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EXECUTIVE SUMMARY

i. BACKGROUND

Columbia Water & Light (CW&L) provides water service to domestic, commercial, institutional, and industrial customers within the City of Columbia (City) limits as well as small areas adjacent to the City. Additional water suppliers in the area consist of the University of Missouri (which has its own deep well based water supply) and rural water districts for the surrounding rural areas.

CW&L contracted with Jacobs Engineering Group, Inc. (Jacobs) to develop a Long Range Water System Study (Study) for future water supply and distribution within CW&L's service area. The objective of the Study is to identify needed capital improvements for CW&L's continued proactive response to provide water service to the customers within their service area for a 20-year planning period (2008 to 2028).

ii. CURRENT AND FUTURE WATER DEMANDS

The nature of predicting future water demands is an inexact science, since there are several unpredictable factors that can result in the actual demands being different than those predicted. Therefore, to account for these uncertainties, the future water demands were estimated with a range of scenarios. The criteria and methodology used are discussed in Section 4.

The estimated future water production needs based on the criteria discussed in Section 4 is shown on the Table below and the range of scenarios is shown on the graph at the end of Section 4.

Estimated Future Water Production

Year[1]	Average Daily Water Production (MGD)	Maximum Daily Water Production (MGD)
2008	14.6	24.5
2009	15.1	25.5
2010	15.6	26.6
2011	16.1	27.7
2012	16.6	28.8
2013	17.2	30.0
2014	17.8	31.3
2015	18.4	32.7
2016	19.0	34.1
2017	19.6	35.6
2018	20.3	37.2
2019	21.0	38.9
2020	21.8	40.8
2021	22.5	42.7
2022	23.3	44.8
2023	24.2	46.9
2024	25.1	49.3

2025	26.0	51.7
2026	26.9	54.4
2027	27.9	57.2
2028	28.9	60.2

iii. PROPOSED SYSTEM IMPROVEMENTS

The current CW&L Five-Year Capital Improvement Plan (CIP) was provided to Jacobs. Improvements identified within the CIP that were related to capacity upgrades (i.e., water main upgrades, new distribution or transmission mains, loop closures, storage or pumping) were evaluated with the KYPIPE model. In addition, evaluation and identification of future system improvements (in five year increments through 2028) necessary to meet the anticipated demands was conducted. The following is a brief summary of the improvements identified.

Five-Year CIP ($38,939,500)

The evaluation of the Five-Year CIP indicated that the improvements identified were adequate to meet the projected water demands. The main capital improvements are briefly discussed below. Additional information is included in Section 5.

- North Section of 24-Inch East Transmission Main. This included a new 24-inch transmission main from the existing Shepard elevated tank to the Hillsdale Pump Station.
- South Section of 24-Inch East Transmission Main. This included a new 24-inch transmission main to connect to an existing 24-inch main south of Grindstone Parkway and Highway 63 and feed the existing Shepard elevated tank.
- Heller Road Water Main. This included about 17,000 ft of new 16-inch distribution main from the existing Stephens Station elevated tank along Heller Road and Mount Hope Road to connect to the existing distribution system near Mount Hope Road and North Kircher Road.
- Route PP Main Upgrade. This includes about 25,000 ft of new 12-inch distribution main from the intersection of Clark Lane and Lake of the Woods Road north to the existing distribution system near Mount Hope Road and North Kircher Road.
- Ground Storage at Hillsdale Pump Station. This included 1.5 MG of new ground storage at the Hillsdale Pump Station site.

Year 2018 Proposed Improvements ($20,758,000)

The main capital improvements are briefly discussed below. Additional information is included in Section 5.

- Additional Pump Station at the site of the existing West Ash Pump Station.
- Elevated storage to replace the existing Prathersville Standpipe. This includes a new 2 MG elevated storage tank.
- 16-Inch Transmission Main. This includes a new 16-inch main for transmission purposes starting from the proposed new pump station at the existing West Ash Pump Station, and feeding directly to the new proposed elevated tower at the Prathersville site.
- There is insufficient treatment capacity at the McBaine WTP to meet the peak anticipated water demand of 37.2 MGD. Additional peak day demands of about 6 MGD can be met through the use of the City's Aquifer Storage and Recovery facilities (two existing facilities and one proposed each with about 2 MGD capacity). It is anticipated that additional treatment capacity will be required

sometime between 2016 and 2019, dependent on the rate of growth over the next 8 to 10 years.

Year 2023 Proposed Improvements ($36,139,000)

The main capital improvements are briefly discussed below. Additional information is included in Section 5.

- 24-Inch Transmission Main to Stephens Station elevated tank. This includes approximately 28,000 feet of 24-inch main for transmission purposes to feed the existing Stephens Station elevated tank.
- Southeast (SE) Pump Station and Ground Storage. This includes a station with 3 pumps and a capacity of approximately 5,000 gpm as well as new ground storage at the site of approximately 2 MG. Finished water for the pump station and ground storage tank would be supplied by either the existing McBaine WTP, or the proposed new Water Treatment Plant recommended by this study.
- 24-Inch Transmission Main from proposed new Southeast Pump Station. This includes approximately 7,200 feet of 24-inch main from the proposed new Southeast Pump Station near Gans Road and running north to Nifong Blvd, where it will connect to the existing 24-inch main.
- Additional Pump Station and Ground Storage at Hillsdale Pump Station. This includes a 2nd pump station identical to the existing one at Hillsdale and would utilize the existing suction and discharge lines. This also includes an additional 3 MG ground storage at the Hillsdale Pump Station in addition to the 1.5 MG ground storage planned for the Five-Year CIP.

Year 2028 Proposed Improvements ($25,411,000)

The main capital improvements are briefly discussed below. Additional information is included in Section 5.

- Additional Pump and Ground Storage at Proposed SE Pump Station. This includes installing a fourth pump at the proposed SE pump station as well as 2 MG of additional ground storage at the site.
- Ground Storage at West Ash Pump Station. This includes an additional 2 MG ground storage at the site of the existing and proposed new West Ash pump station.
- 24-Inch Transmission Main to Hillsdale Ground Storage Tank. This includes an additional 24-inch main from the existing Shepard elevated tank to the Hillsdale Pump Station. This would be a second transmission main along this same basic route in addition to the one described in section 5.2.2, and is heavily dependent on the rate of growth and future development. If it is determined that a second main from Shepard tank to Hillsdale Pump Station is necessary, we would recommend that the City try and obtain adequate easement for the initial 24-inch main to allow for future construction of this 24-inch main.
- 16-Inch Transmission Main to Shepard Elevated Tank. This includes a 16-inch main from near Grindstone Parkway and heading north to the existing Shepard elevated tank. This would be a second transmission main along this same basic route in addition to the one described in section 5.2.2, and is heavily dependent on the rate of growth and future development.

iv. CAPITAL COST ESTIMATES

The cost estimates included in Section 6 (and Appendices 2 to 5) were based on 2008 dollars, with the following notes and clarifications:

- Inflation – 5% per year for escalation of costs
- An allowance for engineering design and engineering during construction
- 15% contingency for construction costs
- Land acquisition and easement costs were NOT included.

Table 6-1, at the end of Section 6, provides a summary of the costs. These costs have been divided into pump stations, storage, other improvements, and water mains (including loop closures).

SECTION 1 – INTRODUCTION

1.1 BACKGROUND

Columbia Water & Light (CW&L) provides water service to domestic, commercial, institutional, and industrial customers within the City of Columbia (City) limits as well as small areas adjacent to the City. Additional water suppliers in the area consist of the University of Missouri (which has its own deep well based water supply) and rural water districts for the surrounding rural areas.

CW&L contracted with Jacobs Engineering Group, Inc. (Jacobs) to develop a Long Range Water System Study (Study) for future water supply and distribution within CW&L's service area. The objective of the Study is to identify needed capital improvements for CW&L's continued proactive response to provide water service to the customers within their service area for a 20-year planning period (2008 to 2028).

1.2 SCOPE OF SERVICES

The scope of this Study included the following:

- Review of previous existing reports and studies.
- Review of historical water consumption data and water production data to identify potential trends for estimating future water demands.
- Development of the estimated future water demands.
- Analyze the current 5-Year CIP (2008 to 2013) for adequacy to meet the anticipated demands.
- Analysis and evaluation of the system to identify future improvements beyond the current 5-Year CIP, including the anticipated year the improvements will be required.
- Conceptual locations and sizing of future improvements.
- Estimate the total project costs for 5-Year CIP and beyond improvements to provide CW&L with information for financial planning, guide in rate development, and future bond referendums.

The scope of this Study did not include the following elements:

- Water supply sources to meet future demands. This report identifies the amount of supply needed to meet the anticipated future water demands, however it does not include a detailed evaluation of the different types of supplies or adequacy of those supplies.
- Physical assessment or detailed evaluation of the City's existing facilities (treatment plant, wells, pump stations, and storage facilities) relative to the structural, mechanical or electrical condition of the facilities.
- Detailed hydraulic evaluation of the City's existing pumping stations or future pumping stations.

1.3 EXISTING REPORTS AND STUDIES

The following reports, studies and other information were reviewed and used to prepare this Study report:

- *1983 Report on Water System for Columbia, Missouri.* This report was a master plan for recommended water system improvements to meet estimated water demands through the year 2000.

- *1989 Long Range Water System Study for Columbia Water & Light Department.* This report was intended to be a plan for recommended improvements to meet estimated water demands through the year 2010.
- *1990 Water System Study for the Northeast Booster District prepared by CW&L personnel.* This report detailed the 5-year capital improvements needed to meet the water demands in the northeast area. The water demands used for the 1990 study were based on the 1989 report.
- *1996 Evaluation of Future Water Supply Sources.* This report was completed to evaluate alternative water supply sources to meet future water demands. This report also projected future water demands through 2025.
- *1999 Water Demand Projection for City of Columbia, Missouri.* This memorandum was intended to re-evaluate the water demands that were projected in the 1996 report based on a maximum day demand of about 22 MGD that was realized in July 1999. This maximum day demand was not anticipated until about year 2010.

SECTION 2 – EXISTING SYSTEM REVIEW

This section presents a summary of the City's current water supply sources, treatment, distribution system, inventory of wells, storage, and pumping facilities, and a description of the computer modeling efforts.

2.1 SERVICE AREA

CW&L supplies domestic, commercial and industrial water customers within the City limits and two former rural water districts adjacent to the City. The City limits, service area boundaries, and main facilities are shown in Figure 1. The University of Missouri campus is located within the service area, however, it has its own deep well water system.

2.2 SOURCES OF SUPPLY AND TREATMENT

2.2.1 Water Supply Wells

The City uses a groundwater source from fifteen (15) shallow alluvial wells in the McBaine Bottoms area near the Missouri River which is pumped to the McBaine Water Treatment Plant (WTP) for treatment and distribution. The City has three (3) additional alluvial wells (16, 17, and 18) planned for construction within the next 5 years.

The City also has one (1) deep well (#7) located within the metropolitan area, which are used to serve as an emergency backup or during periods of excessive demand. This well does not include treatment, with the exception of adding chlorine prior to distribution to the system.

The City recently converted two of their deep wells (8 and 10) into Aquifer Storage and Recovery (ASR) facilities, which allows the City to store treated water from the WTP at these locations during off-peak demand periods. Then during periods of peak demand, the City is able to supplement the supply from the WTP by pumping directly out of these ASRs into the distribution system. Each ASR has a capacity of about 2 MGD.

2.2.2 McBaine WTP

The majority of the City's water is supplied from the McBaine WTP, which is located approximately 12 miles southwest of the City near the Missouri River. The McBaine WTP has a rated capacity of 32 MGD. The water from the alluvial wells is treated with aeration, lime softening, and filtration prior to disinfection and distribution. There are four (4) lagoons for storage of lime softening sludge at the WTP site. The WTP was recently (2006) expanded to its current 32 MGD capacity and the plant is surrounded with a floodwall and levee system, which restricts any future footprint expansion at the current location.

2.3 EXISTING DISTRIBUTION SYSTEM

Finished water from the WTP is pumped by high services pumps at the WTP directly into two 36-inch transmission mains. The transmission mains extend from the WTP to both the West Ash Pump Station and ground storage reservoir and the South Pump Station and ground storage reservoir. Water from these two pump stations is then pumped to the distribution system.

The City distribution system includes two main pressure zones, the primary distribution system, and the Northeast pressure zone. Water main diameters in the CW&L distribution systems range in size from 24 inches to 4 inches.

2.3.1 Pumping Stations

Currently there are three pumping stations within the distribution system and one pumping station that is under construction. The following is a brief description of each pumping station and a summary is included in Table 2-1.

West Ash Pumping Station

This pumping station is located northeast of the intersection of Ash Street and Bernadette Drive. Finished water from the transmission main fills a ground storage reservoir on site, which is on the suction side of the pumping station. The pump station discharges directly to the distribution system. The station contains five (5) pumps. The total rated capacity, with one pump used for backup, is approximately 28 MGD.

South Pump Station

This pumping station is located near the intersection of Nifong Road and Bethel Road. Finished water from the transmission main fills two separate ground storage reservoirs on site, which are on the suction side of the pumping station. The pump station discharges directly to the distribution system. The station contains four (4) pumps. The total rated capacity, with one pump used for backup, is approximately 10 MGD.

Northeast Booster Pumping Station

This pumping station is located near the intersection of Oakland Gravel Road and Vandiver Drive. The suction side of the pump station is taken from the main distribution system (basically the discharge from West Ash Pumping station and Walnut Tank) and discharges to the Northeast pressure area. The station contains three (3) pumps. The total rated capacity, with one pump used for backup, is approximately 4.2 MGD.

Hillsdale Pump Station (currently under construction)

This pumping station is located near the intersection of I-70 Drive SE and Hillsdale Road. Initially, the suction side of the pump station will be taken from the main distribution system (basically the discharge from South Pump station and Shepard Tank) and will discharge to the Northeast pressure area. In the future, a ground storage tank will be constructed at the site and will be used on the suction side of the pump station. The station contains four (4) pumps. The total rated capacity, with one pump used for backup, is approximately 6.5 MGD.

Table 2-1: Pump Station Summary

Station Name	Water Source	No. Pumps	Total Capacity (MGD)	Status
West Ash Pump Station	Finished water from WTP	5	28	In Service
South Pump Station	Finished water from WTP	4	10	In Service
Northeast Booster Pump Station	Distribution system	3	4.2	In Service
Hillsdale Pump Station	Distribution system	4	6.5	Under Construction

2.3.2 Storage Facilities

Currently storage within the system consists of both ground, elevated, and aquifer storage. Information on the existing system storage as well as some near term planned storage is included in Table 2-2 below.

Table 2-2: Existing and Near Term Storage Facilities

Storage Facility Name	Storage Type	Capacity (gallons)	Overflow Elev. (USGS)	Status
Existing Storage				
West Ash	Ground	5,000,000	N/A	In Service
South Pump Station	Ground	4,000,000	N/A	In Service
Walnut	Elevated	1,000,000	911	In Service
Shepard	Elevated	1,500,000	912	In Service
Stephens Station	Elevated	1,500,000	1000	In Service
Prathersville	Standpipe	800,000	N/A	In Service
El Ray	Elevated	300,000	956	Not used
ASR #1 (old DW 10)	Aquifer Storage	2,000,000	N/A	During peaks
ASR #2 (old DW 8)	Aquifer Storage	2,000,000	N/A	During peaks
Total Existing Storage[1]		17,800,000		
Near Term Planned Storage				
Hillsdale Pump Station	Ground	1,500,000		Planned for 2009
New ASR (#3)	Aquifer Storage	2,000,000		Planned for 2010
Total Storage with Planned[1]		21,300,000		

(1) Totals do not include the El Ray Tank

2.3.3 Disinfection By Products

Disinfectants are an essential and important element of drinking water treatment because of the barrier they provide against waterborne disease-causing microorganisms. However, disinfection byproducts (DBPs) can form when disinfectants used to treat drinking water react with naturally occurring materials in the water (e.g., decomposing plant material). One class of these by products are Total trihalomethanes (TTHM's) which are regulated by the USEPA and the Missouri Department of Natural Resources.

TTHM (chloroform, bromoform, bromodichloromethane, and dibromochloromethane) and haloacetic acids (HAA5 – monochloro-, dichloro-, trichloro-, monobromo-, dibromo-) are widely occurring classes of DBPs formed during disinfection with chlorine and chloramine. TTHM's form in water systems when organic molecules that may be present in the water react with high oxidizing potential chemicals such as chlorine. Evidence from research studies conducted in the late 1970's and early 1980's showed a link between TTHM's and cancer in humans at certain levels. There was also research pointing to potential reproductive or developmental risk in humans as well. In response, the USEPA regulated these byproducts in the Stage 1 (1989) and Stage 2 (2005) Disinfection and Disinfection Byproducts rules. These rules set definitive limits as to both the amount and type of TTHM that a water system could allow in its finished water. USEPA proposed the Stage 1 and 2 DBP rules to address disinfection byproducts to improve drinking water quality and provide additional public health protection from disinfection byproducts by tightening compliance and monitoring requirements for two groups of DBPs, trihalomethanes (TTHM) and haloacetic acids (HAA5). The rule targets systems with the greatest risk and will reduce potential health risks related to DBP exposure and provide more equitable public health protection.

The Stage 1 DBP rule set the initial levels of TTHM's as Mean Concentration Levels (MCL's) allowed in a distribution system. The Stage 2 DBP rule builds upon the earlier rules that addressed specific TTHM's and other disinfection byproducts to improve drinking water quality and provide additional public health protection from disinfection byproducts. The Stage 2 rules tighten compliance monitoring requirements for two groups of DBPs, trihalomethanes (TTHM) and haloacetic acids (HAA5). The second rule also included smaller water systems in the regulation as well.

The intent of the EPA rules are to allow utilities to balance their need for a disinfectant with the need to limit TTHM exposure. As part of their efforts, EPA developed a series of progressive practices a utility could employ to meet the objectives of the rule. The methods laid out by EPA, and referred to as a "toolbox" of options were tied to the levels of TTHM's in the water system. In all cases, EPA still recommends chlorine as the primary disinfectant for the distribution system.

The amount of TTHM's in a water system is a function of a number of factors and highly variable over time and seasons. The amount of trihalomethanes and haloacetic acids in drinking water from one water system can change from day to day, depending on the season, water temperature, amount of chlorine added, the amount of organic material in the water, and a variety of other factors. This variability is a major reason why reducing TTHM's requires a detailed understanding of local conditions including distribution system residence time and water age as well as raw water quality, disinfection and

treatment methods. For this reason, distribution system monitoring and evaluation are just as critical as treatment and disinfection in dealing with the issues.

Because TTHM formation is so variable, monitoring has become a critical element of the TTHM Rules. The Stage 2 rule includes a requirement for an Initial Distribution System Evaluation (IDSE), or overall distribution system monitoring process that all water systems serving 10,000 populations or above must conduct. Monitoring was increased to allow utilities to sample at locations from throughout their distribution systems. This enhanced monitoring helps map the TTHM levels throughout the distribution system as TTHM will form at various levels over time. Major systems were required to monitor for TTHMs over a one year period at various points in their systems. This monitoring had to be completed by 2012 and plans put in place to improve TTHM levels if needed. Smaller systems were also required to monitor by 2016.

Alternatives

As part of their rule making process, USEPA convened a committee of disinfection and treatment experts to recommend alternatives to Utilities for reducing TTHM's. The committee's recommendations resulted in a series of options.

The simplest and easiest method is to eliminate organics from the raw water. This can be accomplished by using enhanced coagulation, adding additional coagulants and coagulant aids to remove organics in clarification and filtration. In this case minimal additional equipment was anticipated to be required and appeared to be successful at many treatment facilities.

A second option would be to reduce the amount of chlorine used and add additional disinfectants or oxidants. These "alternative disinfectants" such as Ozone, UV, and Chlorine Dioxide contribute little or no TTHM byproducts (in most cases) and augment chlorine. A large number of utilities have found this method successful, however it does result in additional capital and operating costs. Chloramination is in this group and has proven to be another popular method of alternative disinfection.

Other physical removal options include adding carbon to the raw water. The carbon binds the organics and allows for removal. The carbon can be added in clarification as powdered activated carbon or in a separate filtration stage.

In the last twenty years, it is estimated that over 70% of the major US surface water treatment plants (above 100,000 population equivalents) have initiated some change in their treatment to eliminate the DBP risks. EPA expects over 80% of all surface water systems will have done so by 2020.

2.4 KYPIPE COMPUTER MODEL

KYPIPE is a computer model that can be used to perform hydraulic design and evaluations of water distribution systems. It can be used to size pumps, water mains, and tanks and also estimate system pressures. CW&L provided Jacobs with calibrated KYPIPE computer models of the distribution system. Three separate models were provided by CW&L, including:

- Main Distribution System Model – This is a model of the distribution system including pumping stations, storage tanks, and water mains. In general, water mains within the distribution system 6-inches and up are included in the model. This was the model that was used in the evaluation of proposed system

improvements, as discussed in Section 5 of this report. It should be noted that the El Ray elevated tank is in the model, but it is not used.

- Well field Model – This is a model representing the alluvial wells, pumps and piping on the supply side prior to treatment at McBaine WTP. Because a detailed evaluation of water supply was not completed, this model was not used.
- Oakland Holly Model – This was a small portion of the distribution system in the northeast area that was used to evaluate some improvements in that area. This model was not used, but the improvement information for the area was used to update the main distribution system model.

The following is a brief description of what was added and/or updated in the Main Distribution System model:

- Hillsdale Pump Station and associated suction and discharge piping, including the 24-inch water main that crosses I-70 and connects to the existing water main on Clark Lane.

The main distribution system model was used to evaluate the improvements necessary to meet the future years estimated average and peak day water demands placed on the water distribution system. The following assumptions were used for the modeling:

- A 48-hour extended period flow simulation was run for the analysis.
- Storage tanks were kept as full as possible
- The main pumping stations (West Ash, South, Northeast and Hillsdale) were in operation with the maximum number of pumps for peak day demands.
- No interconnects with adjoining Water Districts were included.
- Water demands were distributed in the model in accordance with the growth areas identified and discussed in Sections 3 and 4 of this report.
- Several diurnal flow patterns (hourly variation in water demand) were used in the computer model depending on whether the demand was residential, commercial or large water users. These flow patterns were based on the patterns in the model provided by the City.

SECTION 3 – HISTORICAL DATA REVIEW

CW&L provided historical information on customers, water consumption, and water production. The following sections provide a summary of the information provided and the evaluation completed.

3.1 CUSTOMERS

A list of the number of customers from September 1997 to July 2007 was provided and included the number and type of customers in the following areas:

- Residential customers both inside the City Limits and outside the City Limits. This also included data from Master meters, which is one meter that serves more than one customer (i.e., apartments and trailer courts).
- Commercial customers both inside the City Limits and outside the City Limits
- Large Commercial customers both inside the City Limits and outside the City Limits. Large Commercial customers are defined by the City as those that exceed a usage of 374,000 gallons (500 CCF) during non-summer months.

3.2 WATER CONSUMPTION

Water consumption quantities by customer were provided by the City for the period October 2002 to September 2007. These quantities were provided for residential, master meter, commercial, and large commercial customers. It should be noted that the quantities for master meter customers were included as residential in our evaluation. In addition, separate quantities were provided for irrigation only customers. These are customers that have a separate water meter that is strictly used for irrigation purposes.

3.3 WATER PRODUCTION

Water production data from January 1996 to October 2007 was provided and included the following:

- Water Production at the McBaine WTP, including daily flows influent to the WTP from the raw water supply wells, and daily flows to the water distribution system (effluent from the high services pumps).
- Daily water pumped from the West Ash, South, and Northeast Booster pumping stations. Data for the Northeast Booster pumping station was only available from March 2002 to October 2007.

3.4 DATA EVALUATION

The following sections provide a summary of our evaluation of the historical data.

3.4.1 Historical Population

The City and Boone County have experienced an increase in population nearly every year since 1900. Table 3-1 provides historical population data.

Table 3-1: Historical Population Data

Year	City of Columbia Population	% Change in Population
1900	5,651	-
1910	9,662	71.0
1920	10,392	7.6
1930	14,967	44.0
1940	18,399	22.9
1950	31,974	73.8
1960	36,650	14.6
1970	58,813	60.5
1980	62,061	5.5
1990	69,101	11.3
1996	75,700	9.5
1997	N/A	N/A
1998	N/A	N/A
1999	80,500	N/A
2000	85,292	5.6
2001	86,081	0.9
2002	87,003	1.1
2003	88,423	1.6
2004	89,803	1.6
2005	91,814	2.2
2006	93,219	1.5
2007	94,645	1.5

(1) Source for data from 1900 to 1996 was from the 1999 Water Demand Projection for City of Columbia, Missouri report

(2) Source for the data from 1999 to 2007 was from the City of Columbia Website; www.gocolumbiamo.com/About_Columbia/documents/demographics.pdf.

(3) Accurate data was unavailable for years 1997 and 1998.

3.4.2 Customers

The data provided by the City was reviewed and evaluated. The information was broken out into different categories, which are described as follows:

- Total Water Customers. This has increased from about 30,000 in 1997 to over 42,000 in 2007, which represents an average increase of 3.3% over that timeframe. Table 3-2 and Figure 2 in Appendix 1 show this information.
- Residential Water Customers. This has increased from about 28,000 in 1997 to about 38,000 in 2007, which represents an average increase of 3.1% over that timeframe. Table 3-3 and Figure 3 in Appendix 1 show this information.
- Commercial Water Customers. This has increased from about 2,700 in 1997 to about 4,700 in 2007, which represents an average increase of 5.5% over that timeframe. Table 3-4 and Figure 4 in Appendix 1 show this information.
- Large Commercial Water Customers. This has remained steady at about 30 customers from 1997 to 2007. Table 3-5 and Figure 5 in Appendix 1 show this information.

- Water Customers within the City Limits. This has increased from about 29,000 in 1997 to over 41,000 in 2007, which represents an average increase of 3.4% over that timeframe. Table 3-6 and Figure 6 in Appendix 1 show this information.
- Water Customers outside the City Limits. This has increased from about 1,000 in 1997 to about 1,200 in 2007, which represents an average increase of 1.6% over that timeframe. Table 3-7 and Figure 7 in Appendix 1 show this information.
- Irrigation Only Water Customers. This has increased from about 250 in 1997 to almost 700 in 2007, which represents an average increase of 12.8% over that timeframe. Table 3-8 shows this information.

Table 3-2: CW&L Total Number of Water Customers

Year[1]	Total Water Customers[2]	% Change in Customers
1997	30,629	-
1998	32499	6.1
1999	33,486	3.0
2000	34,377	2.7
2001	35,185	2.4
2002	36,093	2.6
2003	37,625	4.2
2004	39,258	4.3
2005	40,569	3.3
2006	41,827	3.1
2007	42,583	
Average		3.3%

(1) Data was only available to July, 2007
(2) Customer Information provided by the City.

Table 3-3: CW&L Total Number of Residential Water Customers

Year[1]	Total Water Customers[2]	% Change in Customers
1997	27,873	
1998	29,424	5.6
1999	30,066	2.2
2000	31,033	3.2
2001	31,731	2.2
2002	32,534	2.5
2003	33,568	3.2
2004	34,944	4.1
2005	36,121	3.4
2006	37,395	3.5
2007	37,881	
Average		3.1%

(1) Data was only available to July, 2007
(2) Customer Information provided by the City.

Table 3-4: CW&L Total Number of Commercial Water Customers

Year[1]	Total Water Customers[2]	% Change in Customers
1997	2,724	
1998	3,037	11.5
1999	3,385	11.5
2000	3,307	-2.3
2001	3,416	3.3
2002	3,522	3.1
2003	4,028	14.4
2004	4,285	6.4
2005	4,418	3.1
2006	4,401	-0.4
2007	4,670	
Average		5.5%

(1) Data was only available to July, 2007
(2) Customer Information provided by the City.

Table 3-5: CW&L Total Number of Large Commercial Water Customers

Year[1]	Total Water Customers[2]	% Change in Customers
1997	32	
1998	38	18.8
1999	35	-7.9
2000	37	5.7
2001	38	2.7
2002	37	-2.6
2003	29	-21.6
2004	29	0.0
2005	30	3.4
2006	31	3.3
2007	31	
Average		-0.3%

(1) Data was only available to July, 2007
(2) Customer Information provided by the City.

Table 3-6: CW&L Water Customers Within City Limits

Year[1]	Total Water Customers[2]	% Change in Customers
1997	29,611	
1998	31,169	5.3
1999	32,115	3.0
2000	33,206	3.4
2001	33,983	2.3
2002	34,876	2.6
2003	36,387	4.3
2004	38,051	4.6
2005	39,357	3.4
2006	40,606	3.2
2007	41,373	
Average		3.4%

(1) Data was only available to July, 2007
(2) Customer Information provided by the City.

Table 3-7: CW&L Water Customers Outside City Limits

Year[1]	Total Water Customers[2]	% Change in Customers
1997	1,007	
1998	1,319	31.0
1999	1,361	3.1
2000	1,161	-14.7
2001	1,190	2.5
2002	1,206	1.3
2003	1,227	1.7
2004	1,195	-2.7
2005	1,200	0.5
2006	1,209	0.7
2007	1,198	
Average		1.6%

(1) Data was only available to July, 2007
(2) Customer Information provided by the City.

Table 3-8: CW&L Irrigation Only Water Customers

Year[1]	Total Water Customers[2]	% Change in Customers
1997	254	
1998	300	18
1999	357	19
2000	380	7
2001	378	0
2002	382	1
2003	407	7
2004	439	8
2005	516	18
2006	696	35
2007	N/A	
Average		12.8%

(1) Data was only available to July, 2007
(2) Customer Information provided by the City.

In addition, we evaluated the areas within the City's service area where the majority of the customers have been added from 2003 to 2007. This was done by looking at each individual customer and estimating what year they were added based on when water consumption data first began. It was difficult to distinguish between true "new" customers and those customers that may have moved into a location where water service had temporarily lapsed for a period of time. The following is a general description of our evaluation and Figure 2 shows the areas within the system where the majority of the customer growth has occurred.

- 2003 – We estimated that 1,925 customers were added. A significant amount of the growth was north of I-70 and south and southwest of downtown, and mainly consisted of residential customers. The downtown area included both residential and commercial customers, however it is reasonable to believe that the majority of these were not true new customers, as discussed above.

- 2004 – We estimated that 1,660 customers were added. A significant amount of the growth was north of I-70 and south and southwest of downtown, and mainly consisted of residential customers. The downtown area included some residential and commercial customers, however it is reasonable to believe that the majority of these were not true new customers, as discussed above.
- 2005 – We estimated that 1,666 customers were added. A significant amount of the growth was north and northeast of I-70 as well as south and southwest of downtown, and mainly consisted of residential customers.
- 2006 – We estimated that 1,895 customers were added. A significant amount of the growth was north and northeast of I-70 as well as south and southwest of downtown, and mainly consisted of residential customers.
- 2007 – We estimated that 1,213 customers were added. Some of the growth was north and northeast of I-70 and some was southwest of downtown, and mainly consisted of residential customers.

3.4.3 Water Consumption

The data provided by the City was reviewed and evaluated. The data was evaluated with irrigation included, as well as without irrigation. The following provides a brief summary of our evaluation:

- Total Water Consumption. The total average daily consumption has increased from approximately 11.0 MGD in 2002 to approximately 12.8 MGD in 2007. The peak consumption varies dependent mainly on how dry it is during the summer months. The peak daily consumption has increased from approximately 13.6 MGD in 2002 to approximately 17.2 MGD in 2007. The average consumption per customer has decreased , from about 280 gallons/customer/day in 2002 to about 240 gallons/customer/day in 2007. This data is shown on Figures 13, 14, and 15, included in Appendix 1.
- Residential Water Consumption. The residential average daily consumption has increased from approximately 6.5 MGD in 2002 to approximately 7.7 MGD in 2007. The peak residential consumption also varies dependent mainly on how dry it is during the summer months. The average consumption per residential customer has decreased , from about 190 gallons/customer/day in 2002 to about 170 gallons/customer/day in 2007. This data is shown on Figures 16, 17, and 18, included in Appendix 1.
- Commercial Water Consumption – The commercial average daily consumption has increased from approximately 2.4 MGD in 2002 to approximately 3.0 MGD in 2007. The peak commercial consumption also varies dependent mainly on how dry it is during the summer months. The average consumption per commercial customer has decreased , from about 600 gallons/customer/day in 2002 to about 480 gallons/customer/day in 2007. This data is shown on Figures 19, 20, and 21, included in Appendix 1.
- Large Commercial Water Consumption – The large commercial average daily consumption has remained steady at about 2.1 MGD from 2002 to 2007. The peak consumption does not seem to correlate strongly to

usage in the summer months. The average consumption per large commercial customer has remained fairly steady, ranging from about 60,000 gallons/customer/day in 2002 to about 70,000 gallons/customer/day in 2007. This data is shown on Figures 22, 23, and 24, included in Appendix 1.

- Irrigation usage – The irrigation usage is predominantly used during the peak usage times (summer months). The peak consumption per irrigation customer depends on how dry the summer months are and has been as high as 2,750 gallons/customer/day in 2005 to about 1,100 gallons/customer/day in 2004. This data is shown on Figures 25, 26, and 27, included in Appendix 1.
- Master Meter Consumption – The average consumption per master meter customer has decreased from about 950 gallons/customer/day in 2002 to about 900 gallons/customer/day in 2007. This data is shown on Figure 28, included in Appendix 1.

Peak Water Consumption

We also evaluated the times of year where typical water consumption increases. From an evaluation of the data, the peaks typically occur somewhere between July and September. The average and maximum daily water consumption data was used to determine a peaking factor for each year. This data is shown in Table 3-9 below.

Table 3-9: Average to Peak – Total Water Consumption

Year[1]	Average Daily Water Consumption (gallons)[2]	Maximum Daily Water Consumption (gallons)[3]	Peaking Factor
2003	11,385,531	15,803,720	1.4
2004	10,946,968	12,474,710	1.1
2005	12,615,487	18,793,355	1.5
2006	12,346,902	17,250,738	1.4
2007	12,756,003	17,182,236	1.4

(1) Data was only available to October, 2007

(2) Average daily water consumption values were calculated by summing the total water consumption for each year and dividing by 365 days.

(3) Maximum daily water consumption values were calculated by determining the month during each year of maximum consumption and dividing that total by 31 days.

3.4.4 Water Production

The data provided by the City was reviewed and evaluated. The following provides a brief summary of our evaluation:

- Water Production at the McBaine WTP. The average day water production at the WTP has increased from about 10 MGD in 1996 to about 13 MGD in 2007. The peak day water production at the WTP has increased from about 15 MGD in 1996 to about 23 MGD in 2007. This data is shown on Figure 29, included in Appendix 1.
- West Ash Pump Station. The average day water pumped from the West Ash pump station has increased from about 6 MGD in 1996 to about 8 MGD in 2007. This data is shown on Figure 30, included in Appendix 1.

- South Pump Station. The average day water pumped from the South pump station has increased from about 3.5 MGD in 1996 to about 5 MGD in 2007. This data is shown on Figure 31, included in Appendix 1.
- Northeast Booster Pump Station. The average day water pumped from the Northeast Booster pump station has increased from about 2.5 MGD in 2002 to about 3 MGD in 2007. This data is shown on Figure 32, included in Appendix 1.

Peak Water Production

We also evaluated the average and peak water production data. From an evaluation of the data, the peak months tend to occur between July and October, with average production typically occurring in December. These trends match very well with the water consumption data. The total water production numbers used were the total effluent from the WTP. This data is shown in Table 3-10 below.

Table 3-10: Average to Peak - Total Water Production

Year[1]	Average Daily Water Production (MGD)	Maximum Daily Water Production (MGD)	Peaking Factor
2003	13.07	21.35	1.6
2004	12.79	17.52	1.4
2005	13.83	23.69	1.7
2006	13.91	22.56	1.6
2007	13.69	23.83	1.7

(1) Data was only available to October, 2007

SECTION 4 – CURRENT and FUTURE WATER DEMANDS

4.1 CURRENT WATER PRODUCTION

The average day water production at the WTP has increased from about 10 MGD in 1996 to about 13 MGD in 2007. The peak day water production at the WTP has increased from about 15 MGD in 1996 to about 23 MGD in 2007. A summary of the average day and peak day water production for the last 10 years is shown below in Table 4-1.

Table 4-1: Recent Water Production

Year[1]	Average Daily Water Production (MGD)	Maximum Daily Water Production (MGD)
1997	11.51	18.70
1998	12.15	18.22
1999	13.48	22.79
2000	13.02	18.01
2001	12.47	18.15
2002	12.45	19.09
2003	13.07	21.35
2004	12.79	17.52
2005	13.83	23.69
2006	13.91	22.56
2007	13.69	23.83

(1) Data was only available to October, 2007

4.2 FUTURE ESTIMATE CRITERIA

The nature of predicting future water demands is an inexact science, since there are several unpredictable factors that can result in the actual demands being different than those predicted. Therefore, to account for these uncertainties, the future water demands were estimated with a range of scenarios.

The baseline scenario assumes growth at rates very similar to what was seen over the past 10 years, as follows:

- Residential customer growth at 3.5% per year
- Commercial customer growth at 5.5% per year
- Large commercial growth staying steady, with only 0.5% growth per year
- Master meter customer growth at 1% per year
- Irrigation only customer growth at 10% per year

The more conservative (worst-case) scenario assumes growth at rates higher than what was seen over the past 10 years, as follows:

- Residential customer growth at 5% per year
- Commercial customer growth at 7% per year
- Large commercial growth staying steady, with 1% growth per year
- Master meter customer growth at 2% per year
- Irrigation only customer growth at 16% per year

The less conservative (best-case) scenario assumes growth at rates lower than what was seen over the past 10 years, as follows:

- Residential customer growth at 2% per year
- Commercial customer growth at 2.5% per year
- Large commercial growth staying steady, with 0% growth per year
- Master meter customer growth staying steady, with 0% growth per year
- Irrigation only customer growth at 6% per year

The future water demands were estimated based on the methodology described below and is shown on the graph at the end of this section.

- The current number of different types of customers (residential, commercial, large commercial, master meter, and irrigation only) were increased yearly by the percentages discussed above over the 20 year period.
- The water consumption usage per customer, described in Section 3, was then used for each type of customer to come up with the total demands. The following was used:
    - Residential – 170 gallons / customer / day for average and 1.65 times that for peak.
    - Commercial – 550 gallons / customer / day for average and 1.65 times that for peak.
    - Large Commercial – 70,000 gallons / customer / day for both average and peak.
    - Master Meter – 950 gallons / customer / day for average and 1.65 times that for peak.
    - Irrigation only - 50 gallons / customer / day for average and 2,500 gallons / customer /day for peak.
- "In Plant" water used at the McBaine plant was included in the demands. Historical data was provided and this was evaluated. During the average days, 300,000 gpd was used, and for the peak days 420,000 gpd was used. These were increased slightly over the future to account for additional use.
- Unaccounted for water, or "water loss" was included in the demands. This is the difference between water produced and water billed. These quantities are system specific and are due to a variety of different factors. The *1999 Water Demand Projection for City of Columbia, Missouri* report included an analysis of water produced at the WTP versus water billed from 1972 to 1999, which indicated that it averaged 13.8% over that period. 15% unaccounted for water was included in the future projections.

4.3 TOTAL ESTIMATED FUTURE WATER DEMANDS

The estimated future water production needs based on the criteria discussed in this section is shown in Table 4-2 and the range of scenarios is shown on the graph at the end of this section.

Table 4-2: Estimated Future Water Production

Year[1]	Average Daily Water Production (MGD)	Maximum Daily Water Production (MGD)
2008	14.6	24.5
2009	15.1	25.5
2010	15.6	26.6
2011	16.1	27.7
2012	16.6	28.8
2013	17.2	30.0
2014	17.8	31.3
2015	18.4	32.7
2016	19.0	34.1
2017	19.6	35.6
2018	20.3	37.2
2019	21.0	38.9
2020	21.8	40.8
2021	22.5	42.7
2022	23.3	44.8
2023	24.2	46.9
2024	25.1	49.3
2025	26.0	51.7
2026	26.9	54.4
2027	27.9	57.2
2028	28.9	60.2

The projected water demands, as shown below in Table 4-3, were used for the identification of future system improvements in five year increments.

Table 4-3: Design / Study Future Water Demands

Year	2008	2013	2018	2023	2028
Average Day (MGD)	14.6	17.2	20.3	24.2	28.9
Maximum Day (MGD)	24.5	30.0	37.2	46.9	60.2

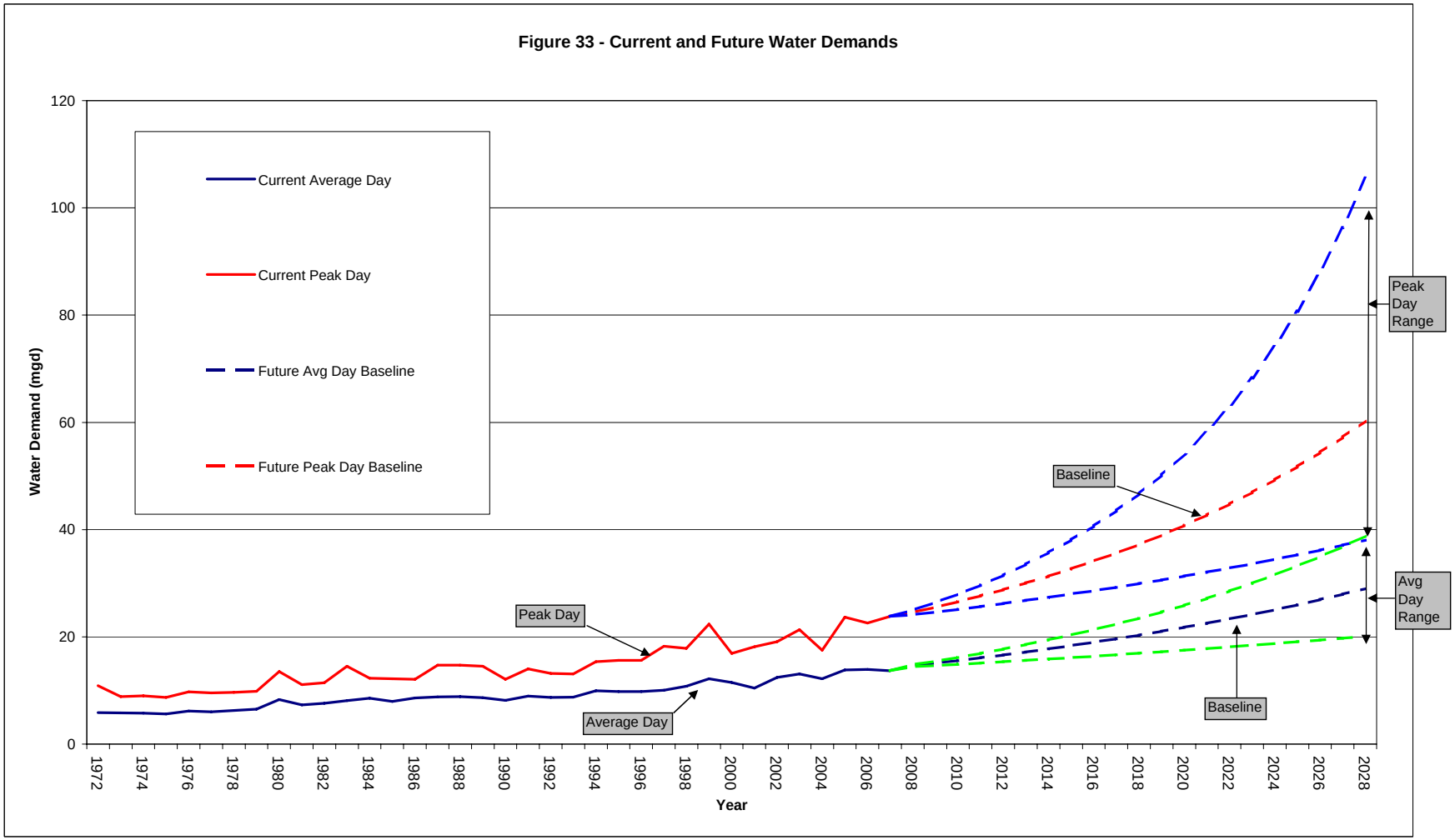


Figure 33 - Current and Future Water Demands
Current Average Day
Current Peak Day
Future Avg Day Baseline
Future Peak Day Baseline
Water Demand (mgd)
Year
Peak Day
Average Day
Baseline
Baseline
Peak Day Range
Avg Day Range
0
20
40
60
80
100
120
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
2024
2026
2028

SECTION 5 – PROPOSED SYSTEM IMPROVEMENTS

5.1 SYSTEM IMPROVEMENTS DESIGN CRITERIA

The Missouri Department of Natural Resources – Public Drinking Water Program states in the "*Design Guide for Community Public Water Supplies"* that a minimum pressure of 20 psi shall be maintained at ground level in all potable water distribution mains at all times. The design guide states that the normal working pressure in the distribution system should not be less than 35 psi and that all booster-pumping stations shall satisfy peak demand with the largest pump out of service.

As a general rule, pressures in the water distribution system should preferably not exceed 140 psi, as measured at ground level. This is to avoid the rupture or breakage of older water mains, and other parts of system. In addition, very high pressures increase loss of water from the system from leakage. Sudden pressure variance in the water distribution system is to be avoided, since this can result in customer complaints, and if the pressure variance is excessive, it can damage the distribution system.

5.1.1 General Criteria

The system improvements discussed in this section consist mainly of elevated tanks, pumping stations, transmission mains, and ground storage tanks. The following was the general criteria used for each of these improvements.

<u>Storage Tanks</u>

Two types of storage tanks were considered, elevated and ground. Criteria for elevated tanks included volume, overflow elevation and location. Volume was set based on the sum of the average daily demand and fire demand, as discussed in Section 5.1.2. The overflow elevation was chosen to maintain sufficient pressure to nearby customers under a range of tank levels and water demands and also to avoid the installation of altitude valves.

The location of the elevated tank is another factor that determines how much pressure customers have and how much water can be pumped into the tank to keep it nearly full. It is generally best to locate elevated tanks close to customers that are at or near the highest ground elevations in the water distribution system. Elevated storage should not be located too distant from sources of supply, since this can result in high headloss, which can make it difficult to refill the tank during times of high demand.

Criteria for ground storage tanks included volume and location. Volume was again set based on the sum of the average daily demand and fire demand, as discussed in Section 5.1.2. The location of the ground storage tanks were placed at existing or proposed pump stations.

<u>Pump Stations</u>

An important criteria that was used for the pump stations was to be able to pump the peak day flow with the largest pump out of service. Other criteria include suction and discharge pressure and location. Suction pressure at in line pump stations was at least 20 psi and discharge pressure should be kept low enough so that customers in the water distribution system do not experience problems. Pump stations need to be located so that elevated storage can be kept nearly full and so that suction and discharge pressures are at acceptable levels.

Transmission Mains

Criteria for water mains included velocity and headloss. The diameters of water mains were selected so that the maximum velocity did not exceed 8 feet per second during the peak hour water demand. Water transmission mains that supply water tanks were sized to be large enough to maintain volume in the tanks.

5.1.2 Storage Requirements

Ten States Recommended Standards for Water Works recommends that a municipal water system have available storage equivalent to the average daily water demand plus the volume required for fire protection. From the *1999 Water Demand Projection for City of Columbia, Missouri* memorandum, the estimated volume required for fire protection was 2,160,000 (6,000 gpm over 6 hours).

Table 5-1 below shows estimated future average daily water demand along with overall required storage. The average daily water demand (ADD) was discussed in Section 4.

Table 5-1: Demand and Required Storage

Year	Average Daily Demand (MG)	Required Storage = ADD + Fire Demand (MG)
2008	14.6	16.8
2013	17.2	19.4
2018	20.3	22.5
2023	24.2	26.4
2028	28.9	31.1

Table 2-2 shows that the total existing storage is 17.8 MG and the total storage including the near term planned projects is 21.3 MG within the City's system. Table 5-2 below indicates the additional storage that needs to be constructed in the water distribution system in the future.

Table 5-2: Additional Storage Needed

Year	Required Storage (MG)	Existing storage (MG)	Additional Storage Needed (MG) (=Required – Existing)
2008	16.8	17.8	0
2013	19.4	21.3	0
2018	22.5	21.3	1.2
2023	26.4	21.3	5.1
2028	31.1	21.3	9.8

5.2 FIVE YEAR CIP EVALUATION – YEAR 2013 PROPOSED IMPROVEMENTS

The current CW&L Five-Year Capital Improvement Plan (CIP) was provided to Jacobs. This CIP is what CW&L uses to plan and budget improvements to meet water demands. Improvements identified within the CIP that were related to capacity upgrades (i.e., water main upgrades, new distribution or transmission mains, loop closures, storage or pumping) were evaluated with the KYPIPE model. Improvements identified within the CIP that were related to main replacements or other non-capacity related improvements were not evaluated. The associated cost estimates for these improvements are included in Section 6 of this report.

5.2.1 KYPIPE Evaluation Results

The improvements noted in the following sub-sections were evaluated using the KYPIPE model. The anticipated year 2013 average day water demand of 17.2 MGD and peak day water demand of 30.0 MGD were input into the model and a 48-hour extended period flow simulation was conducted. Prior to including the proposed improvements, the main issues identified were as follows:

- Shepard elevated tank dropped to about 50% of its capacity at 24 hours into the simulation.
- Stephens Station elevated tank dropped to less than 5% of its capacity at 24 hours into the simulation.
- Shepard and Stephens Station tanks could not recover back to their initial level by the end of the 48 hour simulation.
- Pressure of less than 35 psi during peak demands was noted at numerous locations on the suction side of the Hillsdale Pump Station.

After including the proposed improvements, the following results were noted:

- Shepard elevated tank cycles between full and 70% full.
- Stephens Station elevated tank only drops to approximately 70% of its capacity during peak demands.
- Shepard and Stephens Station both recover to their initial levels within the 48 hour simulation.
- Low pressure problems near the suction side of Hillsdale Pump Station are alleviated. Previous problem locations generally stay above 50 psi throughout the entire simulation.

5.2.2 Water Main Improvements

Main Upgrades. The following main upgrades were included in the Five-Year CIP:

- Downtown along Locust Street from 6th Street to 8th Street. This included upgrading about 600 ft of existing 4” to 8” main.
- Downtown along Locust Street from Hitt Street to Waugh Street. This included upgrading about 500 ft of existing 4” to 8” main.
- Downtown along Paquin Avenue from Hitt Street to College Avenue. This included upgrading about 500 ft of existing 4” to 8” main.
- Downtown along Providence Road from Broadway to Locust Street. This included upgrading about 800 ft of existing 4” to 8” main.
- Downtown along Sixth Street from Broadway to Elm Street. This included upgrading about 1,100 ft of existing 4” to 8” main.
- Downtown along Walnut Street from Providence Road to 6th Street. This included upgrading about 1,000 ft of existing 4” to 8” main.
- Downtown along Waugh Street from Locust Street to Paquin Street. This included upgrading about 650 ft of existing 4” to 8” main.
- Along Thompson Road from Creve Coeur Drive to Highway PP. This included upgrading about 2,800 ft of existing 4” to 8” main.
- Along Mexico Gravel Road from Manchester Drive to Billie Jean Drive. This included upgrading about 1,100 ft of existing 6” to 8” main.
- Along Fifth Street from Ash Street to Hickman Road. This included upgrading about 1,500 ft of existing 4” to 8” main.
- Along Park Avenue from Providence Road to 8th Street. This included upgrading about 1,700 ft of existing 4” to 8” main.

Loop Closures. The following loop closures were included in the Five-Year CIP:

- East Campus along Cliff Drive from Hawthorne Drive to University Avenue. This included about 300 ft of new 6" main and is shown on Figure 3.
- East Campus along University Avenue from Ann Street to Rock Hill Road. This included about 630 ft of new 8" main and is shown on Figure 3.
- Highway 763 at I-70. This included about 1,000 ft of new 8" water main that crosses I-70 and is shown on Figure 4.
- South of Nifong Boulevard. This included about 7,500 feet of new 16" main and is shown on Figure 5.
- Stadium Boulevard at Bernadette. This included about 230 feet of new 6" main and is shown on Figure 6.
- Along Fairmont Drive from Fieldcrest Drive to Parkridge Drive. This included about 350 feet of new 6" main and is shown on Figure 7.
- Along Gillespie Bridge Road from Limestone Avenue to Longview Drive. This included about 800 feet of new 6" main and is shown on Figure 8.
- Along Smith Drive from Silver Thorne Drive to Scott Boulevard. This included about 2,200 feet of new 8" main and is shown on Figure 9.
- Providence Road at Stewart Road. This included about 140 feet of new 8" main crossing Providence Road and is shown on Figure 10.

Transmission and Distribution Water Main Improvements. The following improvements were included in the Five-Year CIP:

- North Section of 24-Inch East Transmission Main. This included a new 24-inch transmission main from the existing Shepard elevated tank to the Hillsdale Pump Station. The 24-inch main would be for transmission purposes only and would feed into the proposed ground storage tank discussed below. Two different alignments were identified for this project, however the overall length of each one is about the same. This is shown on Figure 11.
- South Section of 24-Inch East Transmission Main. This included a new 24-inch transmission main to connect to an existing 24-inch main south of Grindstone Parkway and Highway 63 and feed the existing Shepard elevated tank. The 24-inch main would be for transmission purposes only. Two different alignments were identified for this project, one on the west side of Highway 63 and the other on the east side of Highway along Warren Drive (Option B). The overall length of Option B is about 3,400 feet longer, which correlates to additional costs of about $1.5 million. The higher cost for Option B is included in Section 6. This is shown on Figure 12.
- Heller Road Water Main. This included about 17,000 ft of new 16-inch distribution main from the existing Stephens Station elevated tank along Heller Road and Mount Hope Road to connect to the existing distribution system near Mount Hope Road and North Kircher Road. This is shown on Figure 14.
- Route PP Main Upgrade. This includes about 25,000 ft of new 12-inch distribution main from the intersection of Clark Lane and Lake of the Woods Road north to the existing distribution system near Mount Hope Road and North Kircher Road. This is shown on Figure 15.
- Hackberry Water Main. This included about 6,000 ft of new 12-inch distribution main from an area east of Hackberry Boulevard, under Highway 63, and connecting to the existing distribution system on Oakland Gravel Road. This is shown on Figure 16.

5.2.3 Storage Improvements

The following storage improvements were included in the Five-Year CIP:

- Ground Storage at Hillsdale Pump Station. This included 1.5 MG of new ground storage at the Hillsdale Pump Station site. This will include converting the pump station operation from an in-line booster station to pumping water from the new ground storage tank into the distribution system in the Northeast pressure zone. The location is show on Figure 13.

5.2.4 Pumping Improvements

There are no pumping improvements identified for the Five-Year CIP.

5.2.5 Other Improvements

The following other improvements were included in the Five-Year CIP:

- Installation of Alluvial Well #16. This is another supply well in the McBaine Bottoms to provide water to the McBaine WTP.
- Installation of Alluvial Wells #17 and #18. These are additional supply wells in the McBaine Bottoms to provide water to the McBaine WTP.
- Conversion of Existing Deep Well to an Aquifer Storage and Recovery (ASR) facility. This would provide additional storage to meet peak day demands.
- Sludge Removal Site(s). The existing McBaine WTP has four (4) lagoons used for storage of lime softening sludge. Plant personnel indicate that each lagoon provides approximately one year of sludge storage under current operating conditions. The sludge is decanted and air dried to a condition that can be handled for disposal, which takes somewhere between one and two years dependent on the water content. Current disposal practice is to contract with a private hauler who disposes of the sludge. At the current rate of production, additional sludge storage lagoons will be required.

5.3 YEAR 2018 PROPOSED IMPROVEMENTS

5.3.1 KYPIPE Evaluation Results

The improvements noted in the following sub-sections were evaluated using the KYPIPE model. The anticipated year 2018 average day water demand of 20.3 MGD and peak day water demand of 37.2 MGD were input into the model and a 48-hour extended period flow simulation was conducted. Prior to including the proposed improvements, the main issues identified were as follows:

- There is insufficient treatment capacity at the McBaine WTP to meet the peak anticipated water demand of 37.2 MGD.
- Pressures of less than 35 psi were observed at locations surrounding the Prathersville Standpipe during peak demands.
- An additional 1.2 MG of storage is required.

After including the proposed improvements, the following results were noted:

- Locations that previously had low pressure during peak demands generally stay above 50 psi throughout the entire simulation.
- The required 1.2 MG of storage is provided by the proposed new elevated tank.

5.3.2 Water Main Improvements

The following transmission main improvements were included in the 2018 Model Scenario:

- 16-Inch Transmission Main. This includes a new 16-inch main for transmission purposes starting from the proposed new pump station at the existing West Ash Pump Station, and feeding directly to the new proposed elevated tower at the Prathersville site. The alignment used for the purposes of this study is shown in Figure 17.

5.3.3 Storage Improvements

The following storage improvements were included in the 2018 Model Scenario:

- Elevated storage to replace the existing Prathersville Standpipe. This includes a new 2 MG elevated storage tank matching the overflow elevation of the Walnut and Shepard elevated tanks. The proposed elevated storage tank would be about 120 ft to the high water level and would be a fluted column style tank, similar to the Shepard tank. This new tank would be located at or near the original location of the Prathersville Standpipe, as shown in Figure 17.

5.3.4 Pumping Improvements

The following pumping improvements were included in the 2018 Model Scenario:

- Additional Pump Station at the site of the existing West Ash Pump Station. This included a pump station with 3 pumps and a total capacity of approximately 5,000 gpm with 2 pumps in service and 1 pump for back up. The suction side of this new pump would connect directly to the finished water supplied by either the existing McBaine WTP, or the proposed new Water Treatment Plant recommended by this study, and would not connect to the distribution system. The discharge of the pump will feed directly into the proposed 16-inch transmission main discussed above and would operate based on the level of water in the new proposed Prathersville elevated storage tank. The location is shown on Figure 18.

5.3.5 Other Improvements

There is insufficient treatment capacity at the McBaine WTP to meet the peak anticipated water demand of 37.2 MGD. Additional peak day demands of about 6 MGD can be met through the use of the City's Aquifer Storage and Recovery facilities (two existing facilities and one proposed each with about 2 MGD capacity). It is anticipated that additional treatment capacity will be required sometime between 2016 and 2019, dependent on the rate of growth over the next 8 to 10 years.

In addition, future transmission of the treated water to the City's distribution system will be required. Since the majority of the growth is in the south, southeast and northeast areas of the City's service area, directing this treated water to that area could benefit the City by providing redundancy through separate transmission feeds as well as relieving some of the demand on existing transmissions mains from McBaine WTP.

Therefore it is recommended that the City implement the following steps to plan for future treatment capacity (assuming the need is by 2016):

- Complete a Water Supply Source Study to evaluate the potential water supply sources needed to meet future demands. In addition to the evaluating supply

sources, the Study should also evaluate potential sites for treatment. The Study should also evaluate the possible design impacts as a result of the current TTHM Study the City is completing. It is anticipated that this Study should be started sometime in 2009. It is estimated that approximately 6 to 8 months will be required.

- Select and acquire the future property between 2010 and 2011.
- Preliminary design for the additional treatment and transmission main to the distribution system in 2011. It is estimated that approximately 6 to 8 months will be required.
- Design, bidding and award of a construction contract for the additional treatment capacity and transmission main from 2012 to 2014. It is estimated that approximately 1.5 years will be required.
- Complete the construction of the additional treatment capacity and transmission main from 2014 to 2016. It is estimated that approximately 2 years will be required.

The costs associated with these improvements are difficult to estimate until the location of the additional treatment is completed.

5.4 YEAR 2023 PROPOSED IMPROVEMENTS

5.4.1 KYPIPE Evaluation Results

The improvements noted in the following sub-sections were evaluated using the KYPIPE model. The anticipated year 2023 average day water demand of 24.2 MGD and peak day water demand of 46.9 MGD were input into the model and a 48-hour extended period flow simulation was conducted. Some improvements identified may not be needed during this 5 year increment as they are dependent on future development. Prior to including the proposed improvements, the main issues identified were as follows:

- Stephens Station elevated tank empties about 16 hours into the simulation and stays empty for approximately 10 hours.
- Shepard elevated tank empties from about 16 to 18 hours into the simulation and again from 20 to 26 hours during the simulation.
- An additional 5.1 MG of storage is required.

After including the proposed improvements, the following results were noted:

- Stephens Station elevated tank cycles between full and approximately 90% full.
- Shepard elevated tank cycles between full and approximately 70% full.
- The required 5.1 MG additional storage is provided by the proposed ground storage recommended to be included at existing pump stations as well as new pump station.

5.4.2 Water Main Improvements

The following transmission main improvements were included in the 2023 Model Scenario:

- 24-Inch Transmission Main to Stephens Station elevated tank. This includes approximately 28,000 feet of 24-inch main for transmission purposes to feed the existing Stephens Station elevated tank. This 24-inch main would connect to the existing main along Clark Lane, which is fed from the discharge of the Hillsdale

Pump Station. The alignment used for the purposes of this study is shown in Figure 19.

- 24-Inch Transmission Main from proposed new Southeast Pump Station. This includes approximately 7,200 feet of 24-inch main from the proposed new Southeast Pump Station near Gans Road and running north to Nifong Blvd, where it will connect to the existing 24-inch main. The alignment used for purposes of this study is shown in Figure 20.

5.4.3 Storage Improvements

The following storage improvements were included in the 2023 Model Scenario:

- Additional Ground Storage at Hillsdale Pump Station. This includes an additional 1.5 to 3.5 MG ground storage at the Hillsdale Pump Station in addition to the 1.5 MG ground storage that was described in Section 5.2.3. The original design plans for the Hillsdale Pump Station had provisions to include room for up to 5 MG ground storage at the Hillsdale site. For purposes of estimating costs, we assumed constructing a 3 MG pre-stressed concrete ground storage tank.
- Ground storage at proposed Southeast Pump Station. This includes a new ground storage tank of approximately 1 to 3 MG capacity at the site of the proposed new Southeast Pump Station near Gans Rd. If budget allows, additional ground storage beyond what is needed for the 2023 scenario could be added at this time as well to accommodate some of the additional storage that will be required by the 2028 scenario. For purposes of estimating costs, we assumed constructing a 2 MG pre-stressed concrete ground storage tank.

The additional 4 MG of storage required in this scenario could be split between the 2 proposed pump station improvements as appropriate depending upon future development, needs and site availability.

5.4.4 Pumping Improvements

The following pumping improvements were included in the 2023 Model Scenario:

- Southeast (SE) Pump Station. This includes a station with 3 pumps and a capacity of approximately 5,000 gpm (with 2 pumps in service and 1 pump for back up). The suction side of this new pump station would connect directly to the proposed 2 MG ground storage tank discussed in Section 5.4.3. Finished water for the pump station and ground storage tank would be supplied by either the existing McBaine WTP, or the proposed new Water Treatment Plant recommended by this study. The SE pump station would feed into the proposed 24-inch main heading north to Nifong Blvd. The approximate location used for the purposes of this study is shown in Figure 20.
- Additional Pump Station at Hillsdale. This includes a 2nd pump station identical to the existing one at Hillsdale and would utilize the existing suction and discharge lines. The original design plans for the Hillsdale Pump Station had provisions for a future identical station. Although it is dependent on future development, this 2nd pump station is anticipated to be necessary by 2023 to help feed the proposed 24-inch transmission main heading north to the Stephens Station elevated tank.

5.4.5 Other Improvements

There are no other improvements identified for 2023.

5.5 YEAR 2028 PROPOSED IMPROVEMENTS

5.5.1 KYPIPE Evaluation Results

The improvements noted in the following sub-sections were evaluated using the KYPIPE model. The anticipated year 2028 average day water demand of 28.9 MGD and peak day water demand of 60.2 MGD were input into the model and a 48-hour extended period flow simulation was conducted. Prior to including the proposed improvements, the main issues identified were as follows:

- An additional 9.8 MG of storage is required.
- Based on projected growth in the Northeast pressure zone, the Hillsdale tank begins to empty and cannot meet demands in the northeast part of the City and cannot keep the Stephens Station elevated tank full.
- Also dependent on future development, the Shepard elevated tank begins to empty during peak demands.

After including the proposed improvements, the following results were noted:

- The required storage is provided by the proposed ground storage at the SE and additional West Ash pump stations.
- Hillsdale tank cycles between full and 70% full.
- Shepard elevated tank cycles between full and 70% full.

5.5.2 Water Main Improvements

The following transmission main improvements were included in the 2028 Model Scenario:

- 24-Inch Transmission Main to Hillsdale Ground Storage Tank. This includes an additional 24-inch main from the existing Shepard elevated tank to the Hillsdale Pump Station. This would be a second transmission main along this same basic route in addition to the one described in section 5.2.2, and is heavily dependent on the rate of growth and future development. If it is determined that a second main from Shepard tank to Hillsdale Pump Station is necessary, we would recommend that the City try and obtain adequate easement for the initial 24-inch main to allow for future construction of this 24-inch main. The optional alignment shown on Figure 11 could also be a possible future route.
- 16-Inch Transmission Main to Shepard Elevated Tank. This includes a 16-inch main from near Grindstone Parkway and heading north to the existing Shepard elevated tank. This would be a second transmission main along this same basic route in addition to the one described in section 5.2.2, and is heavily dependent on the rate of growth and future development. If this main is determined to be necessary, the alignment and size of the pipe should be reevaluated. The optional alignment shown in Figure 12 could be one possible route.

5.5.3 Storage Improvements

The following storage improvements were included in the 2028 Model Scenario:

- Additional Ground Storage at Proposed SE Pump Station. In addition to the 2 MG ground storage proposed in the year 2023 recommendations, this includes 2 MG of additional ground storage at the site of the proposed SE pump station.
- Ground Storage at West Ash Pump Station. This includes an additional 2 MG ground storage at the site of the existing and proposed new West Ash pump station.

5.5.4 Pumping Improvements

The following pumping improvements were included in the 2028 Model Scenario:

- Additional Pump at Proposed SE Pump Station. This includes installing a fourth pump at the proposed SE pump station, keeping one pump on stand-by and three pumps operational, which would increase the capacity of the SE pump station to approximately 7,500 gpm.

5.5.5 Other Improvements

There are no other improvements identified for 2028.

SECTION 6 – COST ESTIMATES

This section presents a summary of the project costs associated with the System Improvements discussed in Section 5.

6.1 COST CRITERIA

As discussed in Section 5, the majority of the system improvements consist of elevated tanks, pumping stations, transmission mains and ground storage tanks. The cost estimates were based on 2008 dollars, with the following notes and clarifications:

- Inflation – 5% per year for escalation of costs
- An allowance for engineering design and engineering during construction
- 15% contingency for construction costs
- Land acquisition and easement costs are NOT included. An attempt was made to identify the approximate number of easements that might be required for each project.

The following is a summary of the assumptions and criteria used to estimate the costs for these facilities:

Storage Tanks

The construction costs for the elevated tanks were broken out into two parts, including site work and the tank. The site work includes items such as yard piping, valves, grading, earthwork, site restoration, fencing, and access. These costs were estimated from recent construction bids and projects. The tank costs includes costs for the tank, internal piping, foundation, connections, access doors, painting, electrical lighting, and other tank equipment. These tank costs were received from tank manufacturers and recent project bids. It should be noted that these costs were estimated based on 2008 costs for materials such as steel and concrete.

The construction costs for ground storage tanks were also broken out into two parts, including site work and the tank. The site work includes the same items, which were estimated from recent construction bids and projects. The ground storage tank costs were based on pre-stressed concrete tanks and budgetary estimates from past projects were used.

Pump Stations

The construction costs for the pump stations were broken out into two parts, including site work and the pump station. The site work includes items such as pump station and generator foundation, yard piping, valves, grading, earthwork, site restoration, fencing, and access. These costs were estimated from recent construction bids and projects. The pump station costs were based on package type stations and include costs for the pump building, pumps, interior piping, interior valves, flow meter, PLC, HVAC, lifting equipment, and other pumping equipment. These pumping station costs were received from manufacturers and recent project bids.

Transmission Mains

The construction costs for the transmission mains include the piping installed, isolation valves, air release valves and structures, site restoration, and flushing assemblies (if required). These costs were estimated from recent construction bids and projects.

6.2 COST SUMMARY BY PROJECT TYPE AND YEAR

Costs for each of the improvements described in Section 5 were estimated per the criteria described above. These unit costs and improvements were discussed with the City at different meetings to try and prioritize the projects and distribute them over the 20-year planning period. The cost estimates for each improvement are included in Appendices 2, 3, 4 and 5. Table 6-1, at the end of this section, provides a summary of the costs. These costs have been divided into pump stations, storage, other improvements, and water mains (including loop closures). The table has been divided into four (4) separate sheets.

SECTION 7 – SUMMARY AND RECOMMENDATIONS

7.1 SUMMARY AND RECOMMENDATIONS

It is recommended that the City proceed with the system improvements discussed in Sections 5 and 6 of this report. Furthermore, it is recommended that the City review the list of improvements on an annual basis to evaluate the prioritizations based on needs, growth and actual water demands.

The following table provides a summary of the recommended improvements.

Table 7-1: Recommended Improvements

Project Description	Year Recommended	Estimated Cost
Pump Stations		
New Pump Station at West Ash Site	2018	$ 3,363,000
New Southeast Pump Station	2019	$ 3,586,000
New Pump Station at Hillsdale Site	2023	$ 3,564,000
Pump Stations – Subtotal		$ 10,513,000
Storage		
Ground Storage at Hillsdale Pump Station – 1.5 MG	2009	$ 1,439,000
Elevated Storage at Prathersville – 2 MG	2016	$ 7,694,000
Ground Storage at Hillsdale – 3 MG	2023	$ 3,865,000
Ground Storage at Southeast – 2 MG	2019	$ 2,622,000
Ground Storage at Southeast – 2 MG	2024	$ 3,318,000
Ground Storage at New West Ash Pump Station – 2 MG	2025	$ 3,513,000
Storage – Subtotal		$ 22,451,000
Other Improvements		
Drill Alluvial Well #16	2008	$ 315,000
Drill Alluvial Wells #17 and #18	2010	$ 700,000
ASR #3 – Conversion of Existing Deep Well	2010	$ 475,000
Other Improvements – Subtotal		$ 1,490,000
Water Mains		
Main Upgrades - 4” and 6” (Section 5.2.2)	2008 – 2012	$ 1,860,750
Loop Closures (Section 5.2.2)	2008 – 2011	$ 2,469,000
North Section of 24” East Transmission Main	2009 – 2010	$ 4,494,000
South Section of 24” East Transmission Main	2010 – 2011	$ 6,701,000
Route PP Main Upgrade (12”)	2009	$ 3,497,000
Heller Rd (16”)	2011	$ 3,265,000

Hackberry (12”)	2010	$ 1,018,000
16” Transmission Main from New West Ash Pump Station to New Prathersville Elevated Tank	2017	$ 9,501,000
24” Transmission Main from Hillsdale to Stephens Station Elevated Tank	2022	$ 18,174,000
24” Transmission Main from New Southeast Pump Station	2020	$ 4,528,000
Additional 24” Transmission Main from Shepard Tank to Hillsdale Pump Station	2028	$ 10,843,000
Additional 16” Transmission Main from Grindstone Pkwy to Shepard Tank	2028	$ 7,737,000
Water Mains – Subtotal		$ 74,087,750
TOTAL – All Improvements		$ 108,541,750

In addition it is recommended that the City complete the following:

1. Update to this Study every five years based on the rate and specific areas of growth in the service area.
2. Provide additional sludge storage capacity for the McBaine WTP (described in Section 5.2.5).
3. Begin the necessary planning and studies (described in Section 5.3.5) for additional water treatment and transmission.

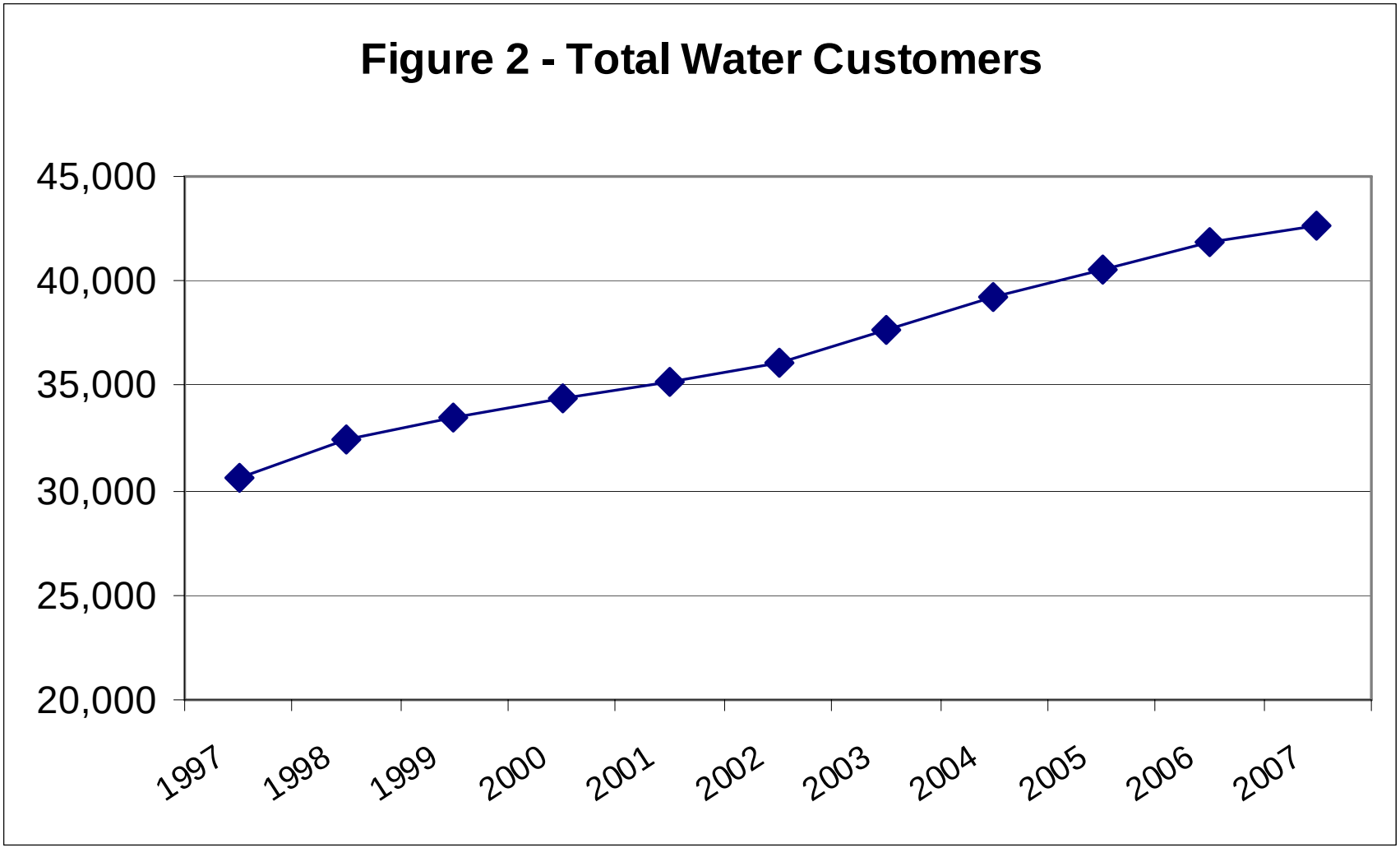


Figure 2 - Total Water Customers
45,000
40,000
35,000
30,000
25,000
20,000
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007

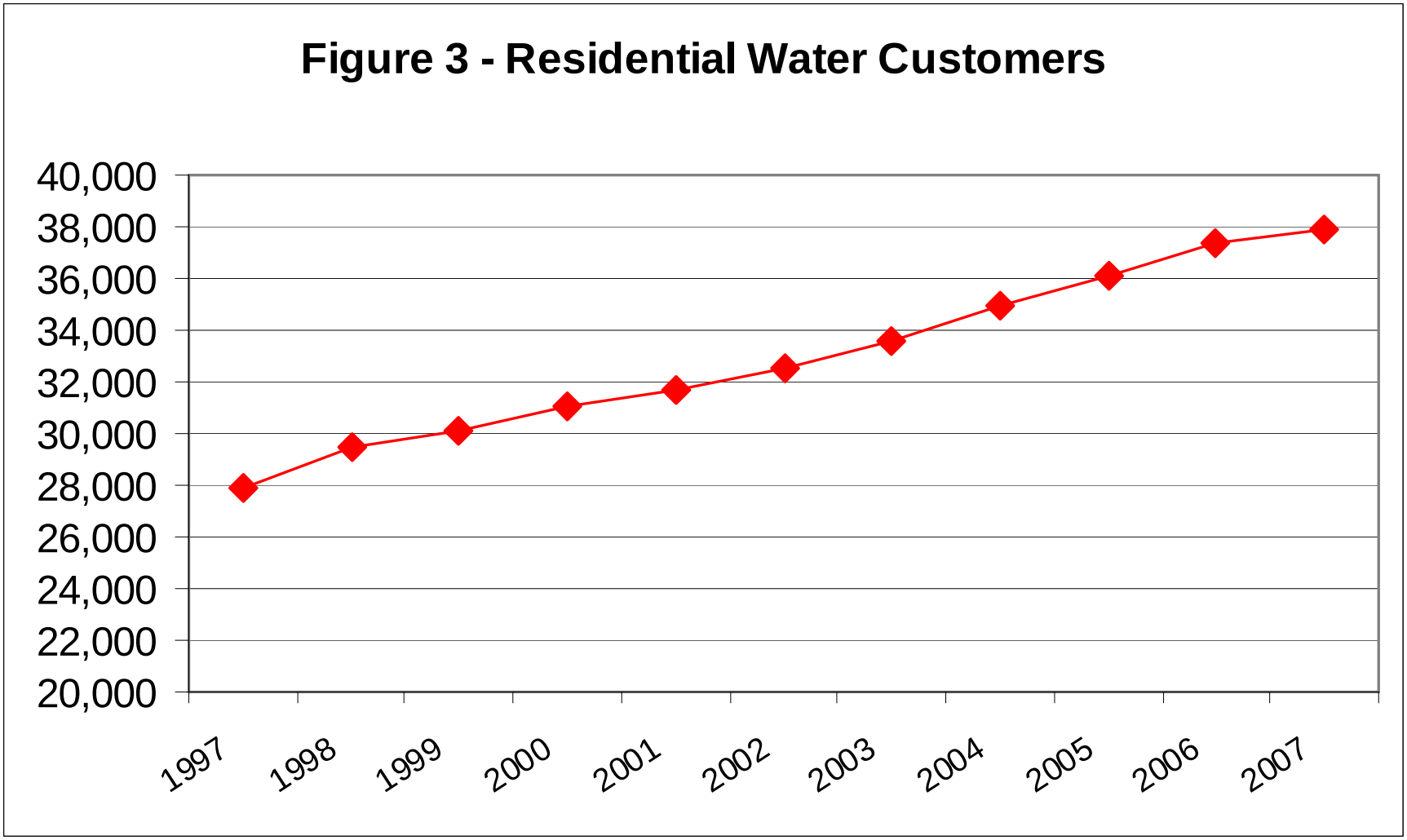


Figure 3 - Residential Water Customers
40,000
38,000
36,000
34,000
32,000
30,000
28,000
26,000
24,000
22,000
20,000
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007

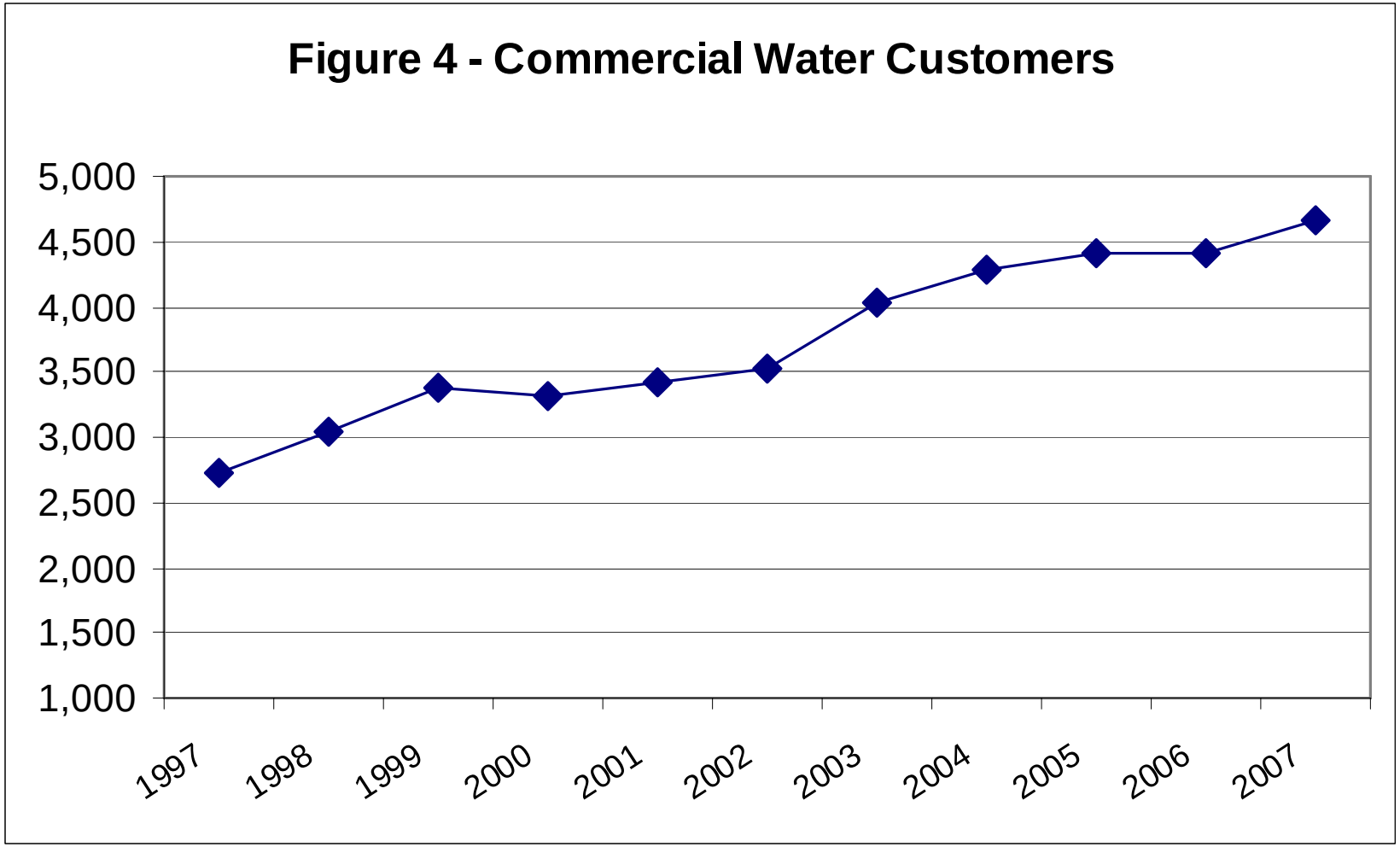


Figure 4 - Commercial Water Customers
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007

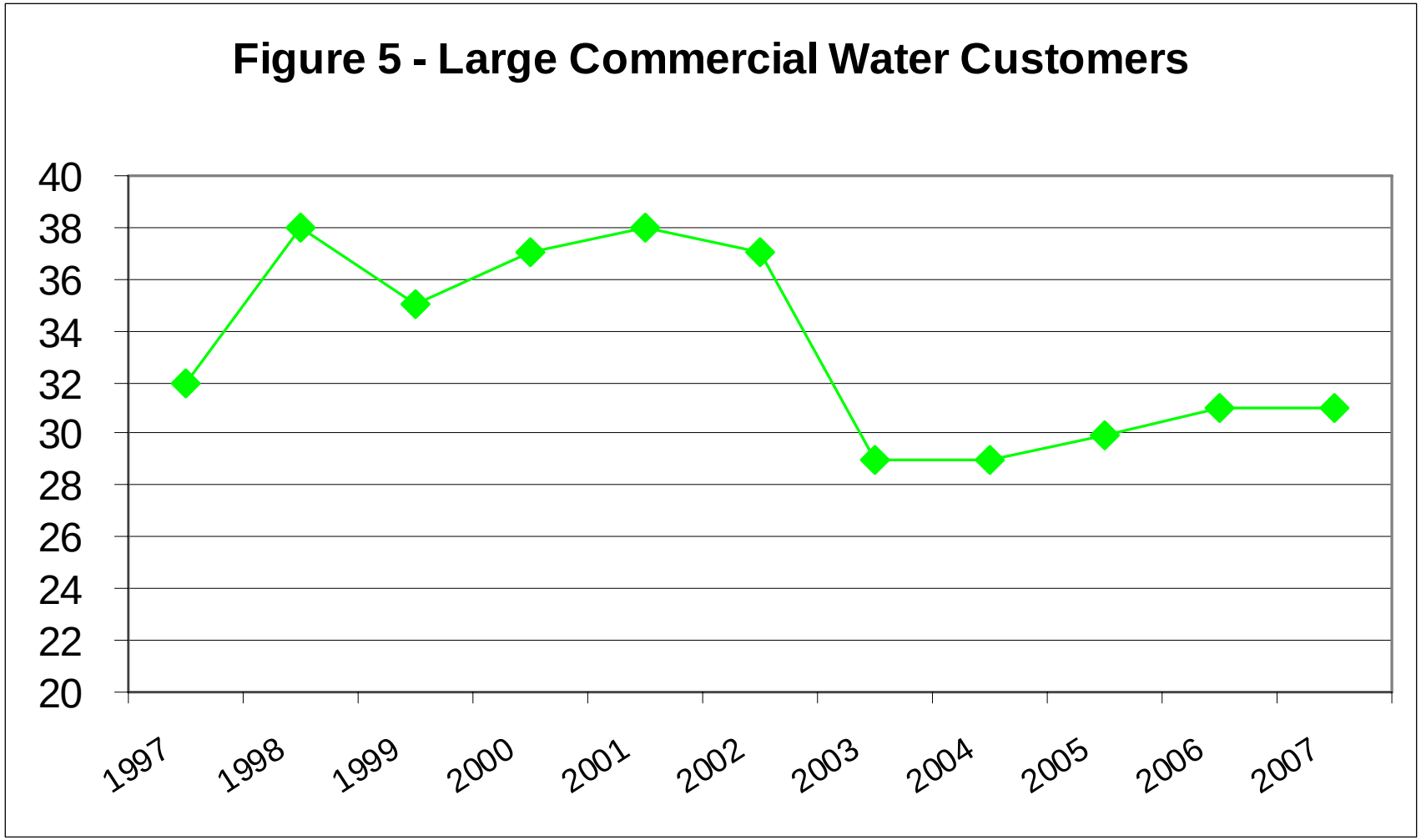


Figure 5 - Large Commercial Water Customers
40
38
36
34
32
30
28
26
24
22
20
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007

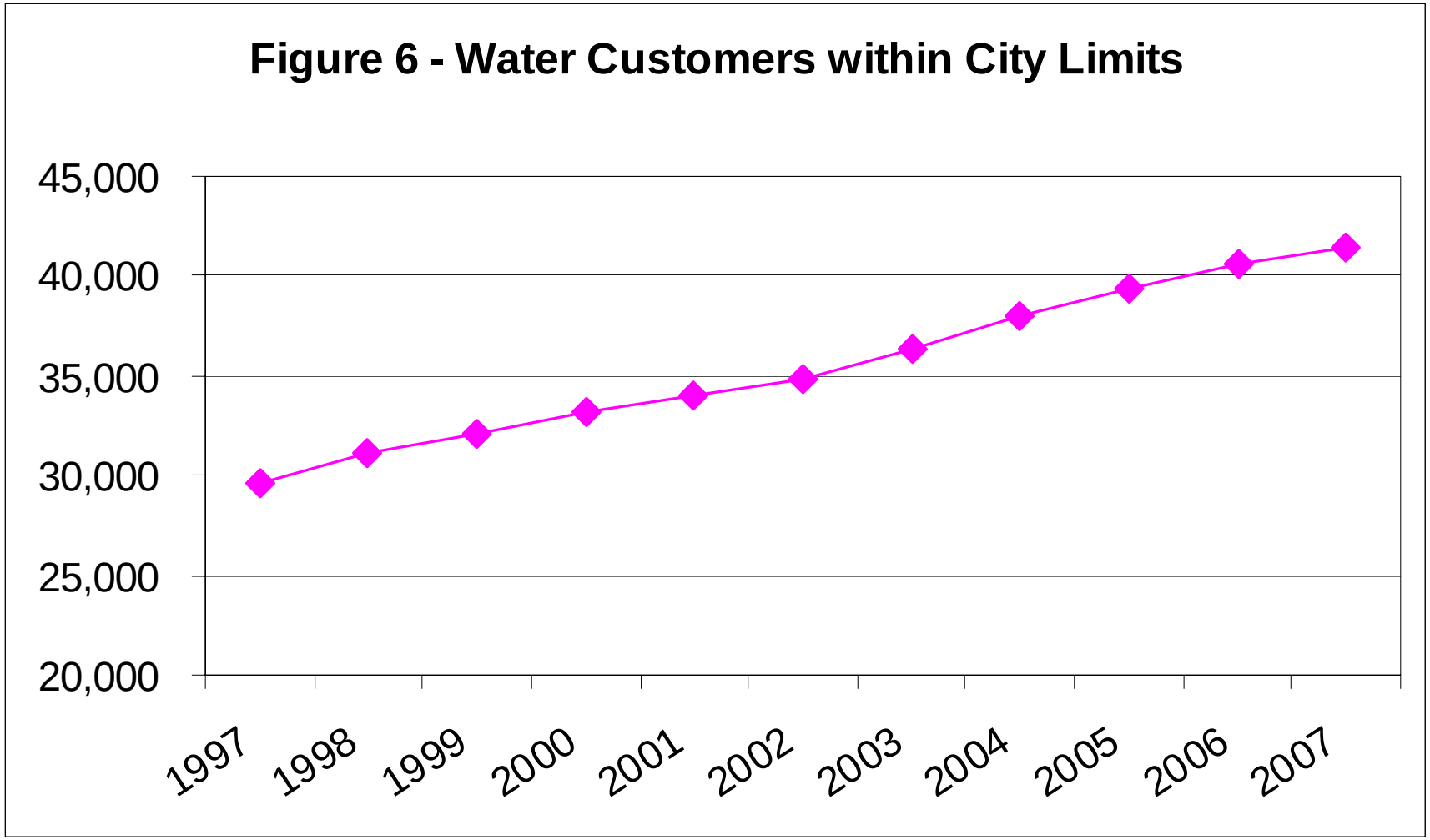


Figure 6 - Water Customers within City Limits
45,000
40,000
35,000
30,000
25,000
20,000
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007

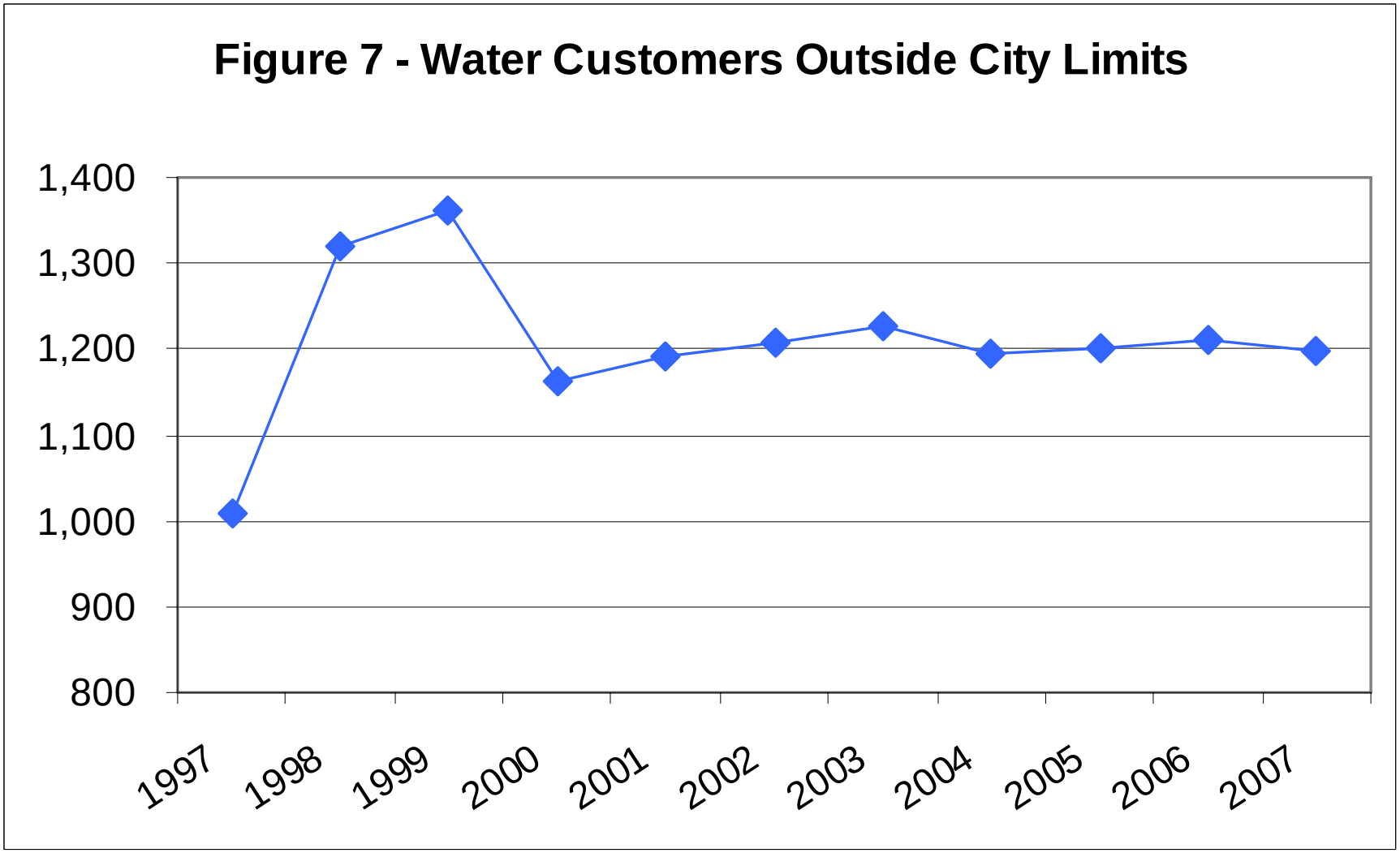


Figure 7 - Water Customers Outside City Limits
1,400
1,300
1,200
1,100
1,000
900
800
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007

Figure 13 - Total Monthly Water Consumption by all Customers
Includes Irrigation

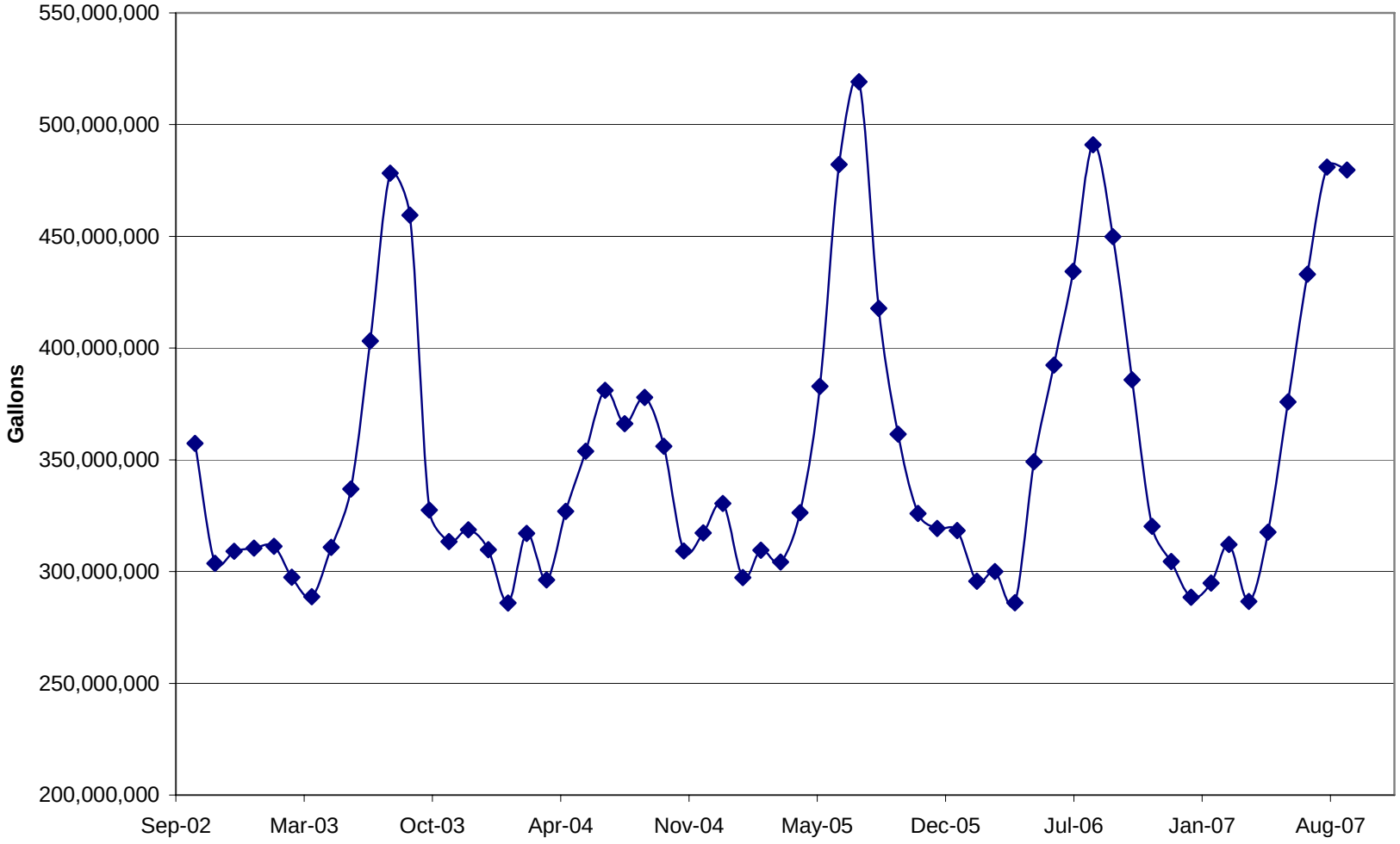


Figure 14 - Average Daily Consumption by all Customers
Includes Irrigation

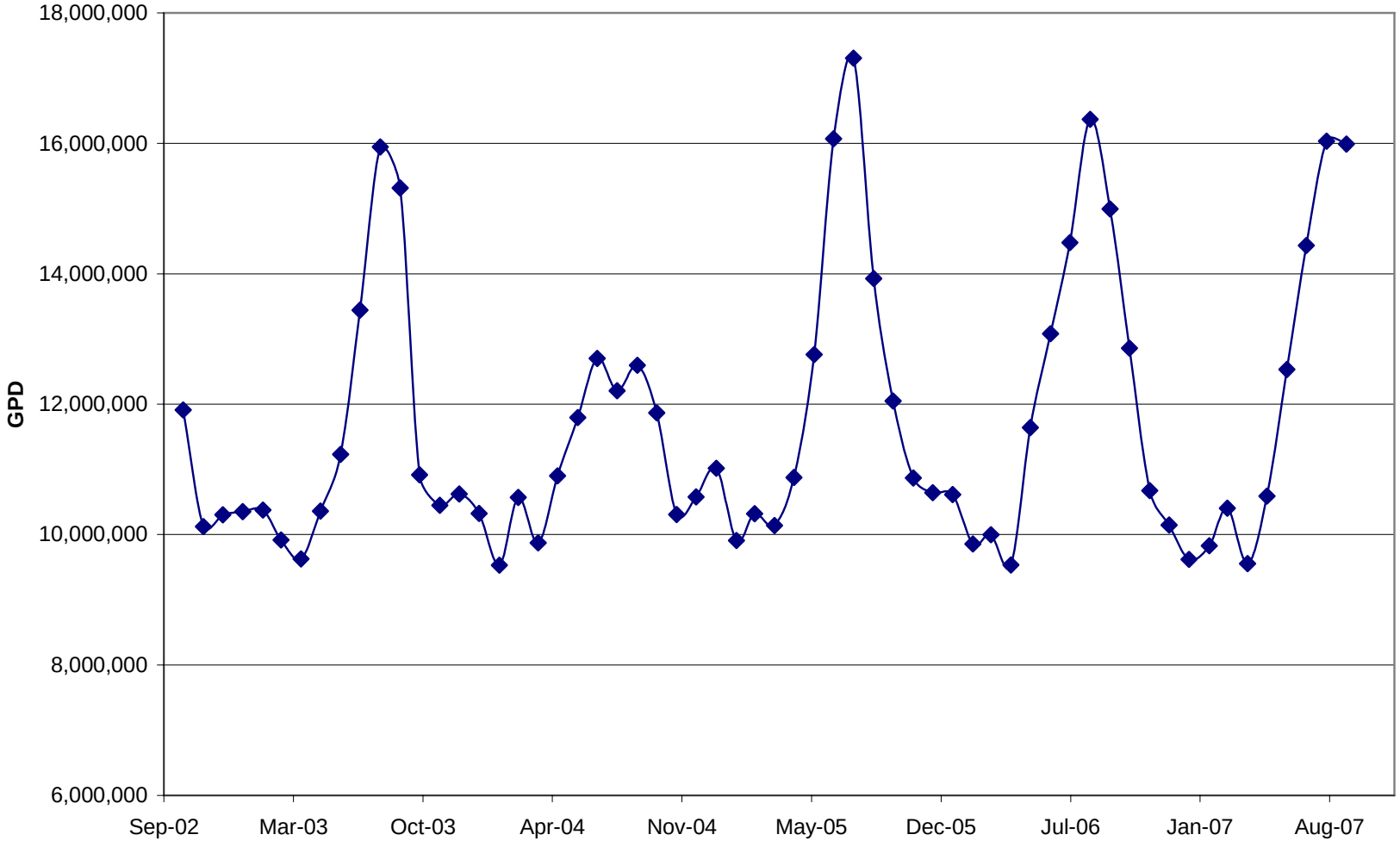


Figure 15 - Average Daily Consumption per Customer by all Customers
Includes Irrigation

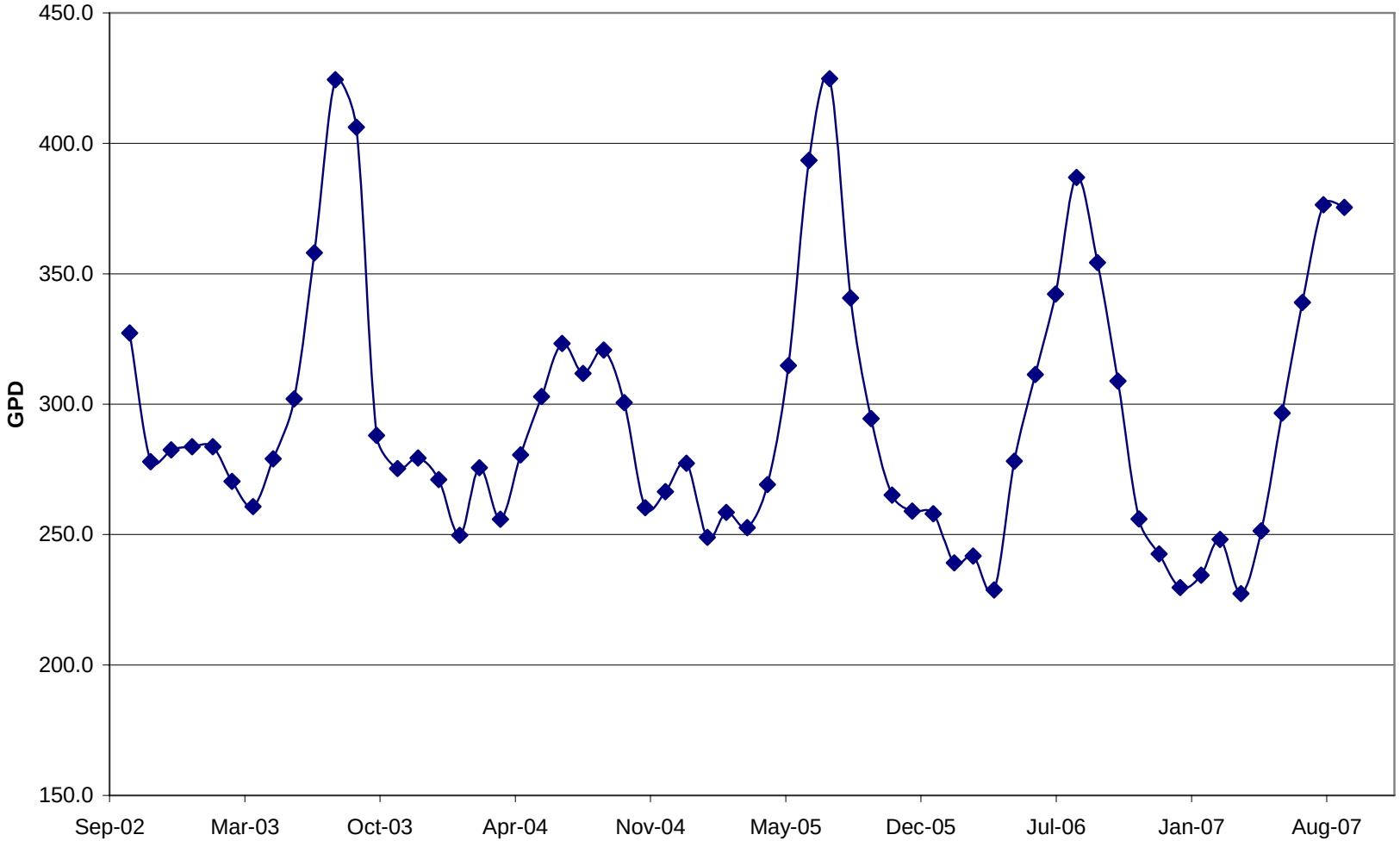


Figure 16 - Total Monthly Consumption by Residential and Master Meter Customers
Includes Irrigation

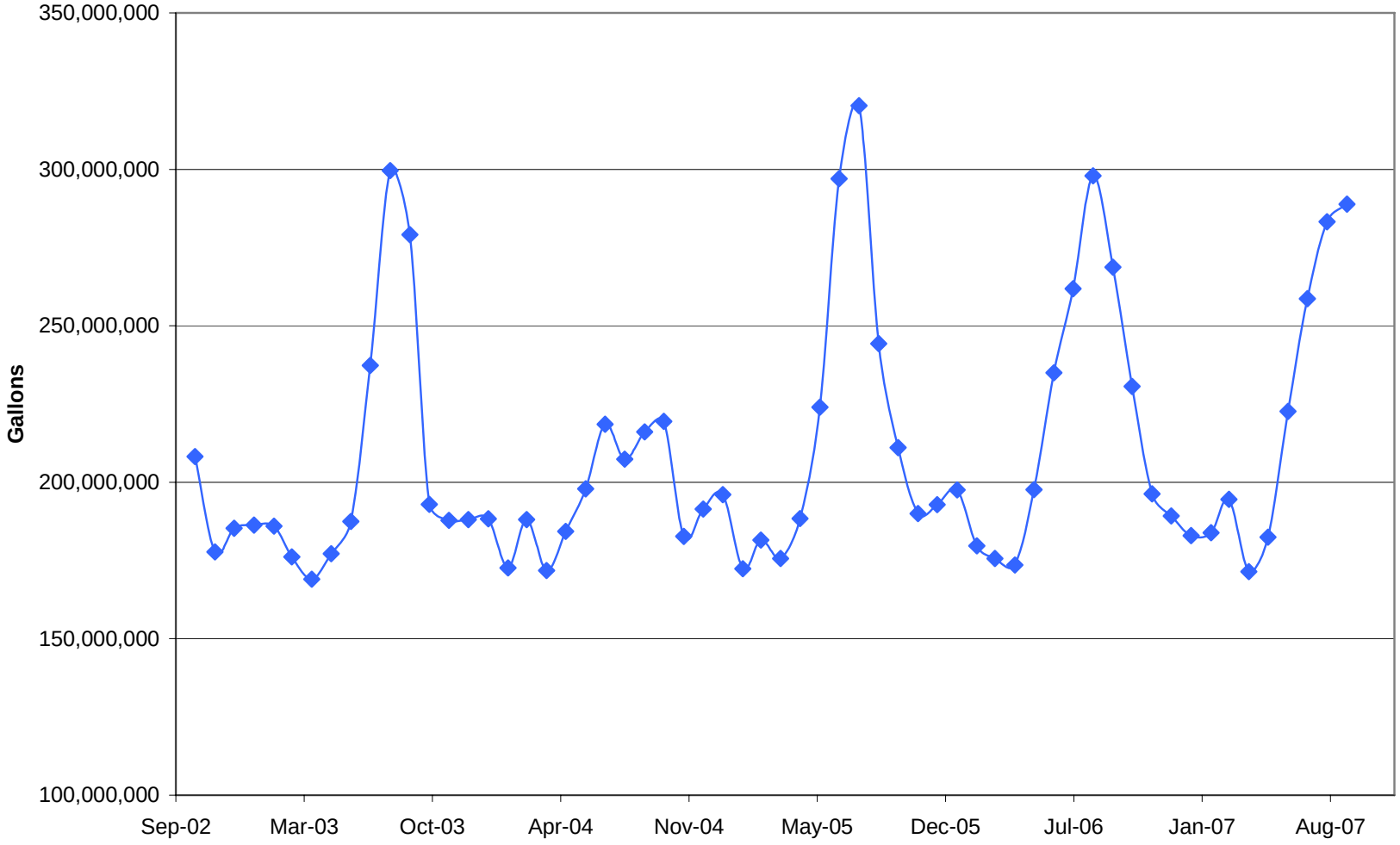


Figure 17 - Average Daily Consumption by Residential and Master Meter Customers
Includes Irrigation

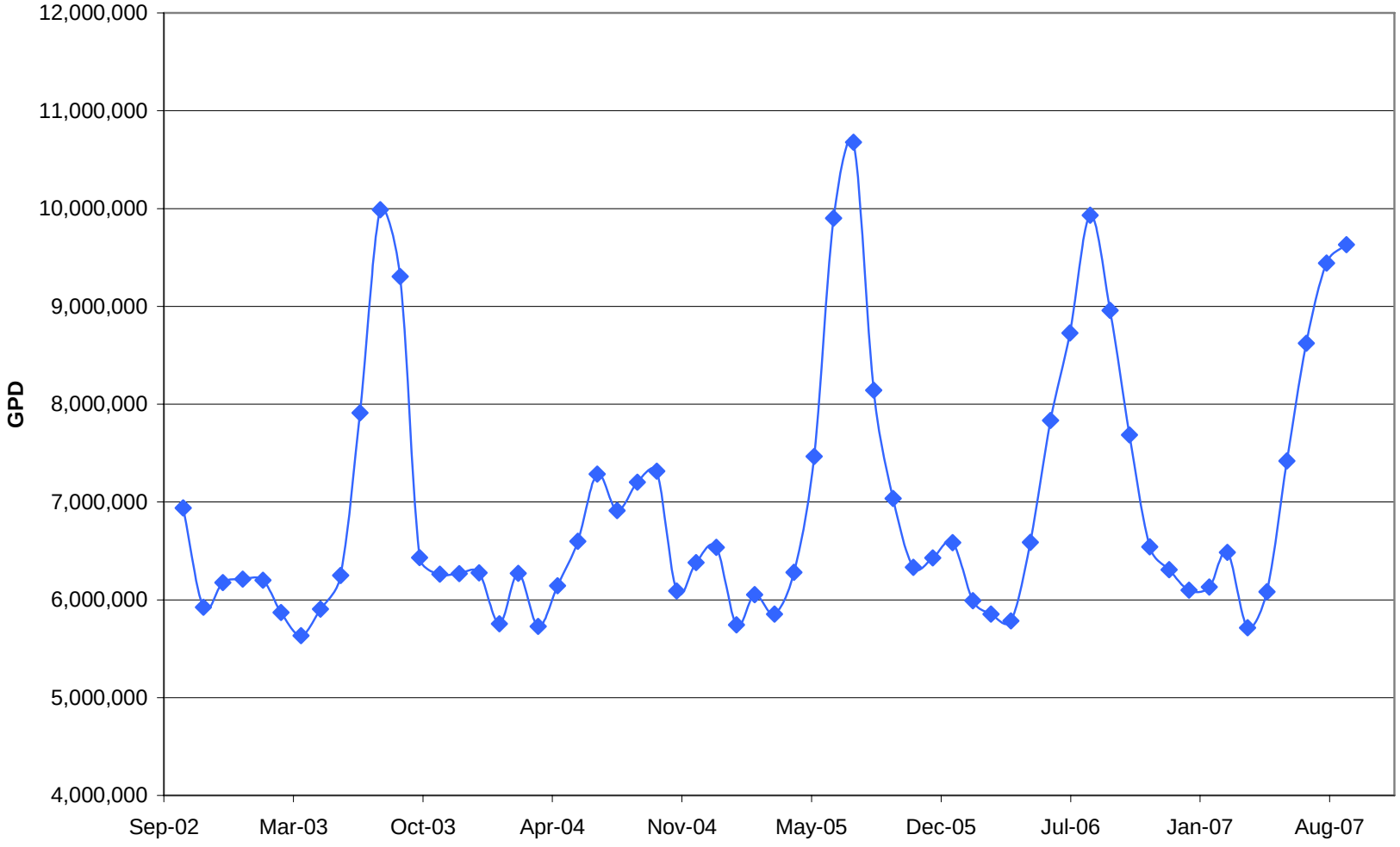


Figure 18 - Average Daily Consumption per Customer by Residential and Master Meter Customers
Includes Irrigation

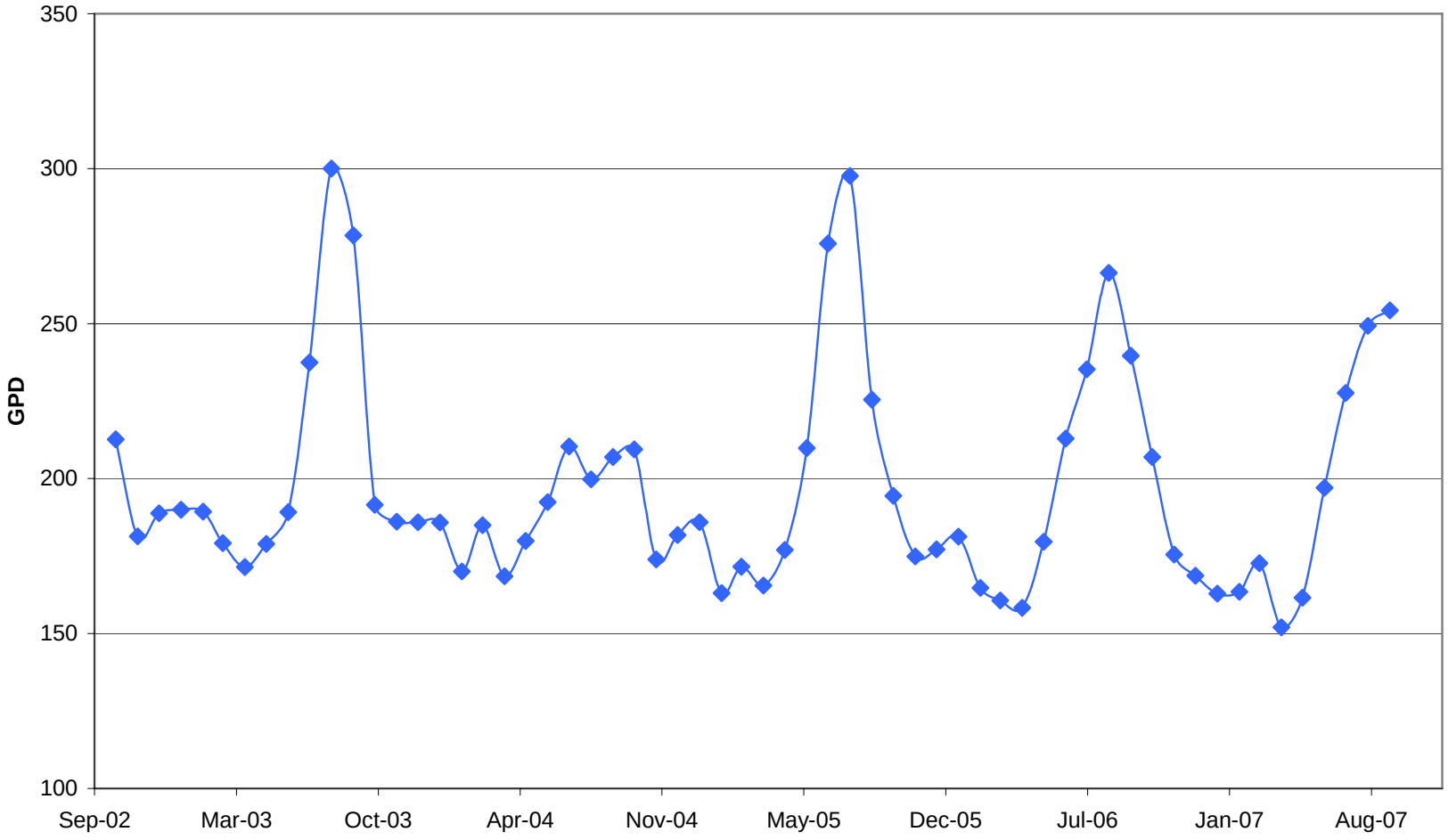


Figure 19 - Total Monthly Water Consumption by Commercial Customers
Includes Irrigation

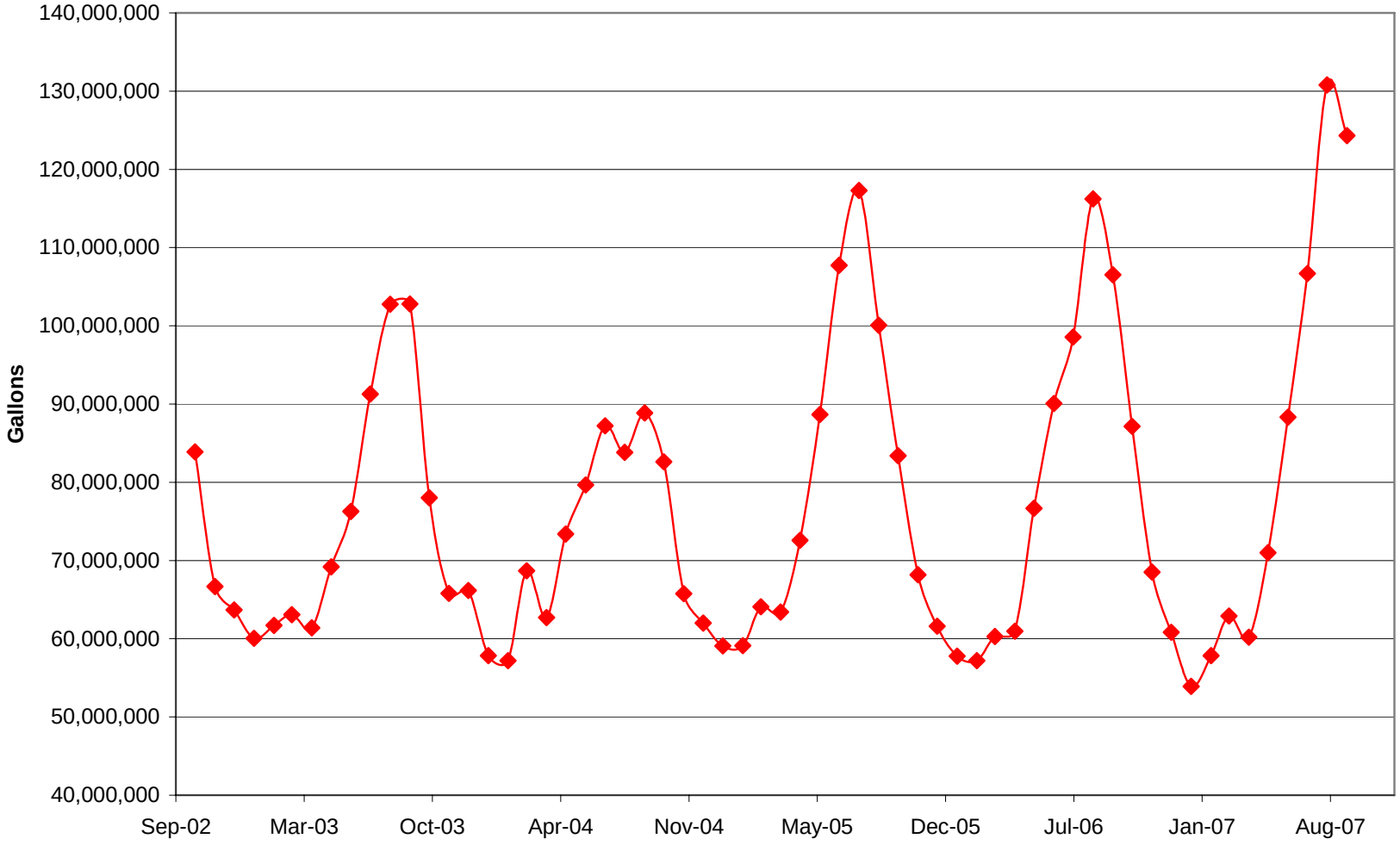


Figure 20 - Average Daily Consumption by Commercial Customers
Includes Irrigation

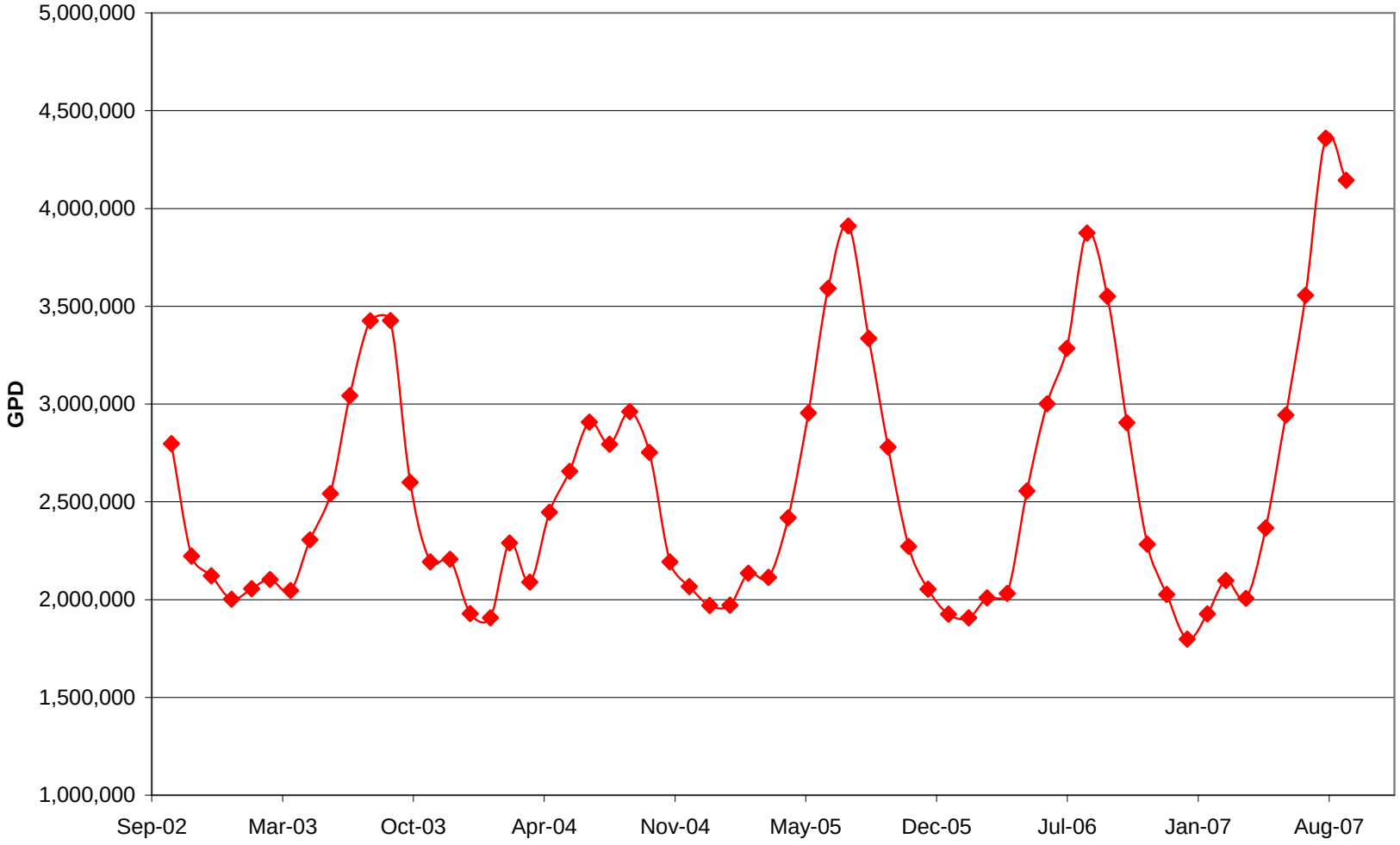


Figure 21 - Average Daily Consumption by Commercial Customers
Includes Irrigation

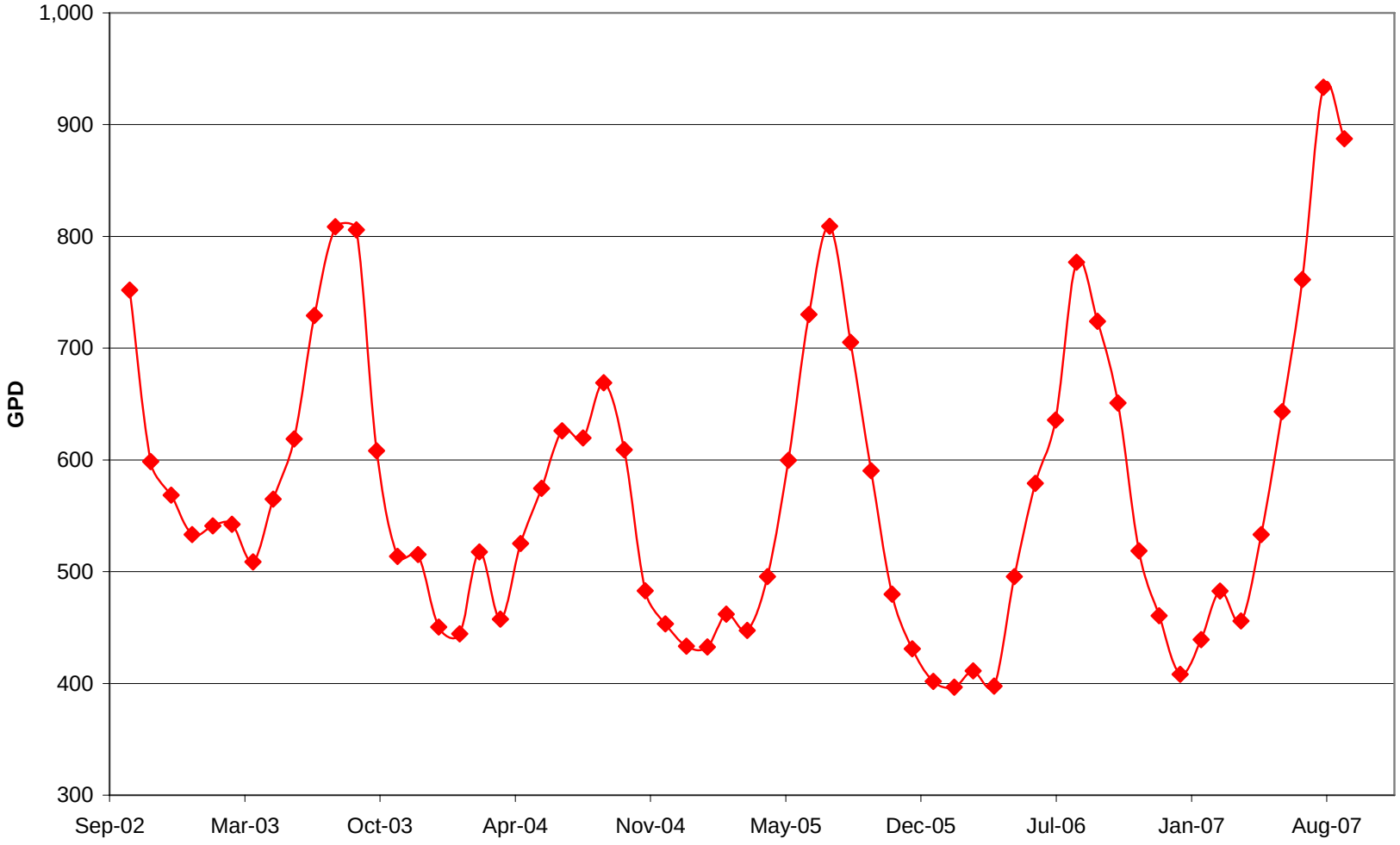


Figure 22 - Total Monthly Consumption by Large Commercial Customers
Includes Irrigation

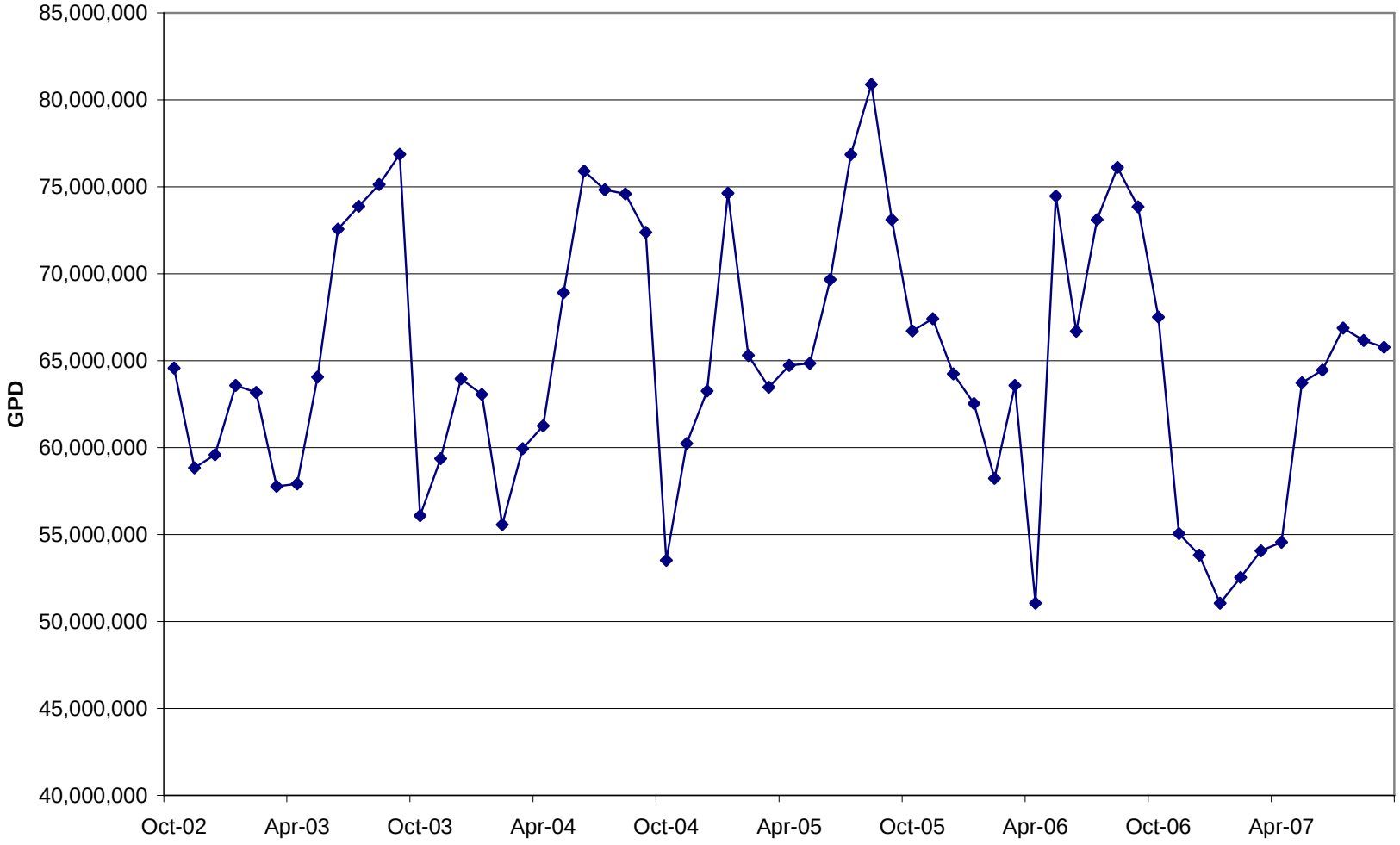


Figure 23 - Average Daily Consumption by Large Commercial Customers
Includes Irrigation

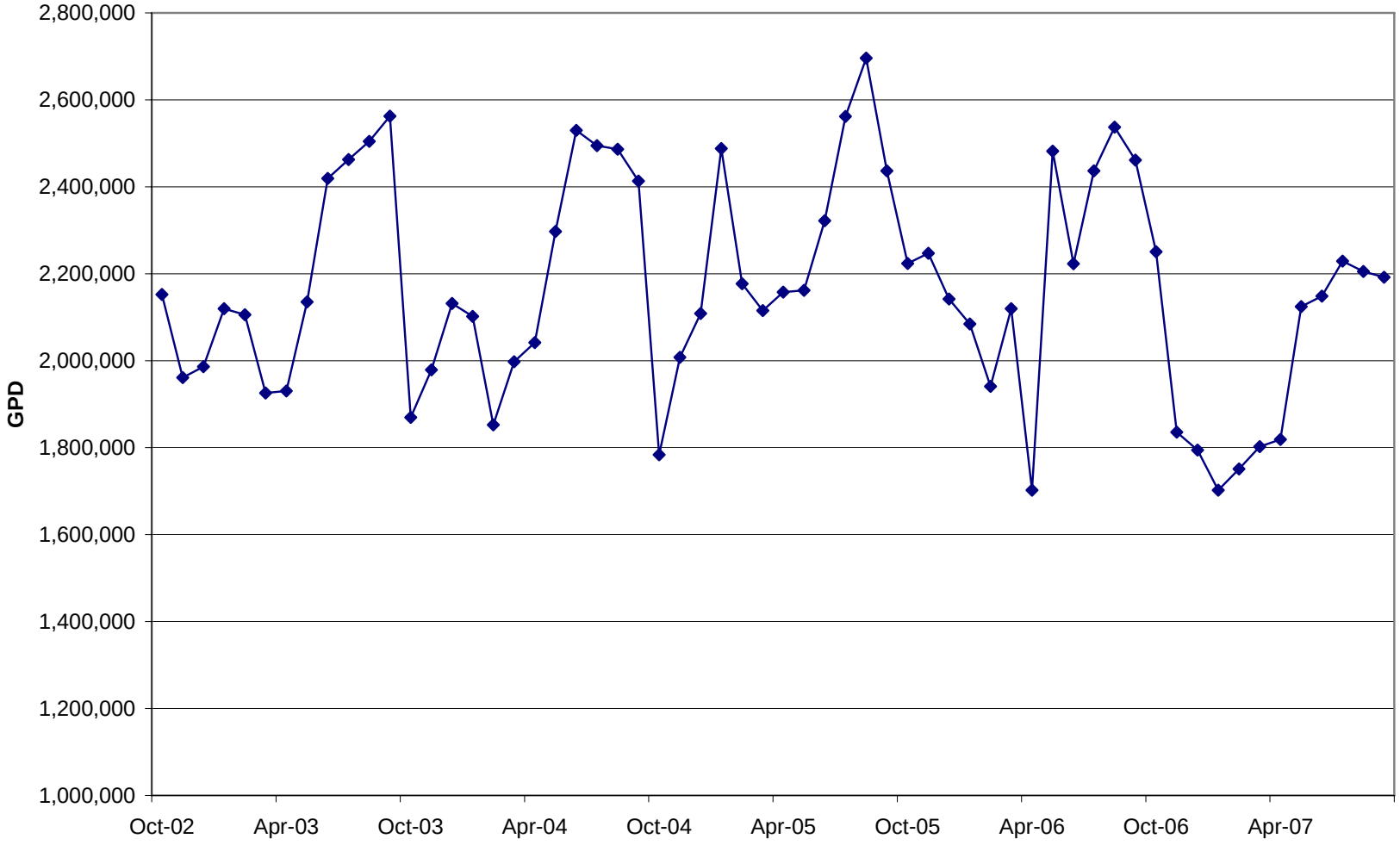


Figure 24 - Average Daily Consumption per Large Commercial Customer

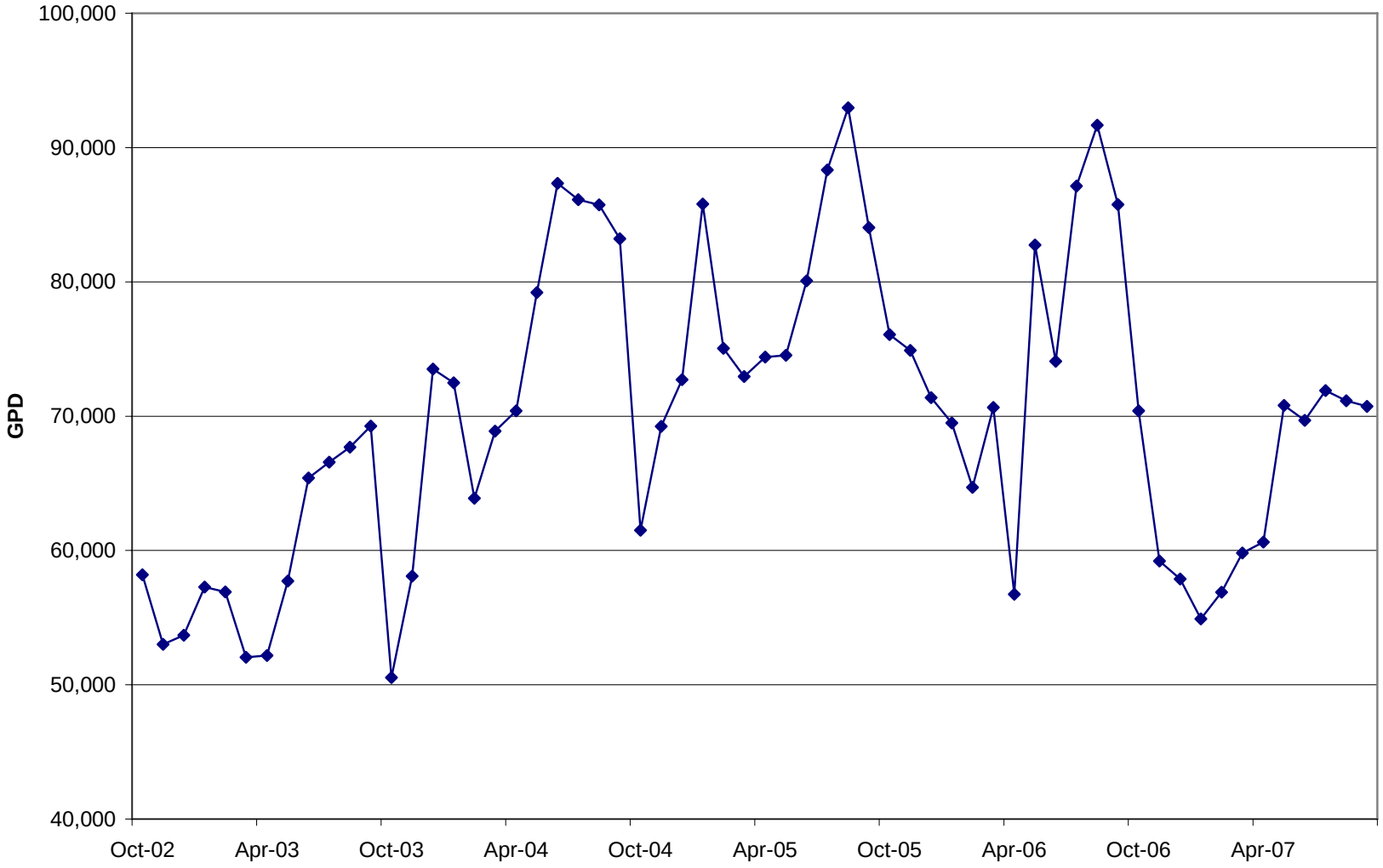


Figure 25 - Total Montly Water Consumption for Irrigation Purposes Only

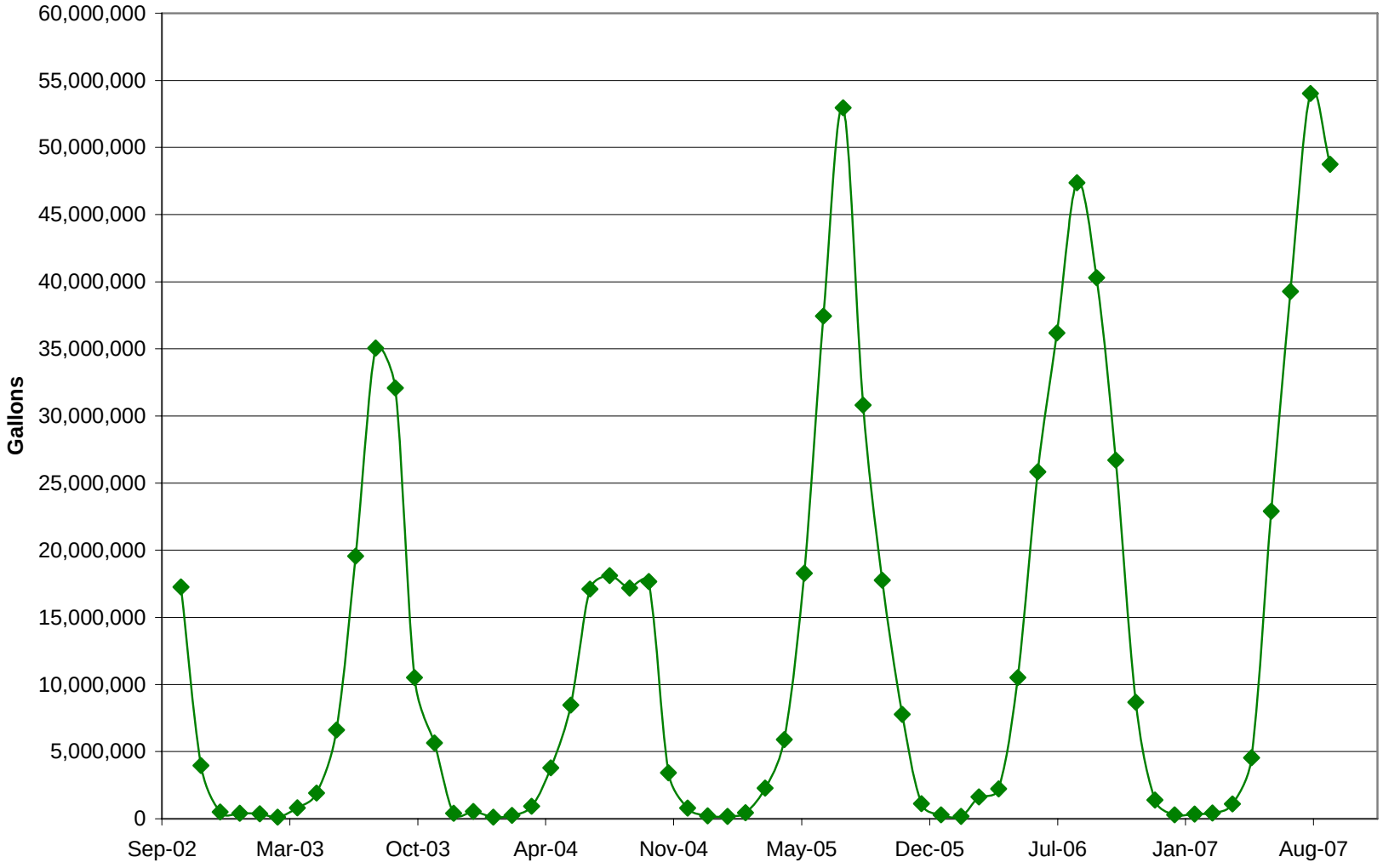


Figure 26 - Average Daily Consumption for Irrigation Purposes Only

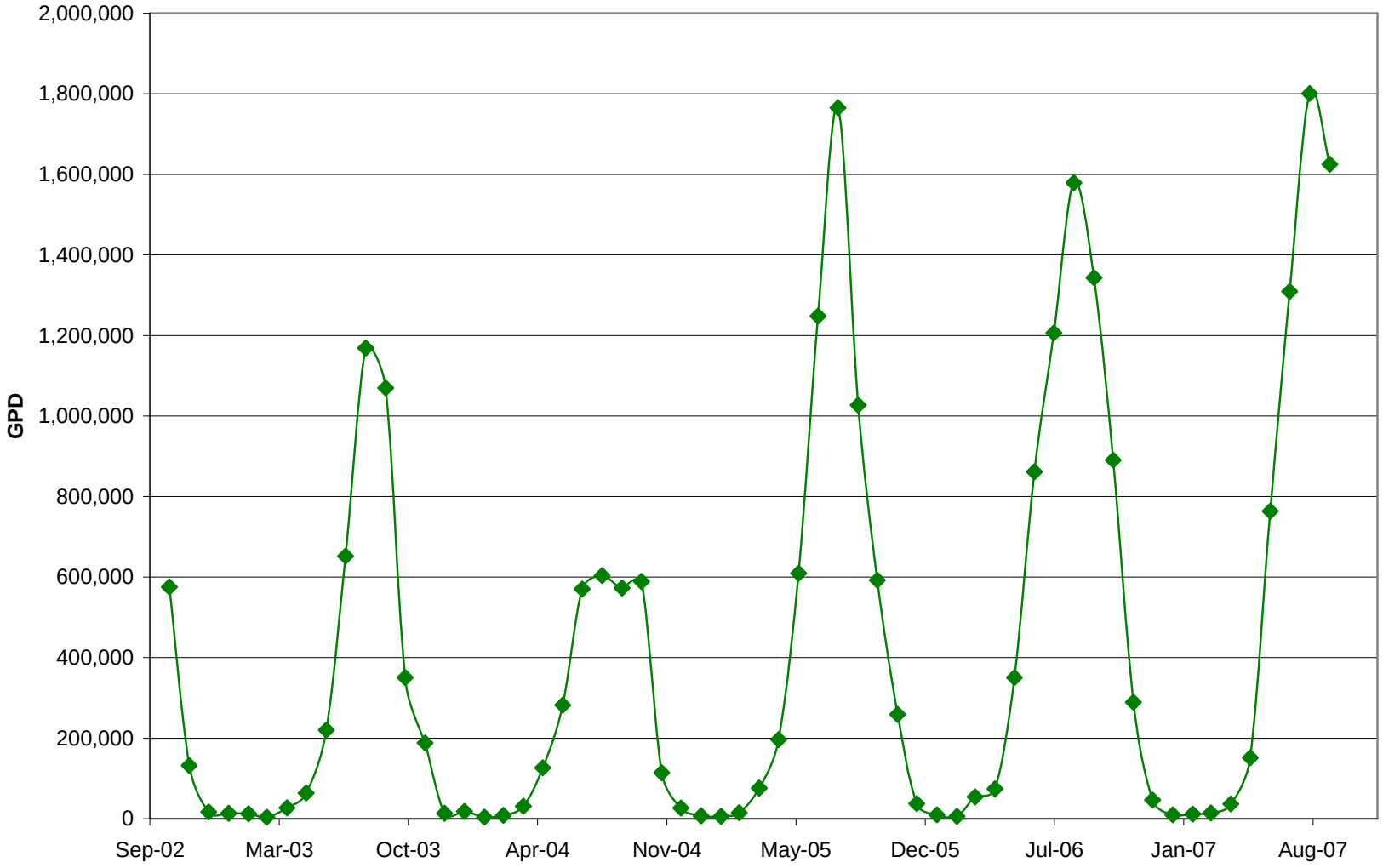


Figure 27 - Average Daily Consumption per Customer for Irrigation Purposes Only

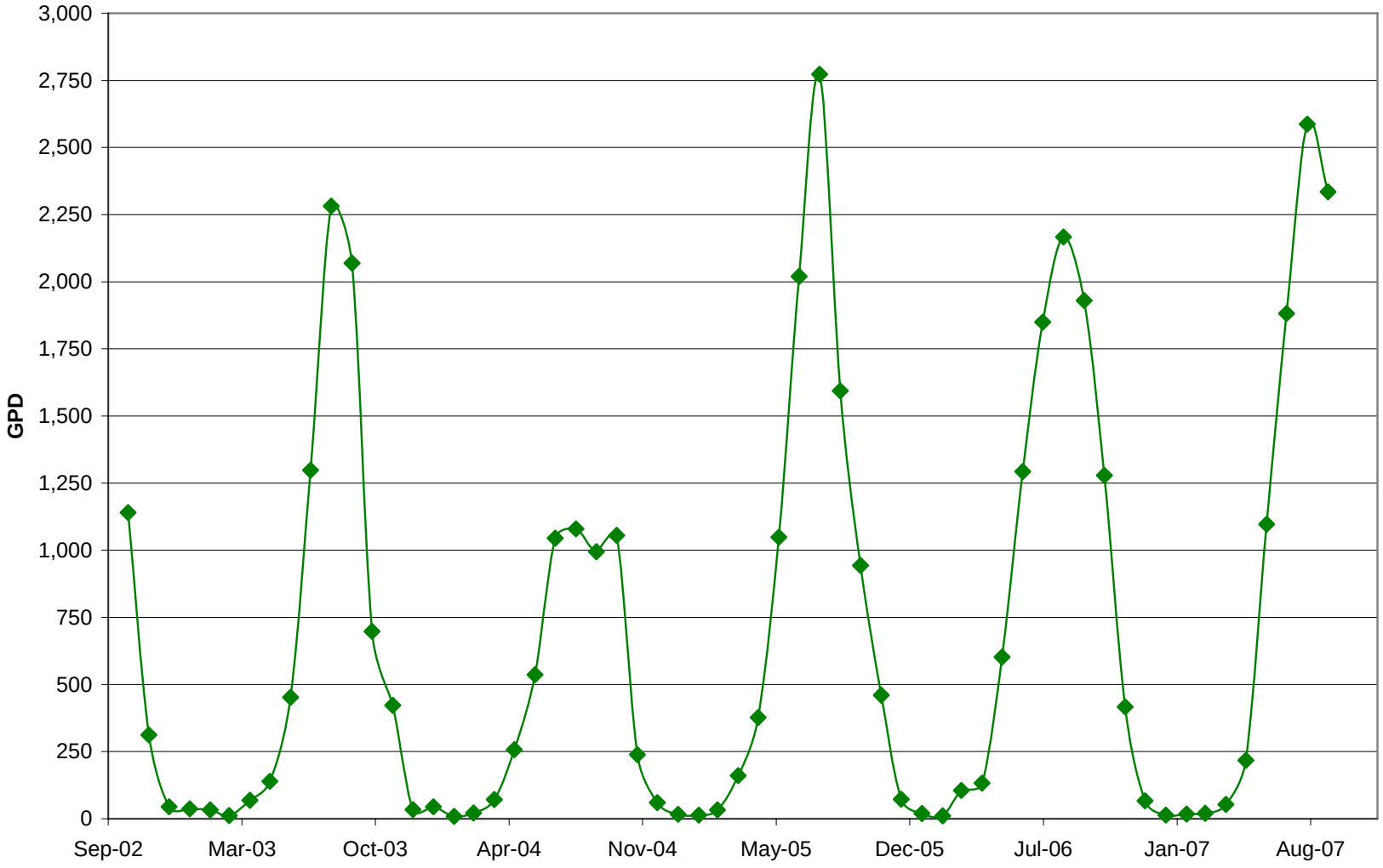


Figure 28 - Average Daily Consumption per Master Meter Customer

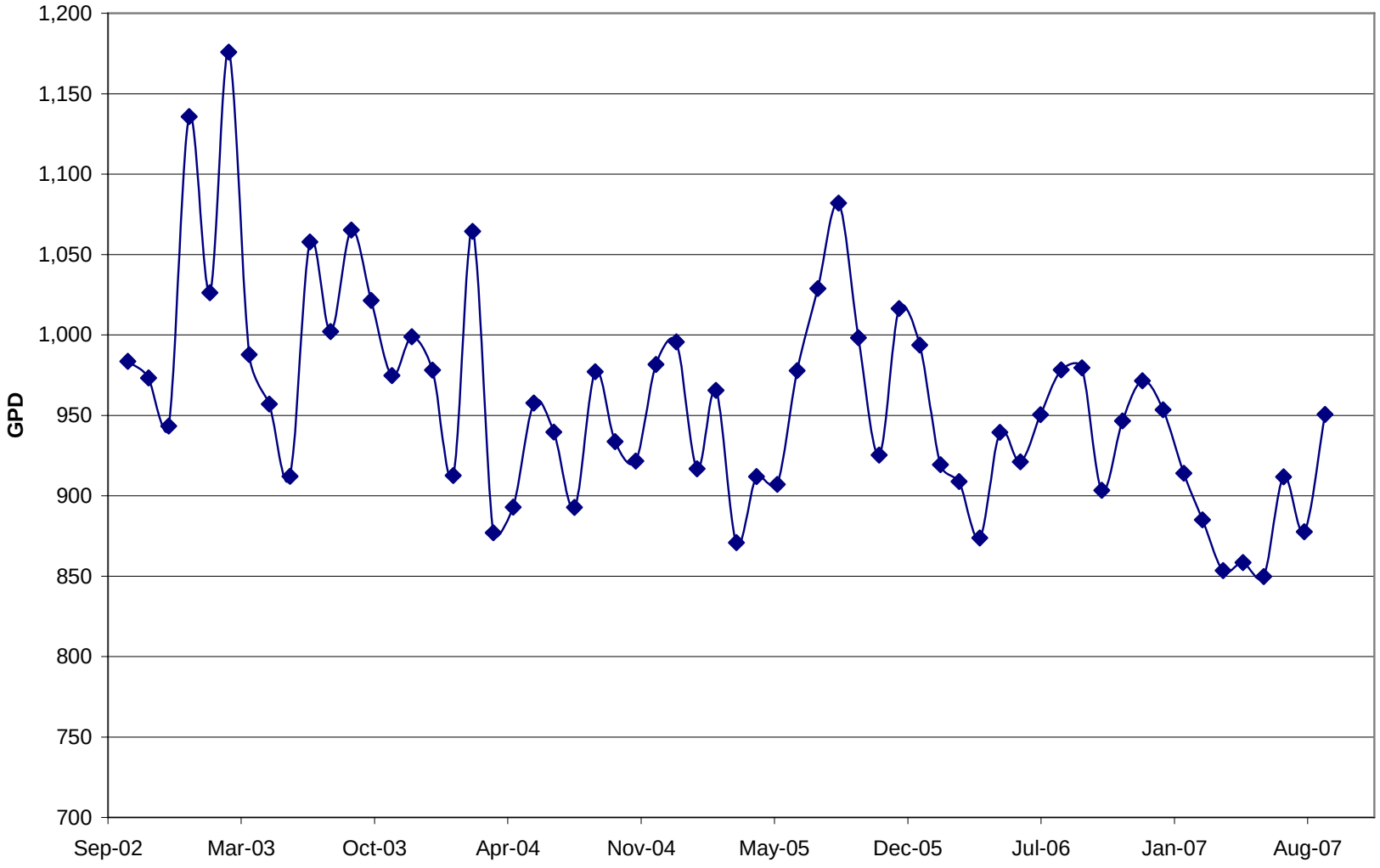


Figure 29 - Water Production at WTP

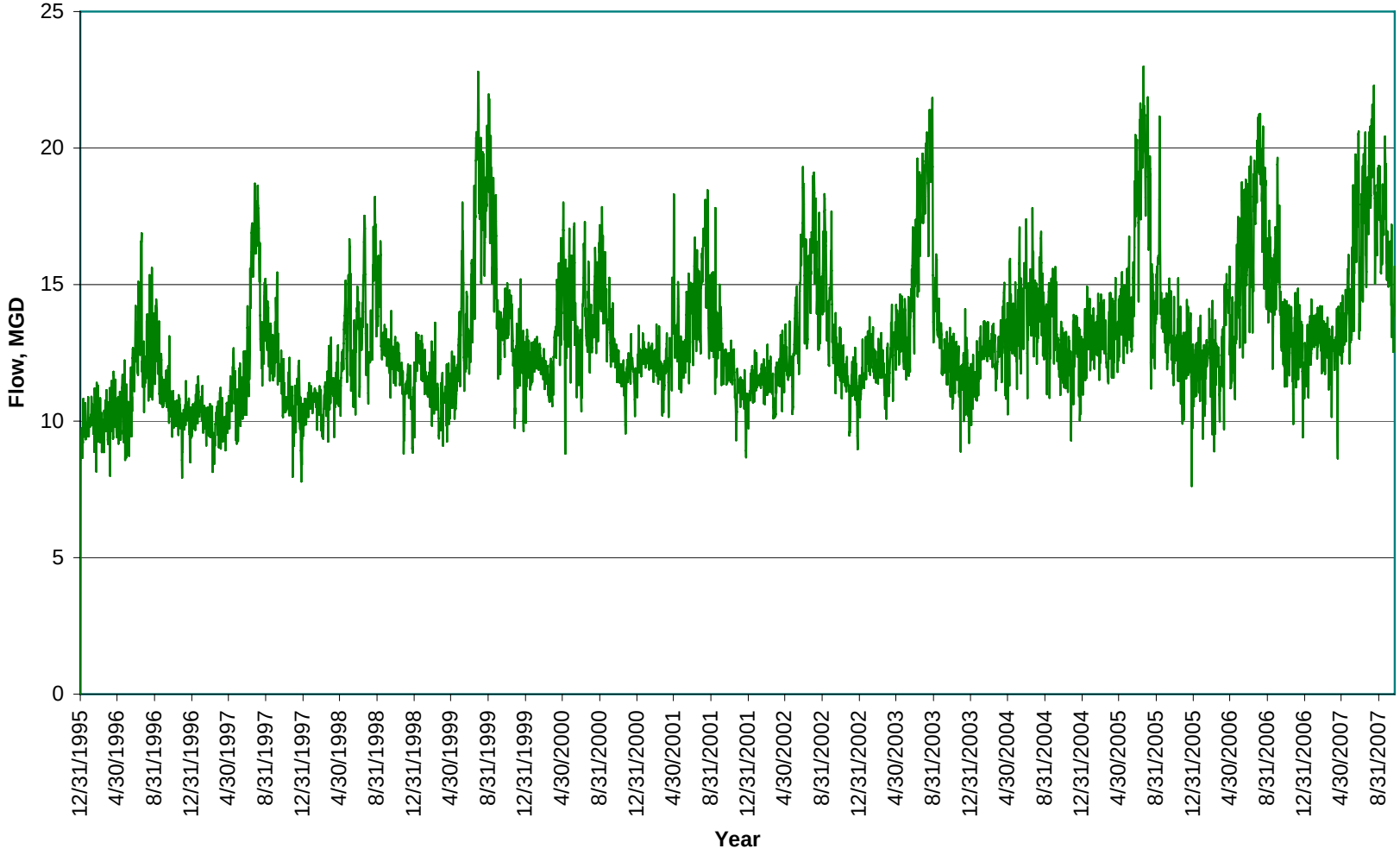


Figure 30 - Water Production at West Ash Pump Station

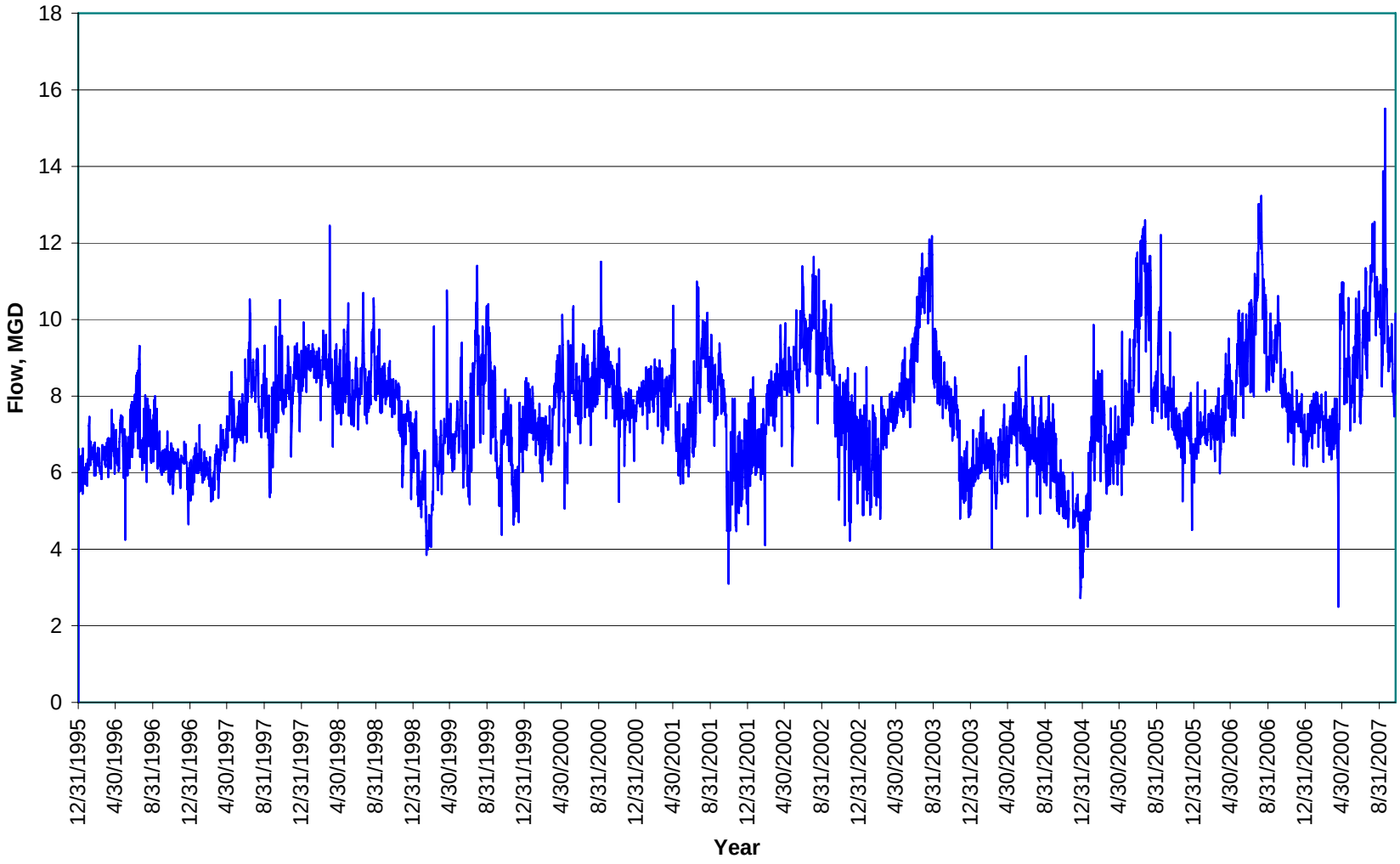


Figure 31 - Water Production at South Pump Station

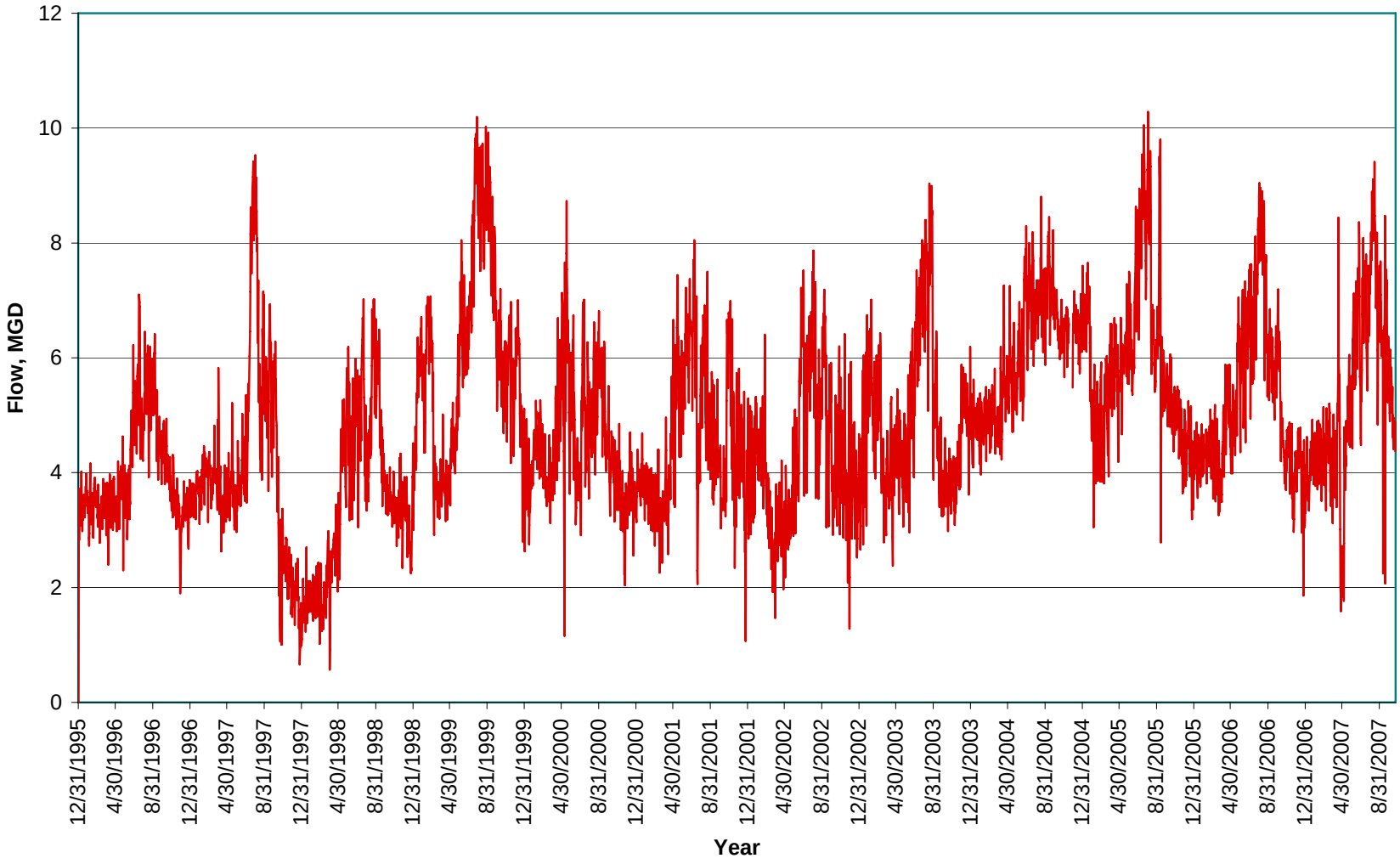
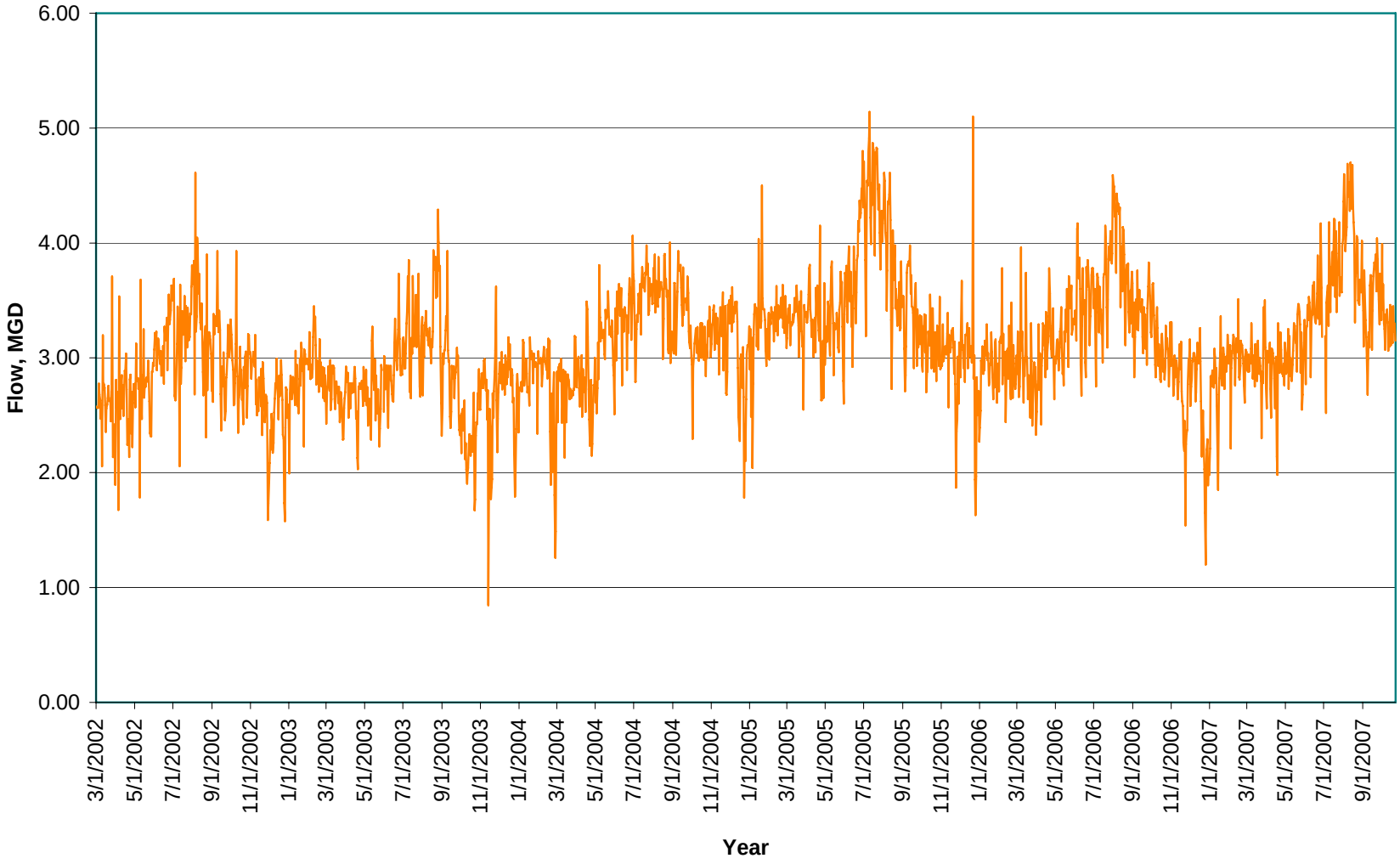


Figure 32 - Water Production at Northeast Booster Pump Station



APPENDIX 2

Cost Estimates
Year 2013

Ground Storage at Hillsdale

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$30,000.00	$ 30,000.00
	Ground Storage Tank				
	1.5 MG Concrete Ground Storage Tank	LS	1	$900,000.00	$ 900,000.00
	Telemetry/Control System/Electrical - for Vault	LS	1	$20,000.00	$ 20,000.00
	Vault for GS Tank Inlet and Outlet				
	Valve vault and valving	LS	1	$150,000.00	$ 150,000.00
	Water Mains				
	18" DIP Water Line (open excavation) - to GS Tank	LF	75	$100.00	$ 7,500.00
	18" DIP Water Line (open excavation) - from GS Tank	LF	100	$100.00	$ 10,000.00
	Tie-in for 18" (to existing valves)	EA	2	$2,500.00	$ 5,000.00
	Fittings (90 bends)	LS	2	$5,000.00	$ 10,000.00
	Rock Excavation - open trench - NONE ANTICIPATED	CY	0	$250.00	$ -
	Geotechnical (use previous data)	LS	0	$10,000.00	$ -
	Surveying	LS	1	$5,000.00	$ 5,000.00
	Site Restoration - Seeding	LS	1	$2,000.00	$ 2,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

Tank quote from Natgun - 4/15/08. Included 5% inflation.
Inflation for remaining aspects was reduced to 1%

Construction:			$1,139,500.00
Inflation (%/yrs):	1%	1	$ 1,150,895.00
Contingency (%):		15%	$ 172,634.25
Engineering Design (%):		7%	$ 80,562.65
Engineering Construction (%):		3%	$ 34,526.85
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2009):			$ 1,438,618.75

TOTAL PROJECT COST (YEAR 2009): $1,439,000.00

5/23/2008

24" Water Main - North

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$98,000.00	$ 98,000.00
	Water Mains				
	24" DIP Water Line (open excavation)	LF	11500	$210.00	$ 2,415,000.00
	Tie-in for 24" (at existing valve)	EA	1	$3,000.00	$ 3,000.00
	Tie-in for 24" (new connection at Shepard)	EA	1	$11,500.00	$ 11,500.00
	Jack & Bore 24-inch	LF	500	$715.00	$ 357,500.00
	Dewatering	LS	1	$5,000.00	$ 5,000.00
	ARVs	EA	6	$3,500.00	$ 21,000.00
	Pre-Cast Concrete Structures for ARVs	EA	6	$4,000.00	$ 24,000.00
	Flushout Assemblies	EA	3	$5,000.00	$ 15,000.00
	24" Gate Valve	EA	8	$15,000.00	$ 120,000.00
	Fittings	LS	2	$15,000.00	$ 30,000.00
	Rock Excavation - open trench (5%)	CY	680	$250.00	$ 170,000.00
	Rock Excavation - Jack & Bore 24-inch (10%)	LF	50	$600.00	$ 30,000.00
	Geotechnical	LS	1	$10,000.00	$ 10,000.00
	Surveying	LS	1	$50,000.00	$ 50,000.00
	Site Restoration - Seeding	LS	1	$10,000.00	$ 10,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	25	$0.00	$ -

		Construction:	$3,370,000.00
Inflation (%/yrs):	5%	1	$ 3,538,500.00
		Contingency (%): 15%	$ 530,775.00
		Engineering Design (%): 8%	$ 283,080.00
		Engineering Construction (%): 4%	$ 141,540.00
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2009):	$ 4,493,895.00

TOTAL PROJECT COST (YEAR 2009): $4,494,000.00

6/12/2008

24" Water Main - South

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$100,000.00	$ 100,000.00
	Water Mains				
	24" DIP Water Line (open excavation)	LF	10200	$210.00	$ 2,142,000.00
	Tie-in for 24"	EA	2	$11,500.00	$ 23,000.00
	Jack & Bore 24-inch	LF	1200	$715.00	$ 858,000.00
	Dewatering	LS	1	$25,000.00	$ 25,000.00
	ARVs	EA	4	$3,500.00	$ 14,000.00
	Pre-Cast Concrete Structures for ARVs	EA	4	$4,000.00	$ 16,000.00
	Flushout Assemblies	EA	2	$5,000.00	$ 10,000.00
	24" Gate Valve	EA	8	$15,000.00	$ 120,000.00
	Fittings	LS	2	$15,000.00	$ 30,000.00
	Rock Excavation - open trench (5%)	CY	600	$250.00	$ 150,000.00
	Rock Excavation - Jack & Bore 24-inch (10%)	LF	120	$600.00	$ 72,000.00
	Geotechnical	LS	1	$10,000.00	$ 10,000.00
	Surveying	LS	1	$50,000.00	$ 50,000.00
	Site Restoration - Seeding	LS	1	$10,000.00	$ 10,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	2	$0.00	$ -

		Construction:	$3,630,000.00
Inflation (%/yrs):	5%	3	$ 4,202,178.75
Contingency (%):		15%	$ 630,326.81
Engineering Design (%):		7%	$ 294,152.51
Engineering Construction (%):		3%	$ 126,065.36
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2011):			$ 5,252,723.44

TOTAL PROJECT COST (YEAR 2011): $5,253,000.00

6/12/2008

24" Water Main - South
Alternate Route

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$135,000.00	$ 135,000.00
	Water Mains				
	24" DIP Water Line (open excavation)	LF	14300	$250.00	$ 3,575,000.00
	Tie-in for 24"	EA	2	$11,500.00	$ 23,000.00
	Jack & Bore 24-inch	LF	500	$715.00	$ 357,500.00
	Dewatering	LS	1	$25,000.00	$ 25,000.00
	ARVs	EA	4	$3,500.00	$ 14,000.00
	Pre-Cast Concrete Structures for ARVs	EA	4	$4,000.00	$ 16,000.00
	Flushout Assemblies	EA	3	$5,000.00	$ 15,000.00
	24" Gate Valve	EA	8	$15,000.00	$ 120,000.00
	Fittings	LS	2	$15,000.00	$ 30,000.00
	Rock Excavation - open trench (5%)	CY	720	$250.00	$ 180,000.00
	Rock Excavation - Jack & Bore 24-inch (10%)	LF	50	$600.00	$ 30,000.00
	Geotechnical	LS	1	$10,000.00	$ 10,000.00
	Surveying	LS	1	$75,000.00	$ 75,000.00
	Site Restoration - Seeding	LS	1	$25,000.00	$ 25,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	13	$0.00	$ -

		Construction:	$4,630,500.00
Inflation (%/yrs):	5%	3	$ 5,360,382.56
		Contingency (%): 15%	$ 804,057.38
		Engineering Design (%): 7%	$ 375,226.78
		Engineering Construction (%): 3%	$ 160,811.48
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2011):	$ 6,700,478.20

TOTAL PROJECT COST (YEAR 2011): $6,701,000.00

6/12/2008

Route PP Main Updgrade
WT0178

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$76,000.00	$ 76,000.00
	Water Mains				
	12" DIP Water Line (open excavation)	LF	25500	$75.00	$ 1,912,500.00
	Tie-in for 12"	EA	2	$6,500.00	$ 13,000.00
	Jack & Bore 12-inch	LF	100	$475.00	$ 47,500.00
	ARVs (~2,000' on center)	EA	12	$3,500.00	$ 42,000.00
	Pre-Cast Concrete Structures for ARVs	EA	12	$4,000.00	$ 48,000.00
	Flushout Assemblies	EA	4	$5,000.00	$ 20,000.00
	12" Butterfly Valve (~2,000 ft on center)	EA	12	$2,600.00	$ 31,200.00
	Fittings (~5% of water main costs)	LS	1	$95,000.00	$ 95,000.00
	Fire Hydrants (~2,000 ft on center)	EA	12	$5,500.00	$ 66,000.00
	Rock Excavation - open trench (~5% of water main length)	CY	480	$250.00	$ 120,000.00
	Service Reconnection	EA	60	$900.00	$ 54,000.00
	Geotechnical	LS	1	$15,000.00	$ 15,000.00
	Concrete Pavement	SY	200	$65.00	$ 13,000.00
	Granular Backfill (at 2 Road crossings)	CY	70	$55.00	$ 3,850.00
	Surveying	LS	1	$40,000.00	$ 40,000.00
	Site Restoration - Seeding	LS	1	$25,000.00	$ 25,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	60	$0.00	$ -

Construction:		$2,622,050.00
Inflation (%/yrs):	5% 1	$ 2,753,152.50
Contingency (%):	15%	$ 412,972.88
Engineering Design (%):	8%	$ 220,252.20
Engineering Construction (%):	4%	$ 110,126.10
Land Acquisition / Easements :		$ -
Total Project Cost (Year 2009):		$ 3,496,503.68

TOTAL PROJECT COST (YEAR 2009): $3,497,000.00

Heller Road - 16" main from Stephens Station Twr to East Mt. Hope Rd & N. Kircher Rd.

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (Approx. 3% of construction)	LS	1	$104,000.00	$ 104,000.00
	Water Mains				
	16" DIP Water Line (open excavation)	LF	16700	$100.00	$ 1,670,000.00
	Tie-in for 16"	EA	2	$8,400.00	$ 16,800.00
	ARVs (~2000' on center)	EA	8	$3,500.00	$ 28,000.00
	Pre-Cast Concrete Structures for ARVs	EA	8	$4,000.00	$ 32,000.00
	16" Butterfly Valve (~2000' on center)	EA	8	$3,600.00	$ 28,800.00
	Fittings (~7% of water main cost)	LS	1	$116,000.00	$ 116,000.00
	Fire Hydrants (~2000' on center)	EA	8	$5,500.00	$ 44,000.00
	Rock Excavation - open trench (~5% of water main length)	CY	500	$250.00	$ 125,000.00
	Geotechnical	LS	1	$25,000.00	$ 25,000.00
	Concrete Pavement	SY	150	$65.00	$ 9,750.00
	Granular Backfill	CY	45	$55.00	$ 2,475.00
	Surveying	LS	1	$30,000.00	$ 30,000.00
	Site Restoration - Seeding	LS	1	$25,000.00	$ 25,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	15	$0.00	$ -

Note: Original CIP length 12,000 feet

Construction:			$2,256,825.00
Inflation (%/yrs):	5%	3	$ 355,732.04
Contingency (%):		15%	$ 338,523.75
Engineering Design (%):		8%	$ 209,004.56
Engineering Construction (%):		4%	$ 104,502.28
Land Acquisition / Easements :			$ -
Total Project Cost (2011):			$3,264,587.64

TOTAL PROJECT COST (2011): $3,265,000.00

6/26/2008

Hackberry 12" Main Extension from Rangeline to Oakland Gravel Rd.

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (Approx 3% of construction)	LS	1	$22,000.00	$ 22,000.00
	Water Mains				
	12" DIP Water Line (open excavation)	LF	5800	$75.00	$ 435,000.00
	Tie-in for 12"	EA	2	$6,500.00	$ 13,000.00
	Jack & Bore 12-inch	LF	250	$475.00	$ 118,750.00
	Dewatering	LS	1	$10,000.00	$ 10,000.00
	ARVs (~2000' on center)	EA	3	$3,500.00	$ 10,500.00
	Pre-Cast Concrete Structures for ARVs	EA	3	$4,000.00	$ 12,000.00
	12" Butterfly Valve (~2000' on center)	EA	4	$2,600.00	$ 10,400.00
	Fittings (~7% of water main cost)	LS	1	$25,000.00	$ 25,000.00
	Fire Hydrants (~2000' on center)	EA	3	$5,500.00	$ 16,500.00
	Rock Excavation - open trench (~5% of water main length)	CY	120	$250.00	$ 30,000.00
	Rock Excavation - Jack & Bore 12-inch (~5% of bore length)	LF	12	$480.00	$ 5,760.00
	Geotechnical	LS	1	$7,000.00	$ 7,000.00
	Concrete Pavement	SY	40	$65.00	$ 2,600.00
	Granular Backfill	CY	25	$55.00	$ 1,375.00
	Surveying	LS	1	$10,000.00	$ 10,000.00
	Site Restoration - Seeding	LS	1	$5,000.00	$ 5,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	6	$0.00	$ -

Construction:			$734,885.00
Inflation (%/yrs):	5%	2	$ 75,325.71
Contingency (%):		15%	$ 110,232.75
Engineering Design (%):		8%	$ 64,816.86
Engineering Construction (%):		4%	$ 32,408.43
Land Acquisition / Easements :			$ -
Total Project Cost (2010):			$1,017,668.75

TOTAL PROJECT COST (2010): $1,018,000.00

6/26/2008

3-5 yrs, #14
Mexico Gravel Road - Manchester Dr to Billy Jean Dr - Main Upgrade WT0179

Item No.	Description	Units	Quantity	Unit Price	Extension
1	Mobilization, Bonds, Insurance (Approx. 5% of Construction)	LS	1	$4,500.00	$ 4,500.00
	Water Mains				
2	8" DIP Water Line (open excavation)	LF	800	$50.00	$ 40,000.00
3	Tie-in for 8"	EA	2	$4,200.00	$ 8,400.00
4	8" Gate Valve	EA	2	$3,000.00	$ 6,000.00
5	Fittings (~10% of water main cost.)	LS	1	$3,600.00	$ 3,600.00
6	Fire Hydrants (flush new main)	EA	1	$5,500.00	$ 5,500.00
7	Rock Excavation - open trench (~5% of water main length)	CY	15	$250.00	$ 3,750.00
8	Geotechnical	LS	1	$2,500.00	$ 2,500.00
9	Surveying	LS	1	$2,500.00	$ 2,500.00
10	Site Restoration - Seeding	LS	0	$2,000.00	$ -
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

		Construction:	$81,750.00
Inflation (%/yrs):	5%	3	$ 12,885.84
Contingency (%):		15%	$ 12,262.50
Engineering Design (%):		8%	$ 7,570.87
Engineering Construction (%):		4%	$ 3,785.43
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2011):			$118,254.65

TOTAL PROJECT COST (YEAR 2011): $119,000.00

6/26/2008

1-2 yrs, #20
East Campus - Cliff Drive - Hawthorne to University - Close Loops WT0154

Item No.	Description	Units	Quantity	Unit Price	Extension
1	Mobilization, Bonds, Insurance (~3% of construction)	LS	1	$1,100.00	$ 1,100.00
	Water Mains				
2	6" DIP Water Line (open excavation)	LF	300	$40.00	$ 12,000.00
3	Tie-in for 6"	EA	2	$3,800.00	$ 7,600.00
4	6" Gate Valve	EA	2	$1,000.00	$ 2,000.00
5	Fittings (~10% of water main cost)	LS	1	$2,800.00	$ 2,800.00
6	Rock Excavation - open trench (~5% of water main length)	CY	10	$250.00	$ 2,500.00
7	Geotechnical	LS	1	$2,500.00	$ 2,500.00
8	Concrete Pavement	SY	10	$65.00	$ 650.00
9	Surveying	LS	1	$4,000.00	$ 4,000.00
10	Site Restoration - Seeding	LS	1	$2,500.00	$ 2,500.00

		Construction:	$37,650.00
Inflation (%/yrs):	5%	0	$ -
Contingency (%):		15%	$ 5,647.50
Engineering Design (%):		8%	$ 3,012.00
Engineering Construction (%):		4%	$ 1,506.00
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2008):			$47,815.50

TOTAL PROJECT COST (YEAR 2008): $48,000.00

6/3/2008

3-5 yrs, #9

East Campus - University Ave. - Ann St. to Rock Hill - Close Loops WT0193

Item No.	Description	Units	Quantity	Unit Price	Extension
1	Mobilization, Bonds, Insurance (~3% of construction)	LS	1	$2,100.00	$ 2,100.00
	Water Mains				
2	8" DIP Water Line (open excavation)	LF	630	$50.00	$ 31,500.00
3	Tie-in for 8"	EA	2	$4,200.00	$ 8,400.00
4	8" Gate Valve	EA	2	$3,000.00	$ 6,000.00
5	Fittings (~10% of water main cost)	LS	1	$2,800.00	$ 2,800.00
6	Fire Hydrants	EA	1	$5,500.00	$ 5,500.00
7	Rock Excavation - open trench (~5% of water main length)	CY	10	$250.00	$ 2,500.00
8	Geotechnical	LS	1	$4,000.00	$ 4,000.00
9	Concrete Pavement	SY	15	$65.00	$ 975.00
10	Surveying	LS	1	$5,000.00	$ 5,000.00
11	Site Restoration - Seeding	LS	1	$3,000.00	$ 3,000.00

		Construction:	$71,775.00
Inflation (%/yrs):	5%	2	$ 7,356.94
Contingency (%):		15%	$ 11,869.79
Engineering Design (%):		8%	$ 6,330.56
Engineering Construction (%):		4%	$ 3,165.28
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2010):			$100,497.56

TOTAL PROJECT COST (YEAR 2010): $101,000.00

6/3/2008

1-2 yrs #29
Highway 763 @ I-70 - Close Loops - WTO153

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3% of construction)	LS	1	$8,000.00	$ 8,000.00
	Water Mains				
	8" DIP Water Line (open excavation)	LF	450	$50.00	$ 22,500.00
	Tie-in for 8"	EA	2	$2,500.00	$ 5,000.00
	Jack & Bore 8-inch	LF	550	$335.00	$ 184,250.00
	Dewatering (NONE ANTICIPATED)	LS	0	$0.00	$ -
	ARVs	EA	1	$3,500.00	$ 3,500.00
	Pre-Cast Concrete Structures for ARVs	EA	1	$4,000.00	$ 4,000.00
	8" Butterfly Valve	EA	2	$1,700.00	$ 3,400.00
	Fittings	EA	4	$2,500.00	$ 10,000.00
	Fire Hydrants	EA	1	$5,500.00	$ 5,500.00
	Rock Excavation - open trench (5%)	CY	8	$250.00	$ 2,000.00
	Rock Excavation - Jack & Bore 8-inch (10%)	LF	55	$425.00	$ 23,375.00
	Service Connection (NONE)	EA	0	$0.00	$ -
	Service Reconnection (NONE)	EA	0	$0.00	$ -
	Geotechnical	LS	1	$5,000.00	$ 5,000.00
	Surveying	LS	1	$5,000.00	$ 5,000.00
	Site Restoration - Seeding	LS	1	$3,000.00	$ 3,000.00
	Site Restoration - Pavement (NONE)	LF	0	$0.00	$ -
	NUMBER OF PROPERTIES for EASEMENTS	EA	2	$0.00	$ -

Comments: Assumed total length of 1,000 linear feet of 8-inch DIP, as shown on map.

Construction:			$284,525.00
Inflation (%/yrs):	5%	1	$ 14,226.25
Contingency (%):		15%	$ 42,678.75
Engineering Design (%):		8%	$ 23,900.10
Engineering Construction (%):		4%	$ 11,950.05
Land Acquisition / Easements :			$ -
Total Project Cost (2009):			$377,280.15

TOTAL PROJECT COST (2009): $378,000.00

5/23/2008

1-2 yrs #44
Providence Rd. @ Stewart Rd. - Close Loop - WTO155

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3% of construction)	LS	1	$2,000.00	$ 2,000.00
	Water Mains				
	Tie-in for 8"	EA	2	$2,500.00	$ 5,000.00
	Jack & Bore 8-inch	LF	100	$335.00	$ 33,500.00
	Dewatering (MINOR - creek near jack and bore)	LS	1	$5,000.00	$ 5,000.00
	8" Butterfly Valve	EA	2	$1,700.00	$ 3,400.00
	Rock Excavation - Jack & Bore 8-inch (40%)	LF	40	$425.00	$ 17,000.00
	Service Reconnection	EA	3	$900.00	$ 2,700.00
	Geotechnical	LS	1	$1,500.00	$ 1,500.00
	Granular Backfill	CY	10	$55.00	$ 550.00
	Surveying	LS	1	$1,500.00	$ 1,500.00
	Site Restoration - Seeding	LS	1	$200.00	$ 200.00
	Site Restoration - Pavement	LS	1	$1,000.00	$ 1,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	2	$0.00	$ -

Comments: Assumed total length of 100 linear feet of 8-inch DIP, as shown on map.

		Construction:	$73,350.00
Inflation (%/yrs):	5%	1	$ 3,667.50
Contingency (%):		15%	$ 11,002.50
Engineering Design (%):		8%	$ 6,161.40
Engineering Construction (%):		4%	$ 3,080.70
Land Acquisition / Easements :			$ -
Total Project Cost (2009):			$97,262.10

TOTAL PROJECT COST (2009): $98,000.00

6/26/2008

1-2 yrs #48
Stadium Blvd. @ Bernadette Dr. - Close Loop - WTO156

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3% of construction)	LS	1	$2,500.00	$ 2,500.00
	Water Mains				
	6" DIP Water Line (open excavation)	LF	30	$40.00	$ 1,200.00
	Tie-in for 6"	EA	2	$2,200.00	$ 4,400.00
	Jack & Bore 6-inch	LF	200	$300.00	$ 60,000.00
	Dewatering (NONE ANTICIPATED)	LS	0	$0.00	$ -
	6" Butterfly Valve	EA	2	$1,700.00	$ 3,400.00
	Fittings	EA	3	$2,000.00	$ 6,000.00
	Rock Excavation - open trench (NONE ANTICIPATED)	CY	0	$0.00	$ -
	Rock Excavation - Jack & Bore 6-inch (NONE ANTICIPATED)	LF	0	$0.00	$ -
	Geotechnical	LS	1	$1,500.00	$ 1,500.00
	Granular Backfill	CY	10	$55.00	$ 550.00
	Surveying	LS	1	$2,000.00	$ 2,000.00
	Site Restoration - Seeding	LS	1	$200.00	$ 200.00
	Site Restoration - Pavement	LS	1	$3,500.00	$ 3,500.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	2	$0.00	$ -

Comments: Assumed total length of 230 linear feet of 6-inch DIP, as shown on map.

		Construction:	$85,250.00
Inflation (%/yrs):	5%	1	$ 4,262.50
Contingency (%):		15%	$ 12,787.50
Engineering Design (%):		8%	$ 7,161.00
Engineering Construction (%):		4%	$ 3,580.50
Land Acquisition / Easements :			$ -
Total Project Cost (2009):			$113,041.50

TOTAL PROJECT COST (2009): $114,000.00

6/26/2008

3-5 yrs, #10
Fairmont Dr. - Fieldcrest to Parkridge - Close Loops - WT0195

Item No.	Description	Units	Quantity	Unit Price	Extension
1	Mobilization, Bonds, Insurance (~5% of construction)	LS	1	$2,000.00	$ 2,000.00
	Water Mains				
2	6" DIP Water Line (open excavation)	LF	350	$40.00	$ 14,000.00
3	Tie-in for 6"	EA	2	$3,800.00	$ 7,600.00
4	6" Gate Valve	EA	2	$1,000.00	$ 2,000.00
5	Fittings (~10% of water main cost)	LS	1	$1,400.00	$ 1,400.00
6	Geotechnical	LS	1	$3,000.00	$ 3,000.00
7	Concrete Pavement	SY	30	$65.00	$ 1,950.00
8	Surveying	LS	1	$4,000.00	$ 4,000.00
9	Site Restoration - Seeding	LS	1	$2,000.00	$ 2,000.00

		Construction:	$37,950.00
Inflation (%/yrs):	5%	2	$ 3,889.88
Contingency (%):		15%	$ 5,692.50
Engineering Design (%):		8%	$ 3,347.19
Engineering Construction (%):		4%	$ 1,673.60
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2010):			$52,553.16

TOTAL PROJECT COST (YEAR 2010): $53,000.00

3-5 yrs, #11
Close Loop on Gilespie Bridge from Limestone to Longview - WT0194

Item No.	Description	Units	Quantity	Unit Price	Extension
1	Mobilization, Bonds, Insurance (~5% of construction)	LS	1	$5,500.00	$ 5,500.00
	Water Mains				
2	6" DIP Water Line (open excavation)	LF	800	$40.00	$ 32,000.00
3	Tie-in for 6"	EA	2	$3,800.00	$ 7,600.00
4	6" Gate Valve	EA	2	$1,000.00	$ 2,000.00
5	Fittings (~10% of water main cost)	LS	1	$3,200.00	$ 3,200.00
6	Fire Hydrants (one at each end)	EA	2	$5,500.00	$ 11,000.00
7	Rock Excavation - open trench (~5% of water main length)	CY	10	$250.00	$ 2,500.00
8	Geotechnical	LS	1	$5,000.00	$ 5,000.00
9	Concrete Pavement	SY	30	$65.00	$ 1,950.00
10	Surveying	LS	1	$7,500.00	$ 7,500.00
11	Site Restoration - Seeding	LS	1	$5,000.00	$ 5,000.00

Construction:			$83,250.00
Inflation (%/yrs):	5%	2	$ 8,533.13
Contingency (%):		15%	$ 12,487.50
Engineering Design (%):		8%	$ 7,342.65
Engineering Construction (%):		4%	$ 3,671.33
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2010):			$115,284.60

TOTAL PROJECT COST (YEAR 2010): $116,000.00

3-5 yrs #17
Smith Dr. - Silver Thorne to Scott Blvd. - Close Loops - WTO196

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3% of construction)	LS	1	$5,500.00	$ 5,500.00
	Water Mains				
	8" DIP Water Line (open excavation)	LF	2200	$50.00	$ 110,000.00
	Tie-in for 8"	EA	2	$2,500.00	$ 5,000.00
	Dewatering (MINOR)	LS	1	$2,000.00	$ 2,000.00
	ARVs	EA	1	$3,500.00	$ 3,500.00
	Pre-Cast Concrete Structures for ARVs	EA	1	$4,000.00	$ 4,000.00
	8" Butterfly Valve	EA	2	$1,700.00	$ 3,400.00
	Fittings	EA	3	$2,000.00	$ 6,000.00
	Fire Hydrants	EA	2	$5,500.00	$ 11,000.00
	Rock Excavation - open trench (5%)	CY	40	$250.00	$ 10,000.00
	Service Reconnection	EA	2	$900.00	$ 1,800.00
	Geotechnical	LS	1	$4,000.00	$ 4,000.00
	Surveying	LS	1	$5,000.00	$ 5,000.00
	Site Restoration - Seeding	LS	1	$2,000.00	$ 2,000.00
	Site Restoration - Pavement	LS	1	$5,000.00	$ 5,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	15	$0.00	$ -

Comments: Assumed total length of 2,200 linear feet of 8-inch DIP as shown on map.

		Construction:	$195,200.00
Inflation (%/yrs):	5%	3	$ 30,768.40
Contingency (%):		15%	$ 29,280.00
Engineering Design (%):		8%	$ 18,077.47
Engineering Construction (%):		4%	$ 9,038.74
Land Acquisition / Easements :			$ -
Total Project Cost (2011):			$282,364.61

TOTAL PROJECT COST (2011): $283,000.00

1-2 yrs #32
Loop Closure of 16" Mains South of Nifong Blvd. - WTO139

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3% of construction)	LS	1	$24,000.00	$ 24,000.00
	Water Mains				
	16" DIP Water Line (open excavation)	LF	7500	$100.00	$ 750,000.00
	Tie-in for 16"	EA	2	$8,400.00	$ 16,800.00
	Dewatering (ponds nearby)	LS	1	$45,000.00	$ 45,000.00
	ARVs	EA	1	$3,500.00	$ 3,500.00
	Pre-Cast Concrete Structures for ARVs	EA	1	$4,000.00	$ 4,000.00
	16" Butterfly Valve	EA	2	$3,600.00	$ 7,200.00
	Fittings	EA	6	$2,500.00	$ 15,000.00
	Fire Hydrants	EA	2	$5,500.00	$ 11,000.00
	Rock Excavation - open trench (5%)	CY	230	$250.00	$ 57,500.00
	Service Reconnection	EA	2	$900.00	$ 1,800.00
	Geotechnical	LS	1	$5,000.00	$ 5,000.00
	Surveying	LS	1	$12,000.00	$ 12,000.00
	Site Restoration - Seeding	LS	1	$4,000.00	$ 4,000.00
	Site Restoration - Pavement	LS	1	$7,000.00	$ 7,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	23	$0.00	$ -

		Construction:	$963,800.00
Inflation (%/yrs):	5%	1	$ 48,190.00
Contingency (%):		15%	$ 144,570.00
Engineering Design (%):		8%	$ 80,959.20
Engineering Construction (%):		4%	$ 40,479.60
Land Acquisition / Easements :			$ -
Total Project Cost (2009):			$1,277,998.80

TOTAL PROJECT COST (YEAR 2009): $1,278,000.00

6/3/2008

APPENDIX 3

Cost Estimates
Year 2018

16" Transmission Main from New West Ash Pump Station

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3% of construction)	LS	1	$140,000.00	$ 140,000.00
	Water Mains				
	16" DIP Water Line (open excavation)	LF	29500	$100.00	$ 2,950,000.00
	Tie-in for 16"	EA	2	$8,400.00	$ 16,800.00
	Jack & Bore 16-inch	LF	800	$675.00	$ 540,000.00
	Dewatering	LS	1	$25,000.00	$ 25,000.00
	ARVs (every 4,000 ft)	EA	8	$3,500.00	$ 28,000.00
	Pre-Cast Concrete Structures for ARVs	EA	8	$4,000.00	$ 32,000.00
	Flushout Assemblies	EA	8	$5,000.00	$ 40,000.00
	16" Gate Valve (every 4,000 ft plus 2 on each end)	EA	12	$12,000.00	$ 144,000.00
	Fittings	LS	2	$15,000.00	$ 30,000.00
	Rock Excavation - open trench (10%)	CY	2700	$250.00	$ 675,000.00
	Rock Excavation - Jack & Bore 16-inch (20%)	LF	160	$540.00	$ 86,400.00
	Geotechnical	LS	1	$20,000.00	$ 20,000.00
	Surveying	LS	1	$75,000.00	$ 75,000.00
	Site Restoration - Seeding	LS	1	$20,000.00	$ 20,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

Was told that this is lot of rock in this area

		Construction:	$4,822,200.00
Inflation (%/yrs):	5%	9	$ 7,480,814.92
Contingency (%):		15%	$ 1,122,122.24
Engineering Design (%):		8%	$ 598,465.19
Engineering Construction (%):		4%	$ 299,232.60
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2017):			$ 9,500,634.95

TOTAL PROJECT COST (YEAR 2017): $9,501,000.00

New 2 MG Elevated Tank
at Existing Prathersville Site

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (indicate quantity as % of construction)	LS	1	$120,000.00	$ 120,000.00
	Elevated Tank				
	2.0 MG Fluted Column Elevated Storage Tank	LS	1	$3,500,000.00	$ 3,500,000.00
	Telemetry/Control System/Electrical	LS	1	$150,000.00	$ 150,000.00
	Lighting	LS	1	$80,000.00	$ 80,000.00
	Dual Piping for Tank Inlet and Outlet				
	Valve vault and valving	LS	1	$150,000.00	$ 150,000.00
	Sitework				
	Fencing (~ 1 Acre Site)	LF	1000	$15.00	$ 15,000.00
	Standard Gate	EA	1	$50,000.00	$ 50,000.00
	Gravel Access Road (100 ft x 20 ft)	SF	2000	$5.00	$ 10,000.00
	Geotechnical	LS	1	$10,000.00	$ 10,000.00
	Surveying	LS	1	$10,000.00	$ 10,000.00
	Site Restoration - Seeding	LS	1	$5,000.00	$ 5,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	1	$0.00	$ -

Construction:			$4,100,000.00
Inflation (%/yrs):	5%	8	$ 6,057,567.32
Contingency (%):		15%	$ 908,635.10
Engineering Design (%):		8%	$ 484,605.39
Engineering Construction (%):		4%	$ 242,302.69
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2016):			$ 7,693,110.50

TOTAL PROJECT COST (YEAR 2016): $7,694,000.00

New Pump Station at West Ash Site

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (indicate quantity as % of construction)	LS	1	$60,000.00	$ 60,000.00
	Booster Pump Station				
	7.2 MGD Booster Pump Station (Turnkey)	LS	1	$1,100,000.00	$ 1,100,000.00
	Telemetry/Control System/Electrical	LS	1	$120,000.00	$ 120,000.00
	Package Generator	LS	1	$65,000.00	$ 65,000.00
	Sitework				
	Standard Security Gate	EA	1	$50,000.00	$ 50,000.00
	Security Fencing	LF	500	$150.00	$ 75,000.00
	Water Mains				
	16" DIP Water Line (open excavation)	LF	200	$100.00	$ 20,000.00
	Tie-in for 16"	EA	1	$8,400.00	$ 8,400.00
	Fittings	LS	2	$25,000.00	$ 50,000.00
	Earthwork (Sitework related to Booster Pump Station)	CY	400	$45.00	$ 18,000.00
	Gravel Access Road (100 ft x 20 ft)	SF	2000	$5.00	$ 10,000.00
	Geotechnical	LS	1	$5,000.00	$ 5,000.00
	Concrete Pavement	SY	200	$65.00	$ 13,000.00
	Granular Backfill	CY	200	$55.00	$ 11,000.00
	Surveying	LS	1	$10,000.00	$ 10,000.00
	Site Restoration - Seeding	LS	1	$10,000.00	$ 10,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

		Construction:	$1,625,400.00
Inflation (%/yrs):	5%	10	$ 2,647,605.33
		Contingency (%): 15%	$397,140.80
		Engineering Design (%): 8%	$211,808.43
		Engineering Construction (%): 4%	$ 105,904.21
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2018):	$ 3,362,458.76

TOTAL PROJECT COST (YEAR 2018): $3,363,000.00

APPENDIX 4

Cost Estimates
Year 2023

Ground Storage at Hillsdale - 2023 Scenario

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$45,000.00	$ 45,000.00
	Ground Storage Tank				
	3.0 MG Concrete Ground Storage Tank	LS	1	$1,240,000.00	$ 1,240,000.00
	Telemetry/Control System/Electrical - for Vault	LS	1	$20,000.00	$ 20,000.00
	Vault for GS Tank Inlet and Outlet				
	Valve vault and valving	LS	1	$150,000.00	$ 150,000.00
	Water Mains				
	18" DIP Water Line (open excavation) - to GS Tank	LF	50	$100.00	$ 5,000.00
	18" DIP Water Line (open excavation) - from GS Tank	LF	100	$100.00	$ 10,000.00
	Fittings (90 bends)	LS	2	$5,000.00	$ 10,000.00
	Rock Excavation - open trench - NONE ANTICIPATED	CY	0	$250.00	$ -
	Geotechnical (use previous data)	LS	0	$5,000.00	$ -
	Surveying	LS	1	$5,000.00	$ 5,000.00
	Site Restoration - Seeding	LS	1	$2,000.00	$ 2,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

Tank quote from Natgun - 6/29/04 of $1,020,000 for 3 MG Concrete.
Added 5% inflation for 4 years to get to 2008 dollars.

		Construction:	$1,487,000.00
Inflation (%/yrs):	5%	15	$ 3,091,366.20
		Contingency (%): 15%	$ 463,704.93
		Engineering Design (%): 7%	$ 216,395.63
		Engineering Construction (%): 3%	$ 92,740.99
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2023):	$ 3,864,207.75

TOTAL PROJECT COST (YEAR 2023): $3,865,000.00

New Southeast Pump Station

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (indicate quantity as % of construction)	LS	1	$60,000.00	$ 60,000.00
	Booster Pump Station				
	7.2 MGD Booster Pump Station (Turnkey)	LS	1	$1,100,000.00	$ 1,100,000.00
	Telemetry/Control System/Electrical	LS	1	$120,000.00	$ 120,000.00
	Package Generator	LS	1	$65,000.00	$ 65,000.00
	Sitework				
	Standard Security Gate	EA	1	$50,000.00	$ 50,000.00
	Security Fencing	LF	500	$150.00	$ 75,000.00
	Water Mains				
	24" DIP Water Line (open excavation)	LF	200	$210.00	$ 42,000.00
	Tie-in for 24"	EA	1	$11,500.00	$ 11,500.00
	Fittings	LS	2	$25,000.00	$ 50,000.00
	Earthwork (Sitework related to Booster Pump Station)	CY	400	$45.00	$ 18,000.00
	Gravel Access Road (100 ft x 20 ft)	SF	2000	$5.00	$ 10,000.00
	Geotechnical	LS	1	$5,000.00	$ 5,000.00
	Concrete Pavement	SY	200	$65.00	$ 13,000.00
	Granular Backfill	CY	200	$55.00	$ 11,000.00
	Surveying	LS	1	$10,000.00	$ 10,000.00
	Site Restoration - Seeding	LS	1	$10,000.00	$ 10,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

		Construction:	$1,650,500.00
Inflation (%/yrs):	5%	11	$ 2,822,915.11
		Contingency (%): 15%	$423,437.27
		Engineering Design (%): 8%	$225,833.21
		Engineering Construction (%): 4%	$ 112,916.60
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2019):	$ 3,585,102.19

TOTAL PROJECT COST (YEAR 2019): $3,586,000.00

7/10/2008

Ground Storage at New SE Pump Station - 2023 Scenario

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$36,000.00	$ 36,000.00
	Ground Storage Tank				
	2.0 MG Concrete Ground Storage Tank	LS	1	$960,000.00	$ 960,000.00
	Telemetry/Control System/Electrical - for Vault	LS	1	$20,000.00	$ 20,000.00
	Vault for GS Tank Inlet and Outlet				
	Valve vault and valving	LS	1	$150,000.00	$ 150,000.00
	Water Mains				
	18" DIP Water Line (open excavation) - to GS Tank	LF	50	$100.00	$ 5,000.00
	18" DIP Water Line (open excavation) - from GS Tank	LF	100	$100.00	$ 10,000.00
	Fittings (90 bends)	LS	2	$5,000.00	$ 10,000.00
	Rock Excavation - open trench (20%)	CY	40	$250.00	$ 10,000.00
	Geotechnical	LS	1	$10,000.00	$ 10,000.00
	Surveying	LS	1	$10,000.00	$ 10,000.00
	Site Restoration - Seeding	LS	1	$5,000.00	$ 5,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

Tank quote from Natgun - 10/22/04 of $785,000 for 2 MG Concrete
Added 5% inflation for 4 years to get to 2008 dollars

		Construction:	$1,226,000.00
Inflation (%/yrs):	5%	11	$ 2,096,876.05
		Contingency (%): 15%	$ 314,531.41
		Engineering Design (%): 7%	$ 146,781.32
		Engineering Construction (%): 3%	$ 62,906.28
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2019):	$ 2,621,095.07

TOTAL PROJECT COST (YEAR 2019): $2,622,000.00

24" Transmission Main from New Southeast Pump Station

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3% of construction)	LS	1	$60,000.00	$ 60,000.00
	Water Mains				
	24" DIP Water Line (open excavation)	LF	7200	$210.00	$ 1,512,000.00
	Tie-in for 24"	EA	2	$11,500.00	$ 23,000.00
	Jack & Bore 24-inch	LF	100	$715.00	$ 71,500.00
	ARVs	EA	2	$3,500.00	$ 7,000.00
	Pre-Cast Concrete Structures for ARVs	EA	2	$4,000.00	$ 8,000.00
	Flushout Assemblies	EA	2	$5,000.00	$ 10,000.00
	24" Gate Valve	EA	5	$15,000.00	$ 75,000.00
	Fittings	LS	3	$15,000.00	$ 45,000.00
	Rock Excavation - open trench (5%)	CY	430	$250.00	$ 107,500.00
	Rock Excavation - Jack & Bore 24-inch (10%)	LF	10	$600.00	$ 6,000.00
	Geotechnical	LS	1	$10,000.00	$ 10,000.00
	Surveying	LS	1	$40,000.00	$ 40,000.00
	Site Restoration - Seeding	LS	1	$10,000.00	$ 10,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	6	$0.00	$ -

		Construction:	$1,985,000.00
Inflation (%/yrs):	5%	12	$ 3,564,774.81
Contingency (%):		15%	$ 534,716.22
Engineering Design (%):		8%	$ 285,181.98
Engineering Construction (%):		4%	$ 142,590.99
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2020):			$ 4,527,264.01

TOTAL PROJECT COST (YEAR 2020): $4,528,000.00

7/10/2008

New Hillsdale Pump Station

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$40,000.00	$ 40,000.00
	Booster Pump Station				
	6.5 MGD Booster Pump Station (Turnkey)	LS	1	$1,000,000.00	$ 1,000,000.00
	Telemetry/Control System/Electrical	LS	1	$120,000.00	$ 120,000.00
	Package Generator	LS	1	$65,000.00	$ 65,000.00
	Sitework				
	Standard Security Gate	EA	0	$50,000.00	$ -
	Security Fencing	LF	0	$150.00	$ -
	Water Mains				
	24" DIP Water Line (open excavation)	LF	200	$210.00	$ 42,000.00
	Tie-in for 24"	EA	1	$11,500.00	$ 11,500.00
	Fittings	LS	1	$25,000.00	$ 25,000.00
	Earthwork (Sitework related to Booster Pump Station)	CY	200	$45.00	$ 9,000.00
	Gravel Access Road (100 ft x 20 ft)	SF	0	$5.00	$ -
	Geotechnical	LS	1	$5,000.00	$ 5,000.00
	Concrete Pavement	SY	100	$65.00	$ 6,500.00
	Granular Backfill	CY	100	$55.00	$ 5,500.00
	Surveying	LS	1	$10,000.00	$ 10,000.00
	Site Restoration - Seeding	LS	1	$10,000.00	$ 10,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

Construction:			$1,349,500.00
Inflation (%/yrs):	5%	15	$ 2,805,513.58
Contingency (%):		15%	$420,827.04
Engineering Design (%):		8%	$224,441.09
Engineering Construction (%):		4%	$ 112,220.54
Land Acquisition / Easements :			$ -
Total Project Cost (Year 2023):			$ 3,563,002.24

TOTAL PROJECT COST (YEAR 2023): $3,564,000.00

7/10/2008

APPENDIX 5

Cost Estimates
Year 2028

Ground Storage at New SE Pump Station - 2028 Scenario

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$36,000.00	$ 36,000.00
	Ground Storage Tank				
	2.0 MG Concrete Ground Storage Tank	LS	1	$960,000.00	$ 960,000.00
	Telemetry/Control System/Electrical - for Vault	LS	1	$20,000.00	$ 20,000.00
	Vault for GS Tank Inlet and Outlet				
	Valve vault and valving	LS	1	$150,000.00	$ 150,000.00
	Water Mains				
	18" DIP Water Line (open excavation) - to GS Tank	LF	50	$100.00	$ 5,000.00
	18" DIP Water Line (open excavation) - from GS Tank	LF	100	$100.00	$ 10,000.00
	Fittings (90 bends)	LS	2	$5,000.00	$ 10,000.00
	Rock Excavation - open trench (20%)	CY	40	$250.00	$ 10,000.00
	Geotechnical (use previous from 2023)	LS	0	$10,000.00	$ -
	Surveying	LS	1	$10,000.00	$ 10,000.00
	Site Restoration - Seeding	LS	1	$5,000.00	$ 5,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

Tank quote from Natgun - 10/22/04 of $785,000 for 2 MG Concrete.
Added 5% inflation for 4 years to get to 2008 dollars.

		Construction:	$1,216,000.00
Inflation (%/yrs):	5%	16	$ 2,654,375.50
		Contingency (%): 15%	$ 398,156.32
		Engineering Design (%): 7%	$ 185,806.28
		Engineering Construction (%): 3%	$ 79,631.26
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2024):	$ 3,317,969.37

TOTAL PROJECT COST (YEAR 2024): $3,318,000.00

Ground Storage at New West Ash Pump Station - 2028 Scenario

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$36,000.00	$ 36,000.00
	Ground Storage Tank				
	2.0 MG Concrete Ground Storage Tank	LS	1	$960,000.00	$ 960,000.00
	Telemetry/Control System/Electrical - for Vault	LS	1	$20,000.00	$ 20,000.00
	Vault for GS Tank Inlet and Outlet				
	Valve vault and valving	LS	1	$150,000.00	$ 150,000.00
	Water Mains				
	18" DIP Water Line (open excavation) - to GS Tank	LF	50	$100.00	$ 5,000.00
	18" DIP Water Line (open excavation) - from GS Tank	LF	100	$100.00	$ 10,000.00
	Fittings (90 bends)	LS	2	$5,000.00	$ 10,000.00
	Rock Excavation - open trench (20%)	CY	40	$250.00	$ 10,000.00
	Geotechnical	LS	1	$10,000.00	$ 10,000.00
	Surveying	LS	1	$10,000.00	$ 10,000.00
	Site Restoration - Seeding	LS	1	$5,000.00	$ 5,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	0	$0.00	$ -

Tank quote from Natgun - 10/22/04 of $785,000 for 2 MG Concrete.
Added 5% inflation for 4 years to get to 2008 dollars.

		Construction:	$1,226,000.00
Inflation (%/yrs):	5%	17	$ 2,810,014.46
		Contingency (%): 15%	$ 421,502.17
		Engineering Design (%): 7%	$ 196,701.01
		Engineering Construction (%): 3%	$ 84,300.43
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2025):	$ 3,512,518.07

TOTAL PROJECT COST (YEAR 2025): $3,513,000.00

Additional 24" Transmission Main from Shepard to Hillsdale

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$98,000.00	$ 98,000.00
	Water Mains				
	24" DIP Water Line (open excavation)	LF	11500	$210.00	$ 2,415,000.00
	Tie-in for 24" (new connection at Shepard)	EA	2	$11,500.00	$ 23,000.00
	Jack & Bore 24-inch	LF	500	$715.00	$ 357,500.00
	Dewatering	LS	1	$5,000.00	$ 5,000.00
	ARVs	EA	6	$3,500.00	$ 21,000.00
	Pre-Cast Concrete Structures for ARVs	EA	6	$4,000.00	$ 24,000.00
	Flushout Assemblies	EA	3	$5,000.00	$ 15,000.00
	24" Gate Valve	EA	8	$15,000.00	$ 120,000.00
	Fittings	LS	2	$15,000.00	$ 30,000.00
	Rock Excavation - open trench (5%)	CY	680	$250.00	$ 170,000.00
	Rock Excavation - Jack & Bore 24-inch (10%)	LF	50	$600.00	$ 30,000.00
	Geotechnical	LS	1	$10,000.00	$ 10,000.00
	Surveying	LS	1	$50,000.00	$ 50,000.00
	Site Restoration - Seeding	LS	1	$10,000.00	$ 10,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	25	$0.00	$ -

		Construction:	$3,378,500.00
Inflation (%/yrs):	5%	19	$ 8,537,301.24
		Contingency (%): 15%	$ 1,280,595.19
		Engineering Design (%): 8%	$ 682,984.10
		Engineering Construction (%): 4%	$ 341,492.05
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2027):	$ 10,842,372.57

TOTAL PROJECT COST (YEAR 2027): $10,843,000.00

7/10/2008

16" Transmission Main from Grindstone Pkwy to Shepard

Item No.	Description	Units	Quantity	Unit Price	Extension
	Mobilization, Bonds, Insurance (3 % of construction)	LS	1	$70,000.00	$ 70,000.00
	Water Mains				
	16" DIP Water Line (open excavation)	LF	10200	$100.00	$ 1,020,000.00
	Tie-in for 16"	EA	2	$8,400.00	$ 16,800.00
	Jack & Bore 16-inch	LF	1200	$675.00	$ 810,000.00
	Dewatering	LS	1	$25,000.00	$ 25,000.00
	ARVs	EA	4	$3,500.00	$ 14,000.00
	Pre-Cast Concrete Structures for ARVs	EA	4	$4,000.00	$ 16,000.00
	Flushout Assemblies	EA	2	$5,000.00	$ 10,000.00
	16" Butterfly Valve	EA	8	$3,600.00	$ 28,800.00
	Fittings	LS	2	$15,000.00	$ 30,000.00
	Rock Excavation - open trench (5%)	CY	600	$250.00	$ 150,000.00
	Rock Excavation - Jack & Bore 24-inch (10%)	LF	120	$600.00	$ 72,000.00
	Geotechnical	LS	1	$10,000.00	$ 10,000.00
	Surveying	LS	1	$50,000.00	$ 50,000.00
	Site Restoration - Seeding	LS	1	$10,000.00	$ 10,000.00
	NUMBER OF PROPERTIES for EASEMENTS	EA	2	$0.00	$ -

		Construction:	$2,332,600.00
Inflation (%/yrs):	5%	20	$ 6,189,082.23
		Contingency (%): 15%	$ 928,362.33
		Engineering Design (%): 7%	$ 433,235.76
		Engineering Construction (%): 3%	$ 185,672.47
		Land Acquisition / Easements :	$ -
		Total Project Cost (Year 2028):	$ 7,736,352.78

TOTAL PROJECT COST (YEAR 2028): $7,737,000.00

7/10/2008

TABLE 6-1: COST SUMMARY BY YEAR

City of Columbia, MO

Long Range Water System Study

Project #	Project Description	Total	Construction Estimate	All Years	Year 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Pump Stations		$ 10,513,000													
N/A	New Pump Station at West Ash Site		$3,363,000	$ 3,363,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 200,000	$ 3,163,000
N/A	New Southeast Pump Station		$3,586,000	$ 3,586,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 200,000
N/A	New Pump Station at Hillsdale Site		$3,564,000	$ 3,564,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Storage		$ 22,451,000													
WT0207	Ground Storage at Hillsdale PS - 1.5MG Tank		$1,439,000	$ 1,439,000	$ -	$ 1,439,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Prathersville - 2 MG Elevated Storage (Replace Ex. Standpipe)		$7,694,000	$ 7,694,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 300,000	$ 2,500,000	$ 4,894,000	$ -	$ -
N/A	Ground Storage at Hillsdale PS - 3 MG Tank (2023 Scenario)		$3,865,000	$ 3,865,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Ground Storage at New Southeast Pump Station - 2 MG Tank (2023 Scenario)		$2,622,000	$ 2,622,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Ground Storage at New Southeast Pump Station - 2 MG Tank (2028 Scenario)		$3,318,000	$ 3,318,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Ground Storage at New West Ash Pump Station - 2 MG Tank (2028 Scenario)		$3,513,000	$ 3,513,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Other Improvements		$ 1,490,000													
WT0134	Drill Alluvial Well #16		$315,000	$ 315,000	$ -	$ 315,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0138	Drill Alluvial Wells #17 and #18		$700,000	$ 700,000	$ -	$ -	$ 700,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0140	ASR #3 - Conversion of Existing Deep Well		$475,000	$ 475,000	$ -	$ -	$ 475,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Water Mains		$ 74,087,750													
WT0136	North Section of 24" East Transmission Main		$4,494,000	$ 4,494,000	$ -	$ 630,000	$ 3,864,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0137	South Section of 24" East Transmission Main		$6,701,000	$ 6,701,000	$ -	$ 370,000	$ -	$ 4,500,000	$ 1,831,000	$ -	$ -	$ -	$ -	$ -	$ -
WT0171	Route PP Main Upgrade - 25,000' of 12" Main		$3,497,000	$ 3,497,000	$ -	$ -	$ 1,748,500	$ 1,748,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0209	Heller Road (E) - 16" Main		$3,265,000	$ 3,265,000	$ -	$ -	$ -	$ 200,000	$ 3,065,000	$ -	$ -	$ -	$ -	$ -	$ -
WT0208	Hackberry - 6,000' of 12" Main		$1,018,000	$ 1,018,000	$ -	$ 1,018,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0175	Locust Street from 6th Street to 8th Street - Main Upgrade		$93,000	$ 93,000	$ -	$ -	$ 93,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0173	Locust Street from Hitt Street to Waugh Street - Main Upgrade		$75,000	$ 75,000	$ -	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0176	Paquin Avenue from Hitt Street to College Avenue - Main Upgrade		$150,000	$ 150,000	$ -	$ -	$ 150,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0172	Providence Road from Broadway to Locust Street - Main Upgrade		$160,000	$ 160,000	$ -	$ 160,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0177	Sixth Street from Broadway to Elm Street - Main Upgrade		$201,250	$ 201,250	$ -	$ -	$ 201,250	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0171	Thompson Road from Creve Coeur Drive to Highway PP - Main Upgrade		$265,000	$ 265,000	$ -	$ 265,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0181	Walnut Street from Providence Road to 6th Street - Main Upgrade		$166,250	$ 166,250	$ -	$ -	$ -	$ -	$ 166,250	$ -	$ -	$ -	$ -	$ -	$ -
WT0180	Waugh Street from Locust Street to Paquin Street - Main Upgrade		$97,500	$ 97,500	$ -	$ -	$ -	$ -	$ 97,500	$ -	$ -	$ -	$ -	$ -	$ -
WT0179	Mexico Gravel Road from Manchester Drive to Billie Jean Drive - Main Upgrade		$119,000	$ 119,000	$ -	$ -	$ -	$ 119,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0183	Fifth Street from Ash Street to Hickman Road - Main Upgrade		$236,250	$ 236,250	$ -	$ -	$ -	$ -	$ 236,250	$ -	$ -	$ -	$ -	$ -	$ -

TABLE 6-1: COST SUMMARY BY YEAR

City of Columbia, MO

Long Range Water System Study

Project #	Project Description	Total	Construction Estimate	All Years	Year 2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Pump Stations		$ 10,513,000												
N/A	New Pump Station at West Ash Site		$3,363,000	$ 3,363,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	New Southeast Pump Station		$3,586,000	$ 3,586,000	$ 3,386,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	New Pump Station at Hillsdale Site		$3,564,000	$ 3,564,000	$ -	$ -	$ -	$ 200,000	$ 3,364,000	$ -	$ -	$ -	$ -	$ -
Storage		$ 22,451,000												
WT0207	Ground Storage at Hillsdale PS - 1.5MG Tank		$1,439,000	$ 1,439,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Prathersville - 2 MG Elevated Storage (Replace Ex. Standpipe)		$7,694,000	$ 7,694,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Ground Storage at Hillsdale PS - 3 MG Tank (2023 Scenario)		$3,865,000	$ 3,865,000	$ -	$ -	$ -	$ -	$ 3,865,000	$ -	$ -	$ -	$ -	$ -
N/A	Ground Storage at New Southeast Pump Station - 2 MG Tank (2023 Scenario)		$2,622,000	$ 2,622,000	$ 2,622,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Ground Storage at New Southeast Pump Station - 2 MG Tank (2028 Scenario)		$3,318,000	$ 3,318,000	$ -	$ -	$ -	$ -	$ -	$ 3,318,000	$ -	$ -	$ -	$ -
N/A	Ground Storage at New West Ash Pump Station - 2 MG Tank (2028 Scenario)		$3,513,000	$ 3,513,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,513,000	$ -	$ -	$ -
Other Improvements		$ 1,490,000												
WT0134	Drill Alluvial Well #16		$315,000	$ 315,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0138	Drill Alluvial Wells #17 and #18		$700,000	$ 700,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0140	ASR #3 - Conversion of Existing Deep Well		$475,000	$ 475,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Water Mains		$ 74,087,750												
WT0136	North Section of 24" East Transmission Main		$4,494,000	$ 4,494,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0137	South Section of 24" East Transmission Main		$6,701,000	$ 6,701,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0171	Route PP Main Upgrade - 25,000' of 12" Main		$3,497,000	$ 3,497,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0209	Heller Road (E) - 16" Main		$3,265,000	$ 3,265,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0208	Hackberry - 6,000' of 12" Main		$1,018,000	$ 1,018,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0175	Locust Street from 6th Street to 8th Street - Main Upgrade		$93,000	$ 93,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0173	Locust Street from Hitt Street to Waugh Street - Main Upgrade		$75,000	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0176	Paquin Avenue from Hitt Street to College Avenue - Main Upgrade		$150,000	$ 150,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0172	Providence Road from Broadway to Locust Street - Main Upgrade		$160,000	$ 160,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0177	Sixth Street from Broadway to Elm Street - Main Upgrade		$201,250	$ 201,250	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0171	Thompson Road from Creve Coeur Drive to Highway PP - Main Upgrade		$265,000	$ 265,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0181	Walnut Street from Providence Road to 6th Street - Main Upgrade		$166,250	$ 166,250	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0180	Waugh Street from Locust Street to Paquin Street - Main Upgrade		$97,500	$ 97,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0179	Mexico Gravel Road from Manchester Drive to Billie Jean Drive - Main Upgrade		$119,000	$ 119,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0183	Fifth Street from Ash Street to Hickman Road - Main Upgrade		$236,250	$ 236,250	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

TABLE 6-1: COST SUMMARY BY YEAR

City of Columbia, MO

Long Range Water System Study

Project #	Project Description	Total	Construction Estimate	All Years	Year 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
WT0182	Park Avenue from Providence Road to 8th Street - Main Upgrade		$297,500	$ 297,500	$ -	$ -	$ -	$ -	$ 297,500	$ -	$ -	$ -	$ -	$ -	$ -
N/A	16" Transmission Main from New West Ash Pump Station		$9,501,000	$ 9,501,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500,000	$ 5,000,000	$ 4,001,000	$ -
N/A	24" Transmission Main from Hillsdale to Stephens Station Tank		$18,174,000	$ 18,174,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	24" Transmission Main from New Southeast Pump Station		$4,528,000	$ 4,528,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Additional 24" Transmission Main from Shepard Tank to Hillsdale Station		$10,843,000	$ 10,843,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Additional 16" Transmission Main from Grindstone Pkwy to Shepard Tank		$7,737,000	$ 7,737,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Loop Closures															
WT0154	Cliff Drive from Hawthorne Drive to University Avenue		$48,000	$ 48,000	$ -	$ 48,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0193	University Avenue from Ann Street to Rock Hill Road		$101,000	$ 101,000	$ -	$ -	$ -	$ 101,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0153	Highway 763 & I-70 - Close Loops		$378,000	$ 378,000	$ -	$ 378,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0155	Providence Road at Stewart - Close Loops		$98,000	$ 98,000	$ -	$ -	$ 98,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0156	Stadium Blvd at Bernadette - Close Loops		$114,000	$ 114,000	$ -	$ -	$ 114,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0195	Fairmont Drive - FieldCrest to Parkridge - Close Loops		$53,000	$ 53,000	$ -	$ -	$ -	$ 53,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0194	Gillespie Bridge Road - Limestone to Longview - Close Loops		$116,000	$ 116,000	$ -	$ -	$ -	$ 116,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0196	Smith Drive - Silver Thorne to Scott Blvd - Close Loops		$283,000	$ 283,000	$ -	$ -	$ -	$ -	$ 283,000	$ -	$ -	$ -	$ -	$ -	$ -
WT0139	Loop Closure of 16" Mains South of Nifong		$1,278,000	$ 1,278,000	$ -	$ 1,278,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total		$ 108,541,750	$ 108,541,750	$ 108,541,750	$ -	$ 5,976,000	$ 7,443,750	$ 6,837,500	$ 5,976,500	$ -	$ 300,000	$ 3,000,000	$ 9,894,000	$ 4,201,000	$ 3,363,000

TABLE 6-1: COST SUMMARY BY YEAR

City of Columbia, MO

Long Range Water System Study

Project #	Project Description	Total	Construction Estimate	All Years	Year 2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
WT0182	Park Avenue from Providence Road to 8th Street - Main Upgrade		$297,500	$ 297,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	16" Transmission Main from New West Ash Pump Station		$9,501,000	$ 9,501,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	24" Transmission Main from Hillsdale to Stephens Station Tank		$18,174,000	$ 18,174,000	$ -	$ 1,000,000	$ 8,500,000	$ 8,674,000	$ -	$ -	$ -	$ -	$ -	$ -
N/A	24" Transmission Main from New Southeast Pump Station		$4,528,000	$ 4,528,000	$ 250,000	$ 4,278,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
N/A	Additional 24" Transmission Main from Shepard Tank to Hillsdale Station		$10,843,000	$ 10,843,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 650,000	$ 8,000,000	$ 2,193,000
N/A	Additional 16" Transmission Main from Grindstone Pkwy to Shepard Tank		$7,737,000	$ 7,737,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 400,000	$ 7,337,000
Loop Closures														
WT0154	Cliff Drive from Hawthorne Drive to University Avenue		$48,000	$ 48,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0193	University Avenue from Ann Street to Rock Hill Road		$101,000	$ 101,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0153	Highway 763 & I-70 - Close Loops		$378,000	$ 378,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0155	Providence Road at Stewart - Close Loops		$98,000	$ 98,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0156	Stadium Blvd at Bernadette - Close Loops		$114,000	$ 114,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0195	Fairmont Drive - FieldCrest to Parkridge - Close Loops		$53,000	$ 53,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0194	Gillespie Bridge Road - Limestone to Longview - Close Loops		$116,000	$ 116,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0196	Smith Drive - Silver Thorne to Scott Blvd - Close Loops		$283,000	$ 283,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
WT0139	Loop Closure of 16" Mains South of Nifong		$1,278,000	$ 1,278,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total		$ 108,541,750	$ 108,541,750	$ 108,541,750	$ 6,258,000	$ 5,278,000	$ 8,500,000	$ 8,874,000	$ 7,229,000	$ 3,318,000	$ 3,513,000	$ 650,000	$ 8,400,000	$ 9,530,000