	<ul style="list-style-type: none"> <li>• Formalize existing ad hoc assistance currently used to address individual problems and apply system-wide.</li> <li>• Payment arrangements, leak adjustment policies, rebates.</li> </ul>
Intermediate	<ul style="list-style-type: none"> <li>• Provide crisis assistance.</li> <li>• Create plumbing assistance fund.</li> <li>• Use program similar to <i>PeopleCare</i> to finance assistance.</li> <li>• Partner with City Inspector to protect tenants by ensuring landlords maintain plumbing infrastructure.</li> </ul>
Comprehensive	<ul style="list-style-type: none"> <li>• Demand-side management to “shrink” problem of affordability.</li> <li>• Conservation initiative.</li> <li>• Address unaffordable bills for indirect customers.</li> </ul>

The author would emphasize that the report body and included tables are elemental to a complete and accurate understanding of the Institute’s findings. Supplementary material that provides more complete discussion and analysis of selected topics is contained in the Appendices. Further information is available upon request.

## Affordability

To determine the affordability of water and wastewater services in Kalamazoo, the author conducted an affordability study. Affordability is generally expressed as a percentage of income that is considered affordable. This percentage is commonly referred to as the burden a service or combination of services places on a household. Considerations of affordability are twofold. First, an affordable percentage of income to spend on these services must be identified. Second, the level of income to serve as a baseline for affordability determinations must be selected.

Affordability indicators are subject to much debate and controversy due to their inherent subjectivity. Thus far, no perfect affordability measure has been developed, and it is not for a lack of trying. It is extremely difficult, if not impossible, to develop a test for affordability that will take into account all customer circumstances within a system, let alone on a national level. In the American Water Works Association Research Foundation's publication, *Water Affordability Programs*, considered by many to be the preeminent treatise on water and wastewater affordability, Saunders et al. adopt two percent affordability thresholds for water and wastewater services and four percent for combined expenditures (1998). While recognizing the subjectivity of affordability indicators, the author feels that these are appropriate thresholds to use, given their widespread acceptance in the industry and consistency with recommendations made by the Environmental Protection Agency's (EPA) Environmental Economics Advisory Committee, trade associations, and policy analysts.

To accurately reflect the conditions faced by low-income customers—the first group to face affordability problems—100 percent of the 2004 federal poverty guidelines (FPG) was adopted as the baseline income used to evaluate the affordability of water and wastewater services provided by the City of Kalamazoo. As noted by Rubin, the “federal poverty level is based on the number of people in the household and an estimate of the expenditures that are needed to ensure the health of these people,” (2002, 5) thus making it an appropriate income upon which to base affordability determinations. Affordability using minimum wage, 150 percent of the FPG, and 100 percent of median household income (MHI) was also considered and can be presented to enable comparison. Table 1 lists the various income levels used.

A profile of a typical customer was needed to evaluate affordability on a system-wide level. Several generalizations were required to develop this profile. An analysis of data from the U.S. Census Bureau and the Department of Public Services, determined that average household size is 2.3 persons and the average consumption of a residential customer in Kalamazoo, with a five-eighths inch meter, is 84 gallons per capita per day (gcd). These figures were used to conduct the water and wastewater affordability analyses that are presented in Tables 2-7.

**Table 1: Annual income levels (\$)**

Household size	100% Poverty guidelines	150% Poverty guidelines	Minimum wage <sup>a</sup>	City median income	County median income
1	9,310	13,965	10,300	31,189	42,022
2	12,490	18,735	10,300	31,189	42,022
3	15,670	23,505	10,300	31,189	42,022
4	18,850	28,275	10,300	31,189	42,022
5	22,030	33,045	10,300	31,189	42,022
6	25,210	37,815	10,300	31,189	42,022
7	28,390	42,585	10,300	31,189	42,022
8	31,570	47,355	10,300	31,189	42,022

<sup>a</sup> One wage earner working 40 hours per week, 50 weeks per year.

SOURCE: Department of Health and Human Services (HHS) 2004 FPG and 2000 U.S. Census.

**Table 2: Water burden of typical customer - City residents**

Income level	Household size (persons)	Consumption (gcd)	Quarterly water bill (\$)	Quarterly income (\$)	Water burden
Minimum wage	2.3	84	29.37	2,575	1.14%
100% FPG	2.3	84	29.37	3,361	0.87%
150% FPG	2.3	84	29.37	5,042	0.58%
City MHI	2.3	84	29.37	7,797	0.38%

SOURCE: Author's calculations based upon FPG and Census Bureau data.

**Table 3: Water burden of typical customer - Non-city residents**

Income level	Household size (persons)	Consumption (gcd)	Quarterly water bill (\$)	Quarterly income (\$)	Water burden
Minimum wage	2.3	84	45.15	2,575	1.75%
100% FPG	2.3	84	45.15	3,361	1.34%
150% FPG	2.3	84	45.15	5,042	0.90%
County MHI	2.3	84	45.15	10,506	0.43%

SOURCE: Author's calculations based upon FPG and Census Bureau data.

The water burdens for typical city and non-city customers are below the two percent affordability threshold, indicating that water is affordable for most customers, both inside and outside the city. Water burdens of single minimum wage earners approached two percent, indicating that affordability problems may begin to emerge for those with some combination of lower income and higher-than-average consumption.

Similar findings occurred with wastewater bills and are shown in Tables 4 and 5. The wastewater burdens of most city and non-city residents are under one percent, indicating that wastewater service, like water, is also highly affordable for the majority. Again, minimum wage earners were the first group to show signs of pending affordability difficulty.

**Table 4: Wastewater burden of typical customer - City residents**

Income level	Household size (persons)	Consumption (gcd)	Quarterly wastewater bill (\$)	Quarterly income (\$)	Wastewater burden
Minimum wage	2.3	84	27.24	2,575	1.06%
100% FPG	2.3	84	27.24	3,361	0.81%
150% FPG	2.3	84	27.24	5,042	0.54%
City MHI	2.3	84	27.24	7,797	0.35%

SOURCE: Author's calculations based upon FPG and Census Bureau data.

**Table 5: Wastewater burden of typical customer - Non-city residents**

Income level	Household size (persons)	Consumption (gcd)	Quarterly wastewater bill (\$)	Quarterly income (\$)	Wastewater burden
Minimum wage	2.3	84	48.78	2,575	1.89%
100% FPG	2.3	84	48.78	3,361	1.45%
150% FPG	2.3	84	48.78	5,042	0.97%
County MHI	2.3	84	48.78	10,506	0.46%

SOURCE: Author's calculations based upon FPG and Census Bureau data.

As expected, the combined bill burdens in Tables 6 and 7 reflect the results of individual water and wastewater affordability assessments—services for city and non-city residents are, on the whole, affordable. According to the eligibility criteria used in this study, no affordability problems exist for households with income at or above the FPG. However, the combined bill burden of the typical sole minimum wage earner does approach four percent, indicating this subgroup is at risk of experiencing affordability problems. A combination of rate increases, low-income, and higher-than-average consumption could and may be causing affordability problems for some customers.

**Table 6: Combined bill burden of typical customer - City residents**

Income level	Household size (persons)	Consumption (gcd)	Quarterly combined bill (\$)	Quarterly income (\$)	Combined bill burden
Minimum wage	2.3	84	56.61	2,575	2.20%
100% FPG	2.3	84	56.61	3,361	1.68%
150% FPG	2.3	84	56.61	5,042	1.12%
City MHI	2.3	84	56.61	7,797	0.73%

SOURCE: Author's calculations based upon FPG and Census Bureau data.

**Table 7: Combined bill burden of typical customer - Non-city residents**

Income level	Household size (persons)	Consumption (gcd)	Quarterly combined bill (\$)	Quarterly income (\$)	Combined bill burden
Minimum wage	2.3	84	93.94	2,575	3.65%
100% FPG	2.3	84	93.94	3,361	2.79%
150% FPG	2.3	84	93.94	5,042	1.86%
County MHI	2.3	84	93.94	10,506	0.89%

SOURCE: Author's calculations based upon FPG and Census Bureau data.

This premise is supported anecdotally by the occurrence of arrearages. While it is true that not all arrearages are the result of the inability to pay, their existence suggests that some customers are genuinely struggling to afford these essential services. Arrearages do



not account for all customers who struggle with the affordability of water and wastewater. They understate the scope of the problem because they fail to reflect the tradeoffs economically disadvantaged customers make in order to pay utility bills; even though someone may be current on their water and wastewater bill, they may have made other sacrifices to remain so. Instead, arrearages most likely represent those customers facing the direst of circumstances. A brief analysis of the City's residential shutoff notices did suggest some seasonal variation but did not show a growing affordability problem.

## Regional and national comparison of rates

Another perspective on affordability in Kalamazoo can be obtained through benchmarking local rates against those of other municipalities in the region and nation. The findings are presented below in Table 8.

**Table 8 - Comparison of combined residential water and wastewater bills (\$)**

System	Quarterly water bill	Quarterly wastewater bill	Total quarterly bill	Annual water bill	Annual wastewater bill	Total annual bill	% of City of Kalamazoo bill
Seattle, WA - Outlying	96.10	138.54	234.64	384.38	554.17	938.55	416%
Seattle, WA - City of	84.27	138.54	222.81	337.08	554.17	891.24	395%
Grand Rapids - Tallmadge	93.20	121.33	214.53	372.81	485.31	858.12	380%
Portland, OR	66.93	126.62	193.55	267.72	506.47	774.19	343%
Grand Rapids - Cascade	95.36	75.33	170.70	381.45	301.33	682.78	302%
Lansing	53.34	110.01	163.35	213.37	440.03	653.40	289%
Philadelphia	49.30	74.36	123.66	197.22	297.44	494.66	219%
Battle Creek - Outlying	64.74	57.99	122.73	258.98	231.96	490.93	217%
Grand Rapids - City of	57.77	62.97	120.74	231.09	251.89	482.98	214%
Grand Rapids - Walker	59.69	61.00	120.70	238.77	244.01	482.78	214%
Grand Rapids - Kentwood	72.64	38.06	110.70	290.54	152.25	442.80	196%
South Bend	49.60	60.77	110.37	198.41	243.08	441.50	196%
Raftelis Average	49.30	55.59	104.88	197.18	222.36	419.54	186%
Battle Creek - City of	43.15	54.35	97.50	172.61	217.40	390.01	173%
National Average	43.91	52.18	96.09	175.66	208.71	384.37	170%
Kalamazoo - Outlying	45.01	48.61	93.62	180.04	194.43	374.47	166%
Jackson	55.35	25.71	81.06	221.42	102.83	324.25	144%
Holland	29.59	44.84	74.42	118.35	179.35	297.69	132%
Muskegon	33.60	39.00	72.59	134.39	155.99	290.37	129%
St. Joseph	28.62	30.67	59.29	114.47	122.68	237.15	105%
Kalamazoo - City of	29.29	27.15	56.44	117.15	108.61	225.75	100%
Memphis, TN - City of	32.54	15.26	47.80	130.17	61.03	191.21	85%

SOURCE: Author's calculations based on Ernst & Young 1994 *National Water and Wastewater Rate Survey*, Raftelis 2002 *Water and Wastewater Rate Survey*, personal communications with utilities, and municipal rate information posted on the internet.

As the results show, there is significant variation among rates both regionally and nationally, reflecting the variability of local conditions and the resulting impacts upon rates. Rates charged to customers, both inside and outside the City of Kalamazoo, are below the national average and comparable to those of other municipalities in the region. An April 2003 survey of Michigan water rates by the consulting firm Black & Veatch ranked Kalamazoo seventh lowest in the state. Nationally, rates in Memphis, TN, are repeatedly identified in surveys as being amongst the lowest. In light of this, Kalamazoo

water and wastewater rates are some of the lowest in the state and likely among the lowest in the nation.

## **The future of rates**

The need for compliance with regulations continually promulgated by the EPA to address new contaminants in drinking water and the need to replace aging infrastructure will result in significant replacement and upgrade costs over the coming decades. Nationally, estimates of replacement costs alone during the next 20 years, range from \$70-\$535 billion (U.S. Congress 2004). While there is debate about the exact timing and amount of these costs, there is no question that a substantial increase in water and wastewater spending is required. Customers may face enormous rate increases depending upon the needs of their local utility. The trend of increasing water rates is well documented. As noted by Beecher (1994) and Saunders et al. (1998), water rates have been increasing at rates far higher than incomes and inflation for the past decade. Saunders et al. also noted in 1998 that water rates are expected to rise even more over the next decade. Empirical evidence of these statements is given by the findings of an international survey of water rates that included 53 U.S. cities. The survey found that U.S. rates rose four percent in 2002. During that time, inflation was only 2.3 percent. (NUG Consulting Group 2003).

Increases in wastewater rates, while less documented, are also occurring. Ernst & Young in its 1994 *National Water and Wastewater Rate Survey* recognized that “the margin by which average monthly wastewater charges exceed average water charges has continued to widen” (3). Given the widespread rise in water rates, this predicts significant increases in wastewater rates. A recent Black & Veatch survey of 524 wastewater utilities in California indicated that rates rose an average 8.8 percent from 2002 to 2004, compared to inflation of 4.2 percent over the same period. Shockingly, 68 percent of those cities reported average rate increases of 21 percent. The study acknowledges that “California may not be the most representative of states, but a recent jump in wastewater charges there may be indicative of changes to come across the country” (Laughlin 2004). Circumstances do vary between regions and utilities, but the national trend of increasing water and wastewater rates and the implications it will have on utilities’ most vulnerable customers cannot be ignored.

## **The Kalamazoo perspective**

Residents living in the City of Kalamazoo have been fortunate to enjoy water rate increases less than the rate of inflation during the period 1999-2004. In fact, as shown in Table 9, the most recent rate change in 2004 actually decreased in-city rates by 0.6 percent. Residents outside the city have not been as fortunate. Over the same period, water rates for non-city customers rose faster than inflation. The most recent rate increase of 10.9 percent in 2004 was substantially higher than inflation.<sup>1</sup>

Wastewater rate changes were even more extreme. From 1999-2004 wastewater rates for city residents declined 9.3 percent overall as seen in Table 10. During this same period, wastewater rates for non-city residents increased by more than twice the rate of inflation,

rising nearly 30 percent. The most recent rate change in 2004 amounted to a 2.4 percent increase for city residents and a 13.8 percent increase for non-city residents. These rate increases could compound the affordability problems some non-city customers are experiencing.

**Table 9: Water rate increases 1999-2004 <sup>a</sup>**

Year	City				Non-city				
	Usage Rate (\$/M <sup>3</sup> )	Demand Charge (\$)	Typical Quarterly Bill (\$)	Percent Increase	Usage Rate (\$/M <sup>3</sup> )	Demand Charge (\$)	Typical Quarterly Bill (\$)	Percent Increase	Inflation
1999	0.245	10.81	27.18	n/a	0.377	12.91	38.09	n/a	2.2%
2000	0.245	10.81	27.18	0.0%	0.377	12.91	38.09	0.0%	3.4%
2001	0.259	11.00	28.30	4.1%	0.386	12.94	38.72	1.7%	2.8%
2002	0.262	12.03	29.53	4.3%	0.402	13.84	40.69	5.1%	2.3%
2003	0.262	12.03	29.53	0.0%	0.402	13.84	40.69	0.0%	2.3%
2004	0.261	11.93	29.36	-0.6%	0.457	14.62	45.15	10.9%	2.0% <sup>b</sup>
Cumulative				8.1%				18.5%	12.6%

<sup>a</sup> For average residential household with 5/8" meter, 2.3 persons, consuming 84 gcd.

<sup>b</sup> January-June.

SOURCE: Author's calculations based upon figures from City of Kalamazoo FY 2003 CAFR and BLS CPI data.

**Table 10: Wastewater rate increases 1999-2004 <sup>a</sup>**

Year	City				Non-city				
	Usage Rate (\$/M <sup>3</sup> )	Demand Charge (\$)	Typical Quarterly Bill (\$)	Percent Increase (Decrease)	Usage Rate (\$/M <sup>3</sup> )	Demand Charge (\$)	Typical Quarterly Bill (\$)	Percent Increase	Inflation
1999	0.327	8.20	30.04	n/a	0.406	10.66	37.78	n/a	2.2%
2000	0.299	8.27	28.24	-6.0%	0.446	10.24	40.03	6.0%	3.4%
2001	0.299	8.27	28.24	0.0%	0.446	10.24	40.03	0.0%	2.8%
2002	0.282	7.77	26.61	-5.8%	0.488	10.25	42.85	7.0%	2.3%
2003	0.282	7.77	26.61	0.0%	0.488	10.25	42.85	0.0%	2.3%
2004	0.288	8.00	27.24	2.4%	0.561	11.30	48.77	13.8%	2.0% <sup>b</sup>
Cumulative				-9.3%				29.1%	12.6%

<sup>a</sup> For average residential household with 5/8" meter, 2.3 persons, consuming 84 gcd.

<sup>b</sup> January-June.

SOURCE: Author's calculations based upon figures from City of Kalamazoo FY 2003 CAFR and BLS CPI data.

## Calculation of eligible customers

The number of customers who are eligible and in need of assistance depends upon the type of program offered and the eligibility requirements used. The author gathered and analyzed data from the 2000 Census to estimate the number of customers who might be eligible under several different assistance programs. Table 11 presents the estimated number of customers eligible for assistance under two different income thresholds.

**Table 11: Number of customers eligible for assistance**

<b>Eligibility</b>	<b>Income threshold</b>	
	<b>100% FPG</b>	<b>150% FPG</b>
All customers	5,195	8,263
Direct customers <sup>a</sup>	1,670	3,508
Indirect customers <sup>b</sup>	3,525	4,755

<sup>a</sup> Direct customers include homeowners and tenants paying for water and wastewater services directly.

<sup>b</sup> Indirect customers are those tenants who pay for water and wastewater services through monthly rental payments.

SOURCE: Author's calculations based upon data from U.S. Census Bureau.

See Appendix B for a discussion of the methodology used to arrive at these numbers. To estimate participation in a program, it is necessary to adjust the numbers in Table 11 with a participation rate.

### **Impacts of a large student population**

The area served by Kalamazoo water and wastewater services is home to a large student population who attend several area colleges and universities. It is likely that many students have earnings that qualify them as low-income.

Data from the Public-Use Microdata Sample (PUMS) of the 2000 Census supports this assertion. PUMS is a five percent sample of long-form census responses for Kalamazoo, Van Buren, and Berrien Counties. This sample indicated that 16.7 and 22.1 percent of those with incomes at or below 150 and 100 percent of the FPG, respectively, are students. These percentages are likely larger in the City of Kalamazoo and Oshtemo and Kalamazoo Townships, each of which are home to a significant student population. Of these students, the vast majority rent or live in group quarters.<sup>2</sup> Accordingly, the number of customers eligible for assistance in Table 11, especially indirect customers, may be skewed to some extent by a large tenant student population.

However, the percentages obtained from PUMS must be interpreted cautiously. The connotation traditionally associated with the term 'student', someone who attends college full- or part-time and is under 25, is very different from the definition of a student used by the Census Bureau. For the purposes of the long-form census, a person enrolled in at least one class is considered a student. As such, these percentages include both full- and part-time students who may or may not be receiving financial assistance from their parents or working to support themselves. Also included in these figures are those who may be non-traditional students or professionals completing continuing education requirements. It is not possible to ascertain the exact composition of these data from PUMS and thus the extent of the impact the local student population has on the estimates of customers eligible for assistance in Table 11.

The number of students who would qualify for assistance depends largely upon the structure of the assistance program adopted. Given the high tenancy rate of traditional students, unless the City adopts a program that specifically addresses the issue of affordability for indirect customers, it is likely that few students who are not legitimately in need of assistance would qualify. Similarly, if categorical eligibility is used to make eligibility determinations, the instances of free riding by students would be minimized, due to the minimal participation by traditional students in governmental assistance programs.<sup>3</sup> Directly barring students from participating in an assistance program would be difficult, counterproductive, and potentially discriminatory. However, assistance programs can be designed to discourage participation by students not genuinely struggling with the affordability of water and wastewater services.

## **Policy options**

The City has a number of policy options from which to select. Since water and wastewater services are affordable for the majority of its customers, the City may choose, and be justified in doing so, to do nothing. If the City is compelled to take action, it must determine how it will address the affordability of water and wastewater services. Three options the City may wish to consider are rate design, a traditional assistance program, and alternative forms of assistance.

### **Assistance through rate design**

Rate structures that attempt to address the problem of affordability generally involve a lifeline rate. The intent of lifeline rates is to meet “the social goal of providing so-called minimum annual water requirements to qualified customers at a below-cost price” (*Principles of Water Rates* 2000, 326). Under lifeline rates, the charge for a quantity of water necessary to meet a minimal standard of living is kept low and thus affordable. The utility must determine what volume of water is necessary to meet minimum sanitary requirements. In reality, the quantity of water needed to maintain a minimal standard of living varies in direct proportion to the size of the household—more people require more water. The simplest form of a lifeline rate provides, at a discount, the quantity of water that is the minimum required amount for the average size household. This will help customers to some extent, but to make a lifeline rate truly effective, the quantity of water that is provided at a lower rate must reflect household size.

### **Traditional assistance program**

The most common assistance programs attempt to achieve affordability by providing customers with a discount on their bill. However, the variety of circumstances faced by customers pose a challenge to policymakers attempting to find a discount that is appropriate and effective for all eligible participants. Even if a discount does not bring a bill fully below an affordability threshold, some assistance is better than none. Discounts are generally percentage-based or fixed. The effectiveness of the following five models at improving affordability was evaluated:

- Model 1 – Readiness to serve charge waiver
- Model 2 – Discount usage rate by 35%
- Model 3 – Discount total bill by 25%
- Model 4 – Discount based on equal percentage of bill
- Model 5 – Per person discount

A complete analysis of these models can be found in Appendix C. The type of discount that is most effective at improving the affordability of services depends largely upon the composition of water and wastewater charges—that is the ratios of fixed and variable charges to the total charges. Household size also has a large impact upon discount effectiveness, since water consumption rises in concert with increases in household size. This rise in consumption results in higher variable charges; thus, for larger households

the ratio of variable charges to total charges is higher. For non-city customers, this effect is compounded by the higher rates charged to this class of customers. These higher rates cause the ratio of variable and total charges to be higher for similarly sized households. Overall, Model 2 provides the most effective and efficient discount for the majority of the household profiles tested.

## **Challenges associated with assistance programs**

The Public Services Department is not a social service organization. As such, providing assistance may pose challenges and difficult political questions not normally confronted by the Department.

### **Eligibility**

If the City chooses to take action to mitigate the limited affordability problems that are occurring, it will have to decide to whom assistance will be provided. Determining eligibility for assistance is the most challenging and contentious aspect of an assistance program. Criteria that can be used to make eligibility decisions are virtually limitless. The requirements that are chosen must strike a balance between inclusiveness and the administrative burden and associated costs imposed on the Department. Generally speaking, the more complex the eligibility requirements, the less likelihood there is of excluding a participant who should have been eligible. The most practical criteria use income thresholds or participation in another assistance program to determine eligibility; however, neither method is perfect.

It is possible to identify a level of income below which customers are likely to experience affordability difficulties, but it will not be exhaustive due to the variety of circumstances faced by customers. Some percentage of the FPG would suffice. At a minimum, income thresholds should be tied to household size. The City must also determine what documentation to accept as proof of income and the frequency with which eligibility must be reestablished. A particularly thorny issue occurs with households whose incomes are slightly over the threshold. These households likely experience the same affordability problems but are ineligible for assistance because their income exceeds the threshold, in some cases by only a few dollars.

Categorical eligibility is a reasonable alternative to the use of income thresholds, but it too suffers from flaws. Programs that low-income customers are likely to participate in are selected as 'triggers'. Participation in one of these programs automatically qualifies a customer for water and wastewater assistance. For categorical eligibility to be effective, it is necessary to use a sufficient number of programs as triggers so not to exclude customers who would benefit from assistance. Even then, some needy customers may be excluded since not all who are eligible for programs necessarily participate and because of the bias many assistance programs have toward families.

## Reaching tenants

Consumers of water and wastewater services can be classified as either direct or indirect customers. A direct customer has an account with the Public Services Department and receives bills in his or her name. Both homeowners and tenants can be direct customers. An indirect customer is a tenant who pays for water and wastewater services indirectly through monthly rental payments. Assistance under traditional assistance programs is provided through a discount on a customer's bill. Therefore, traditional assistance programs do not benefit indirect customers because they do not receive bills to which discounts can be applied. Approximately half of all low-income households (income less than 150 percent of FPG) served by Kalamazoo water and wastewater services are tenants. Of these tenants, 85 percent are indirect customers and thus will not be helped by traditional forms of assistance. To effectively address affordability problems, programs capable of reaching economically disadvantaged tenants are also necessary.

Over the course of this study, a substantial amount of research and time were devoted by the parties involved in an attempt to devise a way to alleviate problems of water and wastewater affordability for this vulnerable population. The lack of sub-metering in multi-family housing, combined with the frequent mobility of low-income households, creates substantial barriers that work against efforts to reach this population with assistance. As such, no 'ideal' solution is apparent at this time.

Several methods have been used by other municipalities to address the affordability of services to indirect customers. The author presents these options with full acknowledgment of their shortcomings in the hope that their mention will encourage further discourse, and a solution to this issue. One option that was evaluated is requiring that landlords keep service in their own name. At first glance, this may seem an attractive option, since the City can shutoff water at landlords' homes for non-payment of rental unit bills. However, upon further examination, it is evident that this requirement does nothing to improve affordability for tenants. It may ensure that the water stays on, but it also ensures that any increases in water or wastewater charges are passed directly to tenants in the form of increased rent.

Some municipalities provide electrical service in addition to water and wastewater. Since most multi-family dwellings have submetered electrical service, and thus a bill for each unit, it is possible for municipalities to address water and wastewater burdens through a discount on a household's electrical bill. This is not a viable option for the City, as it only provides water and wastewater services. Another possibility is to reduce the bill of properties with qualifying tenants and have landlords pass this discount on to these tenants in the form of lower rent. Enforcing this policy would be extremely difficult and costly; as such, it is not a viable option. The City could also provide direct cash assistance to eligible tenants. These transfers would address water and wastewater affordability problems indirectly through rental assistance. The amount of this assistance would likely be based upon average consumption for a similarly sized household living in a rental unit. However, this policy may draw criticism from citizens and ratepayers on the grounds that the City has no control over how the assistance is spent.



The most attractive option is the issuance of scrip or vouchers. This method is similar to direct cash payments, except that the assistance may only be used to pay water and wastewater bills. Scrip or water vouchers could be mailed monthly or quarterly to eligible tenants. The scrip is deducted from monthly rental payments and included with the rent. The landlord then uses the scrip to pay a portion of the water and wastewater bill for the unit. Landlord participation may need to be encouraged through some form of incentive. This could consist of a slight bill reduction in exchange for participation. It even may be the case that the issuance of scrip to tenants will result in an increase of on-time rental payments. In that case, the improvement in payment patterns of tenants should be incentive enough to encourage landlord participation. This program would require administrative time to issue and process the receipt of scrip. Thus it has the highest administrative costs out of the programs evaluated.

A common concern with assistance provided to indirect customers, since it is not provided through their bill, is that it will decrease the benefits received from or make them ineligible for other assistance programs. The FIA confirmed that scrip provided to tenants would be viewed as a reimbursement and not as income; as such, it would have no impact on eligibility for or benefits received from other programs.<sup>4</sup>

It should be noted that any program providing assistance only to direct customers could have negative impacts on tenants. In response, landlords may require that tenants put the utility bill in their name. This significantly reduces the landlord's incentive to repair or replace plumbing and fixtures, as he or she is no longer responsible for the bill. This may exacerbate the affordability problems the household was experiencing.

### **Political hurdle**

The most politically sensitive issue the City will face if it decides to provide assistance is whether or not this assistance will be offered to non-city residents. Even though non-city customers do not vote for city leadership and thus have no say in city policy, the problems faced by this class of customers cannot be ignored. As shown by Table C2, non-city customers face bills substantially higher than city residents and, as a result, struggle more with affordability and thus are most in need of assistance. Improving the affordability of non-city services will cost substantially more per customer because of higher non-city rates. However, city residents may feel that they should not be subsidizing non-city residents. To mitigate this concern, two assistance funds could be established: one funded by city residents for assisting city residents and an identical fund for non-city residents.

### **Administration**

The administrative burden associated with an assistance program depends largely upon the type of program the City chooses to enact. For whichever program might be implemented, the eligibility and application processes would be the most labor intensive aspects. It is likely that additional training and staff would be needed to administer the program.

The administrative burden placed upon the Department of Public Services could be substantially lessened if a community action agency were partnered with to administer the program. The Salvation Army and Community Action Bureau are logical choices. Both are experienced in the administration of assistance programs and have established eligibility criteria. The Salvation Army's utility assistance program provides \$250,000 of assistance annually to Kalamazoo County residents.<sup>5</sup> Clients seeking assistance must be referred by the FIA, have service currently terminated, and be in need of assistance. The Salvation Army verifies that the client's income is no more than 100 percent of the FPG and examines their payment history. An eligible client is given an hour of budget counseling and a maximum of \$50 in assistance every 18 months.<sup>6</sup>

The Community Action Bureau administers a variety of grant programs that provide energy assistance. The eligibility criteria used depend upon the stipulations of the grant providing the funding for assistance. Most community programs use an income threshold of 125 percent of the FPG and require the client to be facing an emergency caused by service termination.<sup>7</sup> A water and wastewater assistance program could use similar guidelines and be administered by either agency.

Administration by a community action agency provides benefits in addition to lessening the administrative burden and associated costs born by the Department of Public Services. These agencies likely serve many of the customers targeted by a water and wastewater assistance program currently in another capacity. These preexisting relationships could be used to increase participation through marketing efforts to make the target population aware of this additional assistance. Community action agencies are often located near their clients to facilitate easy access. Administering an assistance program through these agencies would minimize transportation difficulties, which can be a significant barrier to participation—clients would live near the agency or already have transportation arranged and could apply for assistance during an existing appointment (Saunders et al. 1998).

An outside agency may be seen as impartial by those involved. These agencies know their clientele and are in a better position to determine actual need as a result of these relationships. Clients and donors alike may be more comfortable knowing that the program is being administered by an agency that they know and trust, increasing participation by both parties.

### **Failure to address individual needs**

Traditional assistance programs adopt a “shotgun approach” to providing assistance. This allows fairly uniform assistance to be easily provided to a large number of customers but does little to tailor assistance to meet individual needs. There are not a large number of customers inside and outside the City facing affordability problems. Accordingly, a traditional assistance program is not the best way to lessen the burden that water and wastewater services place on low-income customers.

Some of the affordability problems that are occurring may not be chronic, but are instead experienced by families living on the cusp of poverty who are confronted by an unexpected expense that creates a temporary crisis. An unexpected car repair or medical bill, for example, may be enough to cause a crisis and render water and wastewater services temporarily unaffordable. In fact, the causes of a significant number of affordability problems may be out of the control of low-income customers. The poor are likely to live in older housing stock that has old plumbing and inefficient fixtures, both of which may leak. These factors result in higher consumption that may make otherwise affordable bills unaffordable. Tenants lack the ability to alter the fixtures in their rental units. Even if they did, low-income households have a tight budget constraint that leaves them with little, if any disposable income. Thus, homeowners and those tenants who may have the authority to replace or repair fixtures are unable to do so because of the capital outlay required.

Other customers may face chronically unaffordable bills. Still others may have exhausted their assistance from the FIA or Salvation Army or may not qualify for it. A few customers may even face high bills due to plumbing problems or catastrophes. Different forms of assistance are more effective in some situations than others. Ideally, a menu of options would be available to address specific needs to the greatest extent possible. While offering different forms of assistance, it is also important to strike a balance between flexibility, fairness, and cost.

### **Distorted price signals**

Any distortions that affect the price of a good can lead to inefficient outcomes. It is important to note that any assistance program that alters the marginal cost of water, either by reducing it for some to provide assistance or raising it for others to pay for the assistance, will result in inefficiencies because the variable charge will no longer represent the true cost of consumption. In theory, those with rates below the true cost of service will increase consumption to a socially inefficient quantity and those facing rates higher than the true cost of service will lower consumption to a socially inefficient quantity. These inefficiencies will result in a societal deadweight loss of total surplus.

In reality, since water is essential to life and there are no substitutes for it, an increase in price brings about little change in its consumption. In economic terms, this means that the demand for water is price inelastic. The price elasticity of demand measures the responsiveness of demand to changes in price. It is calculated by dividing the percentage change in quantity demanded by the percentage change in price. Several studies have shown indoor residential water usage to be price inelastic (Saunders et al 1998). These studies also found that while indoor residential water use is unresponsive to changes in price, water used for other residential purposes is price elastic. Since it can be reasonably inferred that low-income households do not have the wherewithal to devote to non-essential water uses, their demand can be characterized as that strictly used for essential indoor applications only. As such, their consumption is very much price inelastic. Therefore, economically disadvantaged customers are unlikely to alter their consumption

significantly in response to changes in price. Even so, any assistance provided by the City should strive to minimize distortions to price signals to avoid inefficiencies.

### **Barriers to participation**

Even if the City were to establish a traditional assistance program, a number of factors are likely to limit participation. A study conducted by the National Consumer Law Center identified barriers that limited participation by low-income households in energy assistance programs (Colton 1992). The City of Portland Bureau of Water Works also identified significant barriers to participation based upon its experience with low-income assistance programs (Hasson 2002). The following are some of the prominent barriers that were identified:

- lack of knowledge of the program's existence;
- lack of knowledge of eligibility requirements;
- unaware of personal eligibility;
- unaware of how to apply for assistance;
- a complex or lengthy sign-up process;
- personal pride or self-reliance ethic ;
- stigma of accepting public assistance;
- lack of transportation to apply for program;
- language barriers faced by a disproportionate number of low-income households;
- mistrust of utilities.

Another factor limiting participation is low water and wastewater rates. The number of customers that would legitimately benefit from assistance is low because affordability problems are not widespread. Since the cost of water and wastewater services is not a significant concern for many, the combination of low rates and barriers to participation will significantly limit participation in any assistance program. After implementing a comprehensive assistance program, Portland experienced a 12 percent participation rate. Rates in Portland, OR are 243 percent higher than those in Kalamazoo.<sup>8</sup> Accordingly, the initial participation rate in Kalamazoo is likely to be very low.

### **Alternative forms of assistance**

The author identified several alternatives to traditional assistance programs that the City may wish to consider. Those presented herewith are intended only as examples of programs that have been successfully implemented by other water and wastewater utilities. Variations on these models are possible and encouraged. The exact amounts of assistance provided by each program will depend on what the City determines is appropriate and within its capability to provide.

#### **Plumbing assistance fund**

By nature, many plumbing repairs are prohibitively expensive for the economically disadvantaged. Even though they may understand the importance of repairing leaking

pipes and fixtures, the poor likely lack the ability to do so. Repair needs may range from relatively simple, such as a new O-ring to keep a faucet from dripping, or may be labor intensive, perhaps a burst pipe or leak behind the walls. Addressing the cause of high bills for such customers would be much more effective than providing them with a discount every bill. One customer had a toilet that ran constantly and faced a bill of \$1,000 as a result.<sup>9</sup> The parts needed to fix the toilet likely cost under \$10, but the customer was unable to afford them. An EPA retrofit study conducted in Tampa, FL found that the majority of leaks can be attributed to the toilet and then again primarily to the flapper (Mayer et al. 2004). A flapper costs less than five dollars and is easy to install. The City should consider setting up a fund to assist eligible customers with such repairs. Due to the expensive nature of some plumbing problems, the assistance provided by the fund would need to be capped at some level.

Portland, OR implemented a fixture repair program as part of its comprehensive approach to improving the affordability of water and wastewater bills for its low-income customers. The program was later expanded to include other plumbing problems. Funding is capped at \$1,000 per household. The program assisted 36 customers during the first six months of 2000 (Hasson 2002).

### **Monthly billing**

Monthly billing arrangements, while not reducing the amount due, can be an effective option for increasing the amount of in-full and on-time payments received from low-income customers, allowing these customers to keep their accounts out of arrears. A quarterly water and wastewater bill may account for a larger than affordable percentage of a household's income in the month it is received. This creates a hardship for low-income households that have carefully apportioned monthly cash flows to cover reoccurring, expected expenses such as rent, food, and monthly utilities.

Households that are living paycheck to paycheck with tight budget constraints have few options when expenses exceed income. Often, these households must choose which bills to pay. If faced with a choice between paying a bill in-full or making a partial payment on another, low-income households can be expected to make payment on the bill they can satisfy in-full (Saunders et al. 1998).

Even if a household manages to pay a seemingly large quarterly water and wastewater bill, as compared to an equivalent monthly amount, the results may still be undesirable. Two studies examining the behavior exhibited by low-income families when faced with expenses that exceed income showed that these families forgo expenditures on food, clothing, transportation, and medical care to ensure that rent and utility bills are paid (Caplovitz 1974; Wisconsin Public Service Corporation 1983). It is little wonder why priorities are arranged in this manner, given the lack of substitutes for water and the necessity of water and wastewater service for health, sanitation, and survival.

Both the City and low-income customers can benefit from a monthly billing arrangement. Breaking previously unaffordable quarterly bills into more manageable monthly

installments would enable many low-income customers currently struggling to make in-full and on-time payments to avoid delinquencies and the costs associated with resulting collection activities. Monthly billing cycles would also aid low-income customers by allowing water bills to be built into households' monthly budgets. The Utilities previously investigated monthly billing on a system-wide basis. It was found that the net impact on revenues would be negative—costs would increase more than additional collections. However, implementing it upon request by customers or as part of a low-income assistance program could be done at little cost.<sup>10</sup> It is likely that these costs would be more than offset by improved collections.

Portland, OR offers the option of monthly budget billing to any residential customer. These billing arrangements have “been found to provide important benefits in terms of improved cash flow and ability to manage financial obligations by those users who are less affluent” (Hasson 2002, 133). During FY 1997-1998, more than 10,000 customers took advantage of this billing arrangement (Hasson 2002).

Low-income households should not be penalized for their inability to pay large, quarterly water and sewer bills. It is in the City's interest to offer flexible payment arrangements that allow better matching and timing of bills with low-income customers' ability to pay. Both parties will be better off in doing so. Further discussion of monthly billing arrangements can be found in Appendix D.

### **Crisis assistance**

Not all households may face chronic affordability problems. For some, unexpected costs may cause a temporary crisis and jeopardize their access to water and wastewater service. The FIA and Salvation Army both have crisis assistance available to those struggling to afford water and wastewater services. The FIA can provide eligible households with up to \$175 annually to assist with bills for water and wastewater.<sup>11</sup> Eligibility depends upon several factors, including assets, income, and household size. A household will be eligible for assistance if its income is roughly below 50 percent of the FPG.<sup>12</sup> As previously discussed, the Salvation Army only assists those referred to them by FIA and can provide \$50 of assistance to a customer every 18 months.

Assistance provided by the FIA and Salvation Army may not be available to all customers who genuinely struggle to afford water and wastewater service. It may also be the case that customers have exhausted their assistance from these agencies and still be struggling with affordability. To meet the needs of customers facing temporary problems with affordability, the City may wish to consider some form of crisis assistance.

Two forms of temporary assistance are worth considering: direct financial assistance and late charge waivers. The City could adopt a program similar to that of the Salvation Army and provide \$50 of direct assistance a year. This program would be an excellent candidate for administration by the Salvation Army and the Community Action Bureau. Currently, the Community Action Bureau provides assistance mostly with energy utilities; water and wastewater assistance is not provided due to a lack of funds. The

Bureau has expressed a desire to administer a water and wastewater assistance program if funds are made available. If a customer is unable to pay a bill, another option is to waive the late charges in exchange for the customer entering into a payment plan, as currently offered by the City.

A program similar to *PeopleCare*, could be used to help fund crisis or temporary assistance. *PeopleCare* is a program administered by the Salvation Army to provide funds for distribution to needy clients. Consumers Energy solicits donations from customers for this program through inserts included with monthly statements. The City may wish to consider a similar arrangement to provide additional funds for water and wastewater assistance. These donations could be combined with funds from the Public Services Department to provide assistance to customers struggling to afford basic utility services provided by the City.

## **Demand-side management: A cost effective approach to improving affordability**

Although affordability is not a significant problem currently, it could become one in the future. Instead of a traditional assistance program, the City might consider a demand-side management initiative to increase the affordability of water and wastewater services. This program would provide larger benefits to participants than any assistance program examined by this report at a much lower cost to the City and ratepayers.

### **Program overview**

Demand-side management would be achieved through a conservation initiative. All residents of the service area would be eligible to participate, thus eliminating the need to make costly eligibility decisions. However, marketing efforts and program design would focus on the low-income customers who stand to benefit the most from reductions in their bills. Participants in the conservation initiative would achieve reductions not only in their water and wastewater bills, but also their energy bills. These reductions would be earned by participants; no other assistance would be provided or necessary after participants join the conservation initiative. The initiative would focus on reducing demand through education, behavioral change, and conservation retrofits.

Interested participants would sign up for a two hour class offered in predominantly low-income areas. Upon completion of the class, participants would be given a free water conservation kit that could be made otherwise available for purchase from the Department of Public Services. The provision of the conservation kit that could save participants a substantial amount of money serves as an incentive for participation in the initiative. By conducting classes in the area in which members of the targeted demographic reside, participation by that group would be increased, while limiting the participation of those who are not struggling with the affordability of basic utility services. The class would begin with an hour-long seminar on budgeting provided in conjunction with the Community Poverty Reduction Initiative. The Department of Public Services would bear no responsibility or cost for this portion of the class. The purpose of including budgeting in the class is two-fold: to provide useful information that can help improve participants' quality of life and to further limit participation by those not in need of assistance.

The second hour of the class would be conducted by the Utilities. It would combine the educational mission of the City's Wellhead Protection Program with a discussion of the potential savings that can be realized through active participation in the conservation initiative. Behavioral modifications and their potential savings would be emphasized. In addition, hands-on installation instruction would be given to enable participants to successfully install the components of the free conservation kit. This instruction is instrumental in improving the retention rates and thus the affordability of bills. A hotline could also be established to provide installation assistance, send additional parts, and arrange on-site assistance if needed. Participants in the initiative could also be qualified for any additional forms of assistance provided by the city through participation in the



class. Another program option would be the use of residential water-use audits. Auditors could provide any needed parts, adaptors, or installation help and identify any additional opportunities for conservation or assistance during their residential visits. This would also be an excellent opportunity to collect data about the needs faced by low-income customers and the condition of plumbing and fixtures in their dwellings. Installation assistance and/or demonstrations could also be provided by Kalamazoo Neighborhood Housing Services or a similar agency.

## Retrofit savings

Conservation kits are available from many distributors. The following conservation retrofit and calculations of potential savings are based upon the Certified 1.5 Water Conservation Kit from Niagara Conservation Corporation and usage rates as measured during the Tampa Water Department Residential Water Conservation Study (TRWCS). The kit was selected because of the high ratings given to the included low-flow showerhead by participants in the TRWCS and because the kit includes an adjustable toilet flapper that fits 1.6, 3.5, five, and seven gallons per flush (gpf) toilets, stopping the largest source of household leaks and reducing the volume of water used by up to 2.5 gpf

Included in the kit are the following:

- 1.75 gallon per minute (gpm) showerhead
- 1 gpm bathroom faucet aerator
- 1.5 gpm swiveling kitchen faucet aerator
- Adjustable toilet flapper
- Leak detection tablets
- Flow meter bag
- Instructions

Per person water and wastewater savings from the conservation retrofit are presented in Table 12. They do not take into account behavioral consumption changes. See Appendix E for a complete discussion of the assumptions used to estimate savings from the conservation retrofit.

**Table 12: Water and wastewater savings per person**

Savings per person (gcd)	City residents		Non-city residents	
	Quarterly savings (\$)	Annual savings (\$)	Quarterly savings (\$)	Annual savings (\$)
Leaks - 27.35	5.19	20.77	9.63	38.52
No leaks - 12.15	2.31	9.23	4.28	17.11

SOURCE: Author's calculations.

The useful lives of the components in the conservation kits vary depending upon local conditions. The flapper is guaranteed to last for at least five years and the showerhead should last between 10 and 15 years. The individual cost of the conservation kits depends upon the model chosen and the quantity ordered. For example, Niagara Conservation can provide 2,500 kits for \$6.75 each or 5,000 kits for \$6.45 apiece. If the useful life of the kit is assumed to be five years, which is a conservative estimate, total water and

wastewater savings per person are as much as \$104 for city customers and \$193 for non-city customers.

Water and wastewater savings are not the only savings realized as a result of the retrofit. Not all water conserved by the retrofit is cold water. Since the quantity of hot water used would also be reduced, participants would achieve savings on their energy bills as well. Water is heated using either natural gas or electricity. Since energy costs frequently strain the budgets of low-income households, these additional savings generated by the retrofit are particularly salient. Per person energy savings are shown in Table 13:

**Table 13: Annual energy savings per person <sup>a</sup>**

<b>Natural gas saved (Ccf)</b>	<b>Reduction in natural gas costs</b>	<b>Electricity saved (kWh)</b>	<b>Reduction in electricity costs</b>
14.82	\$11.66	290.02	\$22.84

NOTE: Savings are calculated using Consumers Energy prices for July 2004.

<sup>a</sup> Cost per kWh \$0.07874. Cost per Ccf \$0.78705.

SOURCE: Author's calculations.

See Appendix E for an explanation of the methodology used to calculate energy savings. Tables A3-A5 present potential total household savings from the conservation retrofit.

### **Program advantages**

The conservation initiative accomplishes the goal of an assistance program—making bills more affordable—without providing a handout. Customers must actively participate in the program in order to reap the benefits. This, combined with the fact that all customers are eligible for the program, has the potential to increase low-income participation and ratepayer acceptance. The conservation initiative also may generate goodwill for the City and Public Services Department as it promotes customer interaction and the development of positive relationships.

Demand-side management is also the most cost-effective method to lower bills. Under a traditional affordability program, there is a dollar-for-dollar correlation between the cost of assistance and the amount of assistance provided. For every dollar spent under the conservation initiative, total undiscounted benefits over the five-year useful life range from \$15.50 to \$237, depending on individual circumstances.<sup>13</sup> There is also no need to establish eligibility and; therefore, no associated administrative costs. While the payback period of the conservation retrofit varies according to household size and the level of participation, it nevertheless is extremely fast; the longest payback period is approximately five months.

The problem of free riders associated with open eligibility is mitigated by program design. The structure of the program discourages participation by those who are not struggling with the affordability of water and wastewater bills. By focusing marketing efforts on the low-income, holding classes in economically depressed areas, and

including a segment on budgeting in the class, middle- and upper-income customers are discouraged from participation, but are not prohibited.<sup>14</sup> Even if some individuals not from the targeted demographic participate, the cost to the City is minimal under the conservation initiative; whereas, if a waiver of the readiness to serve charge were provided, the cost to the City of unintended participation could be enormous.

A reduction in demand would cause a reduction in gross revenue. Using the most liberal estimate of the impact of the conservation retrofit that assumes participation by every customer with income less than 150 percent of the FPG, the reduction in water volume billed would be only 3.5 percent of total system volume billed in 2003.<sup>15</sup> However, the extent of this reduction is likely to be insignificant. Historically low participation in assistance programs coupled with Kalamazoo's low water and wastewater rates mean that the revenue impact is likely to be closer to 0.35 percent.<sup>16</sup>

Whether the conservation initiative is economically efficient from the utility perspective is not determinable without more data concerning the relationship of unaffordable bills to collection activities and the resulting unrecovered costs. Developing a model of the relationship of affordability problems to collection activities, as well as the exact costs of collection would be a costly endeavor, one not justified by the low rates and lack of widespread affordability problems at this time. Such an analysis would be justified if affordability problems emerged system-wide, and the City implemented a comprehensive program to address them.

From a theoretical standpoint, if the initiative would be implemented and was successful at improving the affordability of bills to participants, it would reduce the need for collection activities. Thus, the corresponding unrecovered costs of collection would also be reduced. If the marginal cost of the program is equal to or less than the marginal cost 'saved' by the City, which might be the case, it would be efficient. It is likely that this program would be efficient from a societal perspective.

## **Marketing**

The key to participation by the targeted demographic is effective marketing. The program and its benefits could be marketed through partnerships with agencies that have contact and established relationships with the low-income population. Customers could also be informed of the program through inserts included with bills. Ideally, the program would be marketed as an opportunity for people to do their part to protect the water supply, keep water rates low, and conserve an essential natural resource—all while saving themselves substantial amounts of money.

## **Tenant option**

It is important that any attempt to improve the affordability of water and wastewater service be comprehensive—that is, it must also address the affordability of these services to indirect customers as well. The inclusion of water and wastewater bills in monthly rental payments requires an additional mechanism to pass the savings from a

conservation program on to tenants. The following tenant option is developed by the author with full acknowledgment of the aforementioned shortcomings of these forms of assistance.

In this tenant option, indirect customers would attend the budgeting and conservation classes and receive a water conservation kit. They would also be required to schedule a residential water audit. During the audit, the technician would confirm that the devices are installed or provide installation assistance if necessary. Upon confirming the installation of these devices, the tenant would be enrolled in the water and wastewater scrip program. The scrip would be submitted to the landlord as partial payment of the tenant's overall rent. In turn, the landlords would submit the scrip as part of their utility payment. The amount of scrip provided depends upon what the City feels is appropriate. It likely would have some relation to the number of people in the household and estimated savings from the retrofit. If the City is concerned that tenants may remove the devices after the audit is complete, it could consider installing tamper-proof devices that require a special key for installation and removal.

The frequent mobility of low-income tenants may be of concern to the City. If an indirect customer participating in the conservation initiative moves, the landlord continues to reap the benefits of reduced water consumption without necessarily passing them on to tenants. To mitigate this concern, the City could require a landlord with participating tenants to make an amount of repairs to the unit equivalent to the projected savings for an average size family over the life of the devices. Alternatively, the City could require that this amount of savings be passed onto tenants in the form of lower rent. Both of these methods would require enforcement that potentially could be costly.

Finally, the City and/or Department of Public Services could provide rental assistance similar to, but in place of, scrip. This would address affordability by providing eligible indirect customers with assistance approximately equal to the savings generated by the retrofit. In theory, this should have the same results as scrip. Unfortunately, the City and Utility cannot ensure that these payments are spent on rent, giving rise to previously mentioned problems.

## Recommendations

The Kalamazoo Public Water Supply System is not facing widespread affordability problems. It is our opinion that, given the comparably low cost structure of the system and the limited potential for meaningful savings, no action or change in billing is warranted. However, the City may wish to consider some form of assistance to low-income households. To this effect, three levels of policy action to address the issue of affordability are identified. Any form of assistance implemented should strive to effectively and efficiently provide assistance without encouraging dependency on the assistance.

### Minimal

The Department of Public Services already has several forms of assistance in place that it can use to address individual problems with affordability, including: payment arrangements, a leak adjustment policy, and rebates for improvements made primarily by renters that are provided through credits on utility bills. Payment arrangements are by far the most common. Leak adjustments and rebates are offered as ad hoc solutions but are not frequently used.<sup>17</sup> Formalizing these types of assistance and applying them in more situations would be simple to accomplish and could have potentially significant effects on the affordability of water and wastewater services for low-income customers.

Payment arrangements, entered into when a customer faces an unaffordable bill, are essentially monthly billing arrangements. Offering this option to customers before they fall into arrears may significantly improve the affordability of services. Monthly billing arrangements could be offered to any customer who wishes to take advantage of them or based upon the satisfaction of eligibility criteria. Presumably, the only customers who would elect a monthly cycle would be those who could benefit from it—the low-income. All other customers would likely view a monthly bill as a hassle and opt to remain on a quarterly cycle. Customers could also be qualified for this program using conditional eligibility. To establish conditional eligibility, a number of criteria could be used as triggers for the program. An attractive and appropriate criterion is evidence of payment difficulty indicated by delinquencies. This program would only be effective for direct customers. It would not help those tenants who pay for water and wastewater indirectly through their rent.

Currently, historical consumption data for an account is provided on each bill. This data enables customers to assess and manage their consumption to some extent. However, if a household lives in a dwelling that has historically high consumption, an analysis of this trend is meaningless—it does not indicate a problem. In short, historical account consumption data is of limited value for benchmarking. If this information were coupled with typical consumption data for different sized households in the system, as shown in Table A6, the combination would be much more meaningful. It would enable customers to compare their consumption to the average for a similarly sized household, thus alerting them to potential problems of which they were previously unaware.

## **Intermediate**

An intermediate response would incorporate the steps identified in the preceding section with several alternative forms of assistance. The City could consider creating a plumbing assistance fund and making crisis assistance available. Ideally, crisis assistance would not be the sole form of assistance offered nor would it be limited only to customers in shutoff situations. These factors would only serve to encourage dependency without addressing the root of the problem. Eligibility determinations could be made in the same fashion used to qualify participants for monthly billing. This intermediate level of action would also not address affordability for tenants who are indirect customers.

Administrative costs incurred by the Department of Public Services could be minimized through the establishment of partnerships with community action agencies, such as the Salvation Army and the Community Action Bureau. These agencies are experienced and well equipped to handle the administration of assistance programs. They suffer not from a lack of desire to help the poor or a shortage of staff, but rather from a lack of funds for assistance.<sup>18</sup> The Public Services Department also may wish to consider partnering with the office of the City Inspector to help ensure that landlords make the necessary repairs to maintain the plumbing infrastructure in rental housing. Doing so would help protect tenants who are direct customers from unaffordable bills.

## **Comprehensive**

A comprehensive approach to address the affordability of water and wastewater may be justified should the affordability of these services become a significant issue in the future. It also would be justified currently if the City wishes to provide assistance without encouraging dependency and concludes that customers struggling with affordability are best helped by being empowered to bring bills within their reach themselves. This comprehensive approach to improving affordability would be successful at addressing unaffordable bills for both direct and indirect customers. It combines the elements of the minimal and intermediate levels of policy action with demand-side management to bring bills within the reach of the economically disadvantaged. Demand-side management, used to “shrink the problem” of affordability, would be achieved through the conservation initiative outlined in this report.

More detailed explanations and evaluations of the aforementioned program components are found in the report body. The level of action the City elects to take will depend upon the resources available, the needs it chooses to address, and the extent of social assistance it determines is appropriate to provide.

## Appendix A – Additional tables

**Table A1: Eligibility regardless of customer status - 100% FPG**

Service area	Residential customers	Total	Owner occupied	Renter occupied	Customers eligible (%)	Households below 100% of FPG (%)
Comstock Township	2,352	162	61	101	6.9%	6.8%
Cooper Township	198	2	2	0	1.0%	1.2%
Kalamazoo, City of	17,484	3,902	654	3,247	22.3%	21.8%
Kalamazoo Township	6,559	704	195	510	10.7%	11.3%
Oshtemo Township	2,035	327	34	293	16.1%	15.9%
Pavilion Township	2	0	0	0	0.0%	0.0%
Portage, City of (Kalamazoo water)	868	31	10	21	3.6%	3.5%
Richland Township	804	32	11	20	3.9%	4.1%
Texas Township	1,306	36	22	15	2.8%	2.6%
Total Outlying	14,124	1,294	334	960	9.2%	10.1%
Total	31,608	5,195	988	4,207	16.4%	16.3%

SOURCE: Author's calculations from U.S Census Data.

**Table A2: Eligibility regardless of customer status - 150% FPG**

Service area	Residential customers	Total	Owner occupied	Renter occupied	Customers eligible (%)	Households below 100% of FPG (%)
Comstock Township	2,352	333	150	183	14.2%	14.1%
Cooper Township	198	15	9	6	7.6%	8.0%
Kalamazoo, City of	17,484	5,905	1,696	4,209	33.8%	33.2%
Kalamazoo Township	6,559	1,220	463	757	18.6%	19.1%
Oshtemo Township	2,035	524	136	388	25.8%	25.6%
Pavilion Township	2	0	0	0	0.0%	0.0%
Portage, City of (Kalamazoo water)	868	97	45	52	11.2%	11.1%
Richland Township	804	73	32	41	9.1%	9.0%
Texas Township	1,306	94	44	50	7.2%	5.9%
Total Outlying	14,124	2,357	879	1,478	16.7%	17.7%
Total	31,608	8,263	2,575	5,688	26.1%	26.0%

SOURCE: Author's calculations from U.S Census Data.

**Table A3: Household water and wastewater savings from conservation retrofit - City residents**

Household size	Reduction in daily household consumption (gal)	Reduction in annual household consumption (gal)	Annual savings on water/sewer bill (\$) <sup>a</sup>	Annual savings on water/sewer bill - no leaks (\$) <sup>b</sup>
1	27.35	9,983	\$20.77	\$9.23
2	54.70	19,966	41.54	18.45
3	82.05	29,948	62.31	27.68
4	109.40	39,931	83.08	36.91
5	136.75	49,914	103.86	46.14
6	164.10	59,897	124.63	55.36
7	191.45	69,879	145.40	64.59
8	218.80	79,862	166.17	73.82

<sup>a</sup> Savings compared to average consumption, 84 gcd.

<sup>b</sup> Savings compared to average consumption, 84 gcd.

SOURCE: Author's calculations.

**Table A4: Household water and wastewater savings from conservation retrofit - Non-city residents**

Household size	Reduction in daily household consumption (gal)	Reduction in annual household consumption (gal)	Annual savings on water/sewer bill (\$) <sup>a</sup>	Annual savings on water/sewer bill - no leaks (\$) <sup>b</sup>
1	27.35	9,983	\$38.52	\$17.11
2	54.70	19,966	77.04	34.22
3	82.05	29,948	115.56	51.33
4	109.40	39,931	154.08	68.44
5	136.75	49,914	192.60	85.55
6	164.10	59,897	231.12	102.66
7	191.45	69,879	269.64	119.77
8	218.80	79,862	308.16	136.88

<sup>a</sup> Savings compared to average consumption, 84 gcd.

<sup>b</sup> Savings compared to average consumption, 84 gcd.

SOURCE: Author's calculations.

**Table A5: Household energy savings from conservation retrofit**

Household size	Natural gas water heater		Electric water heater	
	Natural gas saved (Ccf)	Natural gas costs saved (\$)	Electricity saved (kWh)	Electricity costs saved (\$)
1	14.82	\$11.66	290.02	\$22.84
2	29.64	23.32	580.03	45.67
3	44.45	34.99	870.05	68.51
4	59.27	46.65	1,160.07	91.34
5	74.09	58.31	1,450.08	114.18
6	88.91	69.97	1,740.10	137.02
7	103.72	81.64	2,030.12	159.85
8	118.54	93.30	2,320.13	182.69

SOURCE: Author's calculations.



**Table A6: Typical system consumption by household size<sup>a</sup>**

	<b>Number in household</b>							
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
Quarterly consumption (M <sup>3</sup> )	29	58	87	116	145	174	203	232
Annual consumption (M <sup>3</sup> )	116	232	349	465	581	697	813	930

<sup>a</sup>Based on typical per capita consumption of 84 gallons per day.

SOURCE: Author's calculations.

## **Appendix B – Eligibility Methodology**

The results of the 2000 Census are available on the US Census Bureau website. The Census Bureau collects information through two forms of surveys: the long- and short-form. Every household receives a short-form census. Approximately one in six households receives a long-form census. The long-form census contains more detailed questions that are used to paint an accordingly detailed statistical portrait of the nation. The results of the long-form census are contained in Summary File 3 (SF 3). Using data from SF 3, profiles of the areas served by the Kalamazoo Public Water Supply System (PWSS) were constructed.

The Census Bureau collects data on various levels. For the purposes of the census, each county is broken down into census tracts, which are then split into block groups, and finally blocks. The size of each unit is based upon population; so sometimes a block is quite literally, a block. Some data from the long-form census is available on the block level, while other data is available only on the census tract level. Unfortunately, except for the City of Kalamazoo, the geographic boundaries used by the census do not fit neatly into the Kalamazoo PWSS service area. Therefore, it was necessary to construct census appropriate descriptions of the various municipalities served by the Kalamazoo PWSS in terms of census tracts, block groups, and blocks. The areas served by the Kalamazoo PWSS were determined through the use of billing records. There were some discrepancies between the areas served by the PWSS and the wastewater treatment system, but they were not significant enough to materially alter the results and as such were ignored. The following information was gathered for each service area:

- number of households with income below and above the poverty level,
- number of households with income below and 150 percent of the poverty level,
- tenure by poverty status.

Data on incomes were available on the block group and block levels. The data from each block group and block were aggregated to arrive at income data for each area served by the PWSS. Tenure data were only available on the census tract level. Therefore, a ratio of the number of households in the part of a census tract served by the PWSS compared to total number of households in the tract was computed. This ratio was then used to weight the tenure data. The result was tenure data for the areas served by the PWSS.

More information was needed to determine the number of customers eligible for assistance if a 150 percent of FPG income threshold were used and if assistance were to only be provided to direct customers. The additional figures required were computed from the Public-Use Microdata Sample (PUMS). PUMS is a five percent sample of long-form census responses available for large geographic areas. From PUMS, it was estimated that 52 percent of households with income between 100 and 150 percent of the poverty level live in owner-occupied residences and 48 percent of households within that income range are tenants. It was also determined that of 16.2 percent of tenants below the poverty level and 17.1 percent of tenants between 100 and 150 percent of the poverty level pay directly for water and wastewater service.

The number of households between 100 and 150 percent of the poverty level was calculated by subtracting the number of households with incomes at or below 100 percent of the poverty level from the households with incomes at or below 150 percent of the poverty level. The percentages generated from PUMS were then applied to this number, thus completing the profiles of the PWSS service areas. The resulting number of households in each service area was different than the number of residential customers served. To adjust for this, the ratio of the number of residential customers to total households in the service area was calculated. This percentage was then used to weight the data contained in the profiles of each service area. Tables A1 and A2 present eligibility by service area.

## Appendix C – Traditional assistance programs

In this Appendix, the effectiveness of the following five models at achieving affordability is evaluated:

- Model 1 – Readiness to serve charge waiver
- Model 2 – Discount usage rate by 35%
- Model 3 – Discount total bill by 25%
- Model 4 – Discount based on equal percentage of bill
- Model 5 – Per person discount

Models 1 and 5 are fixed discounts, while Models 2 and 3 are percentage discounts. Model 4 is unique in that its goal is to equate the ratio of all participants' discounts to their total bill. It is based upon a waiver of the readiness to serve charge, with an additional amount per capita to maintain equality between recipients. The amounts and percentages used in any model can be altered to better fit the City's needs and desires. The percentages used in Models 2 and 3 are consistent with those used by Saunders et al. (1998).

Since affordability problems do not occur at the 100 percent of FPG threshold, evaluating the effectiveness of assistance programs at this income level is a moot point—all models would be equally ineffective at reducing affordability problems, since none exist. Therefore, for illustrative purposes, the effectiveness of assistance programs is evaluated for city and non-city customers with income from a sole minimum wage earner. This income level allows the effectiveness of the various assistance programs to be seen. The results of this analysis are presented in Tables C1 and C2.

Table C1: Effects of assistance programs on combined bill burden for sole minimum wage earner - City residents

	Number in household							
	1	2	3	4	5	6	7	8
Bill - No discount	1.39%	2.01%	2.63%	3.25%	3.87%	4.49%	5.11%	5.73%
Model 1 - Waive readiness to serve charge								
Both	0.62%	1.24%	1.86%	2.48%	3.10%	3.72%	4.34%	4.95%
Water	0.93%	1.55%	2.17%	2.79%	3.41%	4.03%	4.65%	5.27%
Wastewater	1.08%	1.70%	2.32%	2.94%	3.56%	4.18%	4.80%	5.42%
Model 2 - Discount usage rate by 35%								
Both	1.18%	1.58%	1.98%	2.38%	2.79%	3.19%	3.59%	3.99%
Water	1.29%	1.81%	2.32%	2.84%	3.36%	3.87%	4.39%	4.90%
Wastewater	1.28%	1.79%	2.29%	2.80%	3.30%	3.81%	4.31%	4.82%
Model 3 - Discount total bill by 25%								
Both	1.05%	1.51%	1.97%	2.44%	2.90%	3.37%	3.83%	4.30%
Water	1.20%	1.75%	2.30%	2.84%	3.39%	3.93%	4.48%	5.02%
Wastewater	1.23%	1.77%	2.31%	2.85%	3.39%	3.93%	4.46%	5.00%
Model 4 - Discount based on % of bill								
Both	0.62%	0.90%	1.18%	1.46%	1.75%	2.03%	2.31%	2.59%
Water	0.93%	1.37%	1.81%	2.25%	2.69%	3.13%	3.57%	4.01%
Wastewater	1.08%	1.54%	2.01%	2.47%	2.93%	3.39%	3.85%	4.31%
Model 5 - Per person discount								
Both	0.23%	0.85%	1.47%	1.85%	2.24%	2.63%	3.01%	3.40%
Water	0.81%	1.43%	2.05%	2.55%	3.06%	3.56%	4.06%	4.56%
Wastewater	0.81%	1.43%	2.05%	2.55%	3.06%	3.56%	4.06%	4.56%

NOTE: Burdens based upon income from sole minimum wage earner. Shaded cells indicate unaffordable bills.

SOURCE: Author's calculations.

**Table C2: Effects of assistance programs on combined bill burden for sole minimum wage earner - Non-city residents**

	Number in household							
	1	2	3	4	5	6	7	8
<b>Bill - No discount</b>	2.16%	3.30%	4.45%	5.60%	6.75%	7.90%	9.05%	10.19%
<b>Model 1 - Waive readiness to serve charge</b>								
Both	1.15%	2.30%	3.45%	4.59%	5.74%	6.89%	8.04%	9.19%
Water	1.59%	2.74%	3.88%	5.03%	6.18%	7.33%	8.48%	9.63%
Wastewater	1.72%	2.86%	4.01%	5.16%	6.31%	7.46%	8.61%	9.76%
<b>Model 2 - Discount usage rate by 35%</b>								
Both	1.75%	2.50%	3.25%	3.99%	4.74%	5.49%	6.23%	6.98%
Water	1.97%	2.94%	3.91%	4.88%	5.85%	6.81%	7.78%	8.75%
Wastewater	1.93%	2.86%	3.79%	4.71%	5.64%	6.57%	7.50%	8.42%
<b>Model 3 - Discount total bill by 25%</b>								
Both	1.62%	2.48%	3.34%	4.20%	5.06%	5.92%	6.78%	7.65%
Water	1.88%	2.90%	3.92%	4.94%	5.96%	6.98%	8.00%	9.02%
Wastewater	1.89%	2.88%	3.87%	4.86%	5.85%	6.84%	7.83%	8.82%
<b>Model 4 - Discount based on % of bill</b>								
Both	1.15%	1.77%	2.39%	3.01%	3.63%	4.25%	4.87%	5.49%
Water	1.59%	2.47%	3.34%	4.22%	5.10%	5.98%	6.86%	7.73%
Wastewater	1.72%	2.61%	3.50%	4.39%	5.28%	6.17%	7.06%	7.95%
<b>Model 5 - Per person discount</b>								
Both	0.99%	2.14%	3.29%	4.20%	5.12%	6.03%	6.95%	7.86%
Water	1.57%	2.72%	3.87%	4.90%	5.93%	6.97%	8.00%	9.03%
Wastewater	1.57%	2.72%	3.87%	4.90%	5.93%	6.97%	8.00%	9.03%

NOTE: Burdens based upon income from sole minimum wage earner. Shaded cells indicate unaffordable bills.

SOURCE: Author's calculations.

The effectiveness of an assistance program is indicated by the extent to which bills are brought down to an affordable level, less than four percent of household income in the case of combined bills. For city residents, Models 2, 4, and 5 are equally effective by this standard, in that they reduce burdens for each household to less than four percent. If the level to which bills are reduced is the only criterion used to evaluate assistance programs, the most effective program would be one that provides participants with free water and wastewater services. However, the goal is to make services affordable, not free.

In addition to making bills affordable, the efficiency with which the models achieve this must also be taken into consideration. In light of this, as shown in Table C3, Model 2 is the most effective and efficient assistance program. It provides the most appropriate amount of a subsidy—just enough to lower bills under the four percent threshold—and does so at 50 percent of the cost of Model 4 and approximately 75 percent of the cost of Model 5. When variable charges constitute the largest portion of the bill, a discounted usage rate will be most effective at increasing affordability, as is the case for the typical customer inside and outside the city.

For non-city residents, Models 2 and 4 were the most effective at improving affordability. Due to the higher rates charged to this class of customer, affordability problems are experienced by more households. Model 4 is the most successful at reducing the greatest number of bills to an affordable level; however, it is not the most efficient. Model 2 accomplishes its reduction in bills at nearly half the cost of Model 4 and as such is the most efficient form of assistance, as is shown in Table C4. A comparison of Tables C1 and C2 substantiates the fact that non-city customers are more likely to face affordability problems due to higher rates charged outside the city—there are three times the number of shaded cells in Table C2 than in Table C1. It also demonstrates that substantially larger amounts of assistance are needed to bring non-city bills down to an affordable level.

**Table C3: Estimated quarterly assistance provided per customer (\$) - City residents<sup>a</sup>**

	Number in household							
	1	2	3	4	5	6	7	8
<b>Model 1 - Waive readiness to serve charge</b>								
Both	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93
Water	11.93	11.93	11.93	11.93	11.93	11.93	11.93	11.93
Wastewater	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
<b>Model 2 - Discount usage rate by 35%</b>								
Both	5.58	11.17	16.74	22.33	27.91	33.49	39.08	44.66
Water	2.65	5.31	7.96	10.62	13.27	15.92	18.58	21.23
Wastewater	2.93	5.86	8.78	11.71	14.64	17.57	20.50	23.43
<b>Model 3 - Discount total bill by 25%</b>								
Both	8.97	12.95	16.94	20.93	24.92	28.91	32.89	36.88
Water	4.88	6.77	8.67	10.56	12.46	14.36	16.25	18.15
Wastewater	4.09	6.18	8.27	10.37	12.46	14.55	16.64	18.73
<b>Model 4 - Discount based on % of bill</b>								
Both	19.93	28.63	37.33	46.03	54.73	63.43	72.13	80.83
Water	11.93	16.56	21.19	25.82	30.45	35.08	39.71	44.34
Wastewater	8.00	12.07	16.14	20.21	24.28	28.35	32.42	36.49
<b>Model 5 - Per person discount</b>								
Both	30.00	30.00	30.00	36.00	42.00	48.00	54.00	60.00
Water	15.00	15.00	15.00	18.00	21.00	24.00	27.00	30.00
Wastewater	15.00	15.00	15.00	18.00	21.00	24.00	27.00	30.00

<sup>a</sup> Average consumption 84 gcd.

SOURCE: Author's calculations.

**Table C4: Estimated quarterly assistance provided per customer (\$) - Non-city residents<sup>a</sup>**

	Number in household							
	1	2	3	4	5	6	7	8
<b>Model 1 - Waive readiness to serve charge</b>								
Both	25.92	25.92	25.92	25.92	25.92	25.92	25.92	25.92
Water	14.62	14.62	14.62	14.62	14.62	14.62	14.62	14.62
Wastewater	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30
<b>Model 2 - Discount usage rate by 35%</b>								
Both	10.35	20.70	31.05	41.41	51.75	62.10	72.46	82.80
Water	4.65	9.29	13.94	18.59	23.23	27.88	32.53	37.17
Wastewater	5.70	11.41	17.11	22.82	28.52	34.22	39.93	45.63
<b>Model 3 - Discount total bill by 25%</b>								
Both	13.87	21.26	28.66	36.05	43.45	50.84	58.24	65.63
Water	6.97	10.29	13.61	16.93	20.25	23.57	26.89	30.21
Wastewater	6.90	10.97	15.05	19.12	23.20	27.27	31.35	35.42
<b>Model 4 - Discount based on % of bill</b>								
Both	25.92	39.53	53.14	66.75	80.36	93.97	107.58	121.19
Water	14.62	21.58	28.54	35.50	42.46	49.42	56.38	63.34
Wastewater	11.30	17.95	24.60	31.25	37.90	44.55	51.20	57.85
<b>Model 5 - Per person discount</b>								
Both	30.00	30.00	30.00	36.00	42.00	48.00	54.00	60.00
Water	15.00	15.00	15.00	18.00	21.00	24.00	27.00	30.00
Wastewater	15.00	15.00	15.00	18.00	21.00	24.00	27.00	30.00

<sup>a</sup> Average consumption 84 gcd.

SOURCE: Author's calculations.

## **Appendix D – Monthly Billing**

It is possible that adopting a monthly billing cycle for low-income customers will increase net revenue. Monthly billing arrangements do require additional expenditures to compute, mail, and process payment of monthly bills. However, the extent of these additional expenditures depends upon the structure of the billing plan adopted.

There are several ways to structure a monthly billing arrangement. Billing customers monthly does not require meters to be read more often, nor does it require bills to be sent more frequently. Meters and bills could still be read and sent quarterly. Three payment stubs, each for an amount equal to one-third of the quarterly bill, could be enclosed giving customers the option of monthly billing while the City only incurs the additional costs of dividing quarterly bills into monthly installments, printing the stubs, and processing the additional payments received.

However, monthly billing, as accomplished through the use of stubs enclosed with quarterly bills, may not be as effective as mailing bills directly to customers each month. The use of payment stubs requires customers to retain the stubs and remember to make monthly payments without the prompting of a bill. Stubs also lack the payment obligation of a bill, providing customers with the flexibility to skip monthly payments when facing a shortage of funds, thus defeating the purpose of the program. Accordingly, actual monthly billing may be more effective at increasing the amount of revenue received from low-income customers.

Mailing estimated monthly bills based upon historical quarterly consumption is only marginally more expensive than monthly billing as accomplished through the use of stubs. Mailing estimated bills monthly would require eight additional bills to be sent per year. The only costs associated with these additional bills are paper, printing, envelopes, and postage. Meters can, but need not, be read monthly. An option that would enable monthly bills to be based upon actual consumption, without much additional cost to the City, is for customers participating in monthly billing arrangements to phone in monthly meter readings. Meters would still be read quarterly by Consumers Energy. Bills could be based upon the phoned in readings, and any discrepancies between reported and actual consumption would be corrected quarterly.

The advantages of mailing monthly bills based upon actual consumption include providing customers with frequent feedback on the success of and savings resulting from efforts to conserve water and avoiding large bills necessary to adjust for spikes in consumption not reflected in budgeted bills based upon historical consumption. These advantages may or may not be outweighed by the additional costs of reading water meters monthly. No matter what form of monthly billing is adopted, offering the option only to low-income customers would limit costs associated with these arrangements.

More important than the increase in costs arising from monthly billing is the impact monthly billing may have on net costs. Fewer customers falling into arrears will result in a corresponding reduction in collection activities. As a result, net costs may actually

decrease, assuming that the additional per customer costs of monthly billing arrangements are lower than the utility's unrecovered costs from attempted collection activities. This is most likely to be the case when service disconnection is used as a collection device. A \$10 reconnection fee is levied to recoup some, but not all, of the costs associated with shutoff and reconnection activities. Table D1 shows that this fee is not enough to recoup all of the costs incurred by the City in even the simplest of cases. Any amount not recovered through the reconnection fee is borne by the utility. This amount can be approximated by subtracting \$10 from the total cost per shutoff and reconnection in Table D1.

**Table D1: Estimated cost of water service shutoff and reconnection (\$) <sup>a</sup>**

	During business hours	After business hours
Shutoff - easy	7.39	n/a
Reconnection - easy	5.02	177.24
Total - easy	12.41	177.24
Shutoff - hard	19.80	n/a
Reconnection - hard	19.80	177.24
Total - hard	39.60	177.24

NOTE: Only reconnections are performed after business hours. The cost per reconnection after hours is lower if more than one can be completed within two hours.

<sup>a</sup> Only costs for physical shutoff and reconnection activities were available. Actual costs of shutoff and reconnection also include administrative, mailing, and processing costs.

SOURCE: City of Kalamazoo Department of Public Services.

Since Table D1 omits administrative, mailing, processing, and related customer service costs of collection activities, the approximate amounts of costs borne by the City are conservative estimates. The \$10 charge is much more effective at limiting the costs borne by the City in the case of easy shutoffs and reconnections (\$2.41) than those that are incurred in a more difficult case (\$29.60) or a reconnection made after hours (\$167.24). Ultimately any costs that are not recovered by the City are passed on to customers in the form of higher rates.

If monthly billing cycles are effective at increasing low-income customers' on-time and in-full payments, service terminations and reconnections and the amount of costs borne by the City will be reduced, quite significantly in some cases. This reduction in net costs combined with the increase in revenues collected from low-income customers could result in an increase in net revenue.



## Appendix E – Conservation Calculations

Estimated savings from the installation of the conservation kit are based upon the usage and rates of flow in Table E1. This table does not include savings from conservation oriented behavioral changes.

**Table E1: Water and wastewater savings from conservation retrofit (per person)**

Type of use	Baseline		Baseline usage (gcd)	Retrofit		Retrofit usage (gcd)
	frequency of use	Flow rate (gpm, gpf)		frequency of use	Flow rate (gpm, gpf)	
Faucet	10.7 min/day	2 gpm	21.40	10.7 min/day	1.5 gpm	16.05
Shower	8 min/day	2.1 gpm	16.80	8 min/day	1.75 gpm	14.00
Toilet	5 flushes/day	3.5 gpf	17.50	5 flushes/day	2.7 gpf	13.50
Leaks			18.90			3.70
<b>Total</b>			<b>74.60</b>			<b>47.25</b>

SOURCE: Author's calculations based on *Urban Water Demand Management and Planning* and Tampa Water Department residential water conservation study.

The baseline frequencies of use and flow rates are based upon the results of two weeks of data from flow trace devices installed during the Tampa Water Department Residential Water Conservation Study. These baseline figures were comparable to the Residential End Uses of Water Survey conducted by the American Water Works Association in 1999, which studied indoor consumption patterns in 1,200 homes across the country (Meyer et al. 2004). The baseline flow rates, while consistent with the findings of both studies, are conservative estimates that are near the maximum flow rates allowed by the 1992 Energy Policy Act passed by Congress. The Energy Policy Act required toilets to use no more than 1.6 gallons per flush (gpf) and limited showerheads and faucets to 2.5 gallons per minutes (gpm). Older fixtures, such as the ones likely to be found in low-income households, use substantially more water. Toilets can use between 3.5 to seven gpf. Showerheads may use between four and eight gpm. The flow rates of faucets may range from five to seven gpm (Low-flow fixtures 2004). Therefore, savings from conservation may be substantially higher for low-income households.

Since reduced water use will result in reduced hot water consumption, participants in the conservation initiative will lower their energy costs in addition to their water and wastewater costs. To calculate the reduction in energy costs, the temperature of water entering the house, the average temperature of water for showers and faucet use, and the efficiency of water heaters needed to be known. The temperature of water entering a residence varies slightly due to a number of factors, but averages 52.5 degrees Fahrenheit in the Kalamazoo PWSS.<sup>19</sup> The remaining information was provided by the State of Nebraska Energy Office (Hauschild 2004). The methodology used to calculate energy savings is presented in Table E2.

**Table E2: Energy savings from conservation retrofit (per person)**

	Baseline		Retrofit	
	Shower	Faucet	Shower	Faucet
Water temperature upon delivery (°F)	52.5	52.5	52.5	52.5
Water temperature upon use (°F)	105	105	105	105
Temperature difference (°F)	52.5	52.5	52.5	52.5
Adjustment factor <sup>a</sup>	0	0.5	0	0.5
Annual water consumption (gal)	6,132	7,811	5,110	5,858
Efficiency of water heater - gas	57%	57%	57%	57%
Efficiency of water heater - electric	88%	88%	88%	88%
Energy required - gas (Btus)	4,687,753	2,985,652	3,906,461	2,239,239
Energy required - electric (Btus)	3,036,385	1,933,888	2,530,321	1,450,416
Natural gas required (Ccf)	45.47	28.96	37.89	21.72
Kilowatt hours (kWh)	889.91	566.79	741.59	425.09

<sup>a</sup> Assumes hot and cold water are mixed equally.

SOURCE: Author's calculations based on methodology from State of Nebraska Energy Office, Bruce Hauschild.

**Table E3: Annual energy savings (per person)<sup>a</sup>**

	Natural gas saved (Ccf)	Natural gas costs saved (\$)	Electricity saved (kWh)	Electricity costs saved (\$)
Shower	7.58	5.96	148.32	11.68
Faucet	7.24	5.70	141.70	11.16
<b>Total</b>	<b>14.82</b>	<b>\$11.66</b>	<b>290.02</b>	<b>\$22.84</b>

NOTE: Savings are calculated using Consumers Energy prices for July 2004.

<sup>a</sup> Cost per kWh \$0.07874. Cost per Ccf \$0.78705.

SOURCE: Author's calculations based on Table E2.

## Notes

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- <sup>1</sup> It should be noted that rate changes vary between customer classes.
- <sup>2</sup> The sample size for individuals with income less than 150 percent of the FPG is 5,367 respondents. Of that group 894, or 16.7 percent, are enrolled in at least one college class. The vast majority of these students either rent (454) or live in group quarters (368). The sample size for individuals with income less than 100 percent of the FPG is 3,333. Of that group 738, or 22.1 percent, are enrolled in at least one college class. The vast majority of these students either rent (326) or live in group quarters (367).
- <sup>3</sup> See page 10 for a discussion of eligibility issues.
- <sup>4</sup> Personal communication with Tim Charron, Family Independence Manager, Kalamazoo County FIA. August 5, 2004.
- <sup>5</sup> Personal communication with Tim Charron, Family Independence Manager, Kalamazoo County FIA. July, 2004.
- <sup>6</sup> Personal communication with Maria Almaguer, Social Services Coordinator, Kalamazoo County Salvation Army. July 15, 2004.
- <sup>7</sup> Personal communication with Lois Justice, Human Services Specialist, Kalamazoo County Human Services Department. August 23, 2004.
- <sup>8</sup> Table 8, p.4.
- <sup>9</sup> Personal communication with Nancy Fitzsimmons, Customer Service Billing Supervisor, Kalamazoo Department of Public Services, May 19, 2004.
- <sup>10</sup> Personal communication with Abbie Walker, City of Kalamazoo Public Services Financial Manager. August 12, 2004.
- <sup>11</sup> Personal communication with Tim Charron, Family Independence Manager, Kalamazoo County FIA. July, 15 2004.
- <sup>12</sup> Author's calculations based upon data from FIA website.
- <sup>13</sup> Author's calculations based upon Tables A3-A5. Assumes cost of conservation kit to be \$6.75 each.
- <sup>14</sup> It may not be "worth their time."
- <sup>15</sup> Author's calculations based upon participation of 8,263 households, average household size 2.6 persons, reduced consumption 27.35 gcd. Reduction in volume billed: 812,832 M<sup>3</sup>. Total system volume billed in 2003: 22,717,891 M<sup>3</sup> (CAFR 2003).

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<sup>16</sup> Author's calculations using a 10 percent participation rate.

<sup>17</sup> Personal communication with Abbie Walker, City of Kalamazoo Public Services Financial Manager and Jerri Barnett-Moore, City of Kalamazoo Director of Public Services. August 12, 2004.

<sup>18</sup> Personal communication with Lois Justice, Human Services Specialist, Kalamazoo County Human Services Department. August 12, 2004.

<sup>19</sup> Personal communication with Abbie Walker, City of Kalamazoo Public Services Financial Manager. July 21, 2004.

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