TENNESSEE-AMERICAN WATER COMPANY
CASE NO. TRA 2010-_____
DIRECT TESTIMONY
JOHN S. WATSON

1. Q. **PLEASE STATE YOUR NAME AND BUSINESS ADDRESS FOR THE RECORD.**

A. My name is John S. Watson and my address is 1101 Broad Street, Chattanooga, Tennessee 37402.

2. Q. **WHAT IS YOUR POSITION WITH THE APPLICANT IN THIS PROCEEDING?**

A. I am President of Tennessee-American Water Company ("TAWC" or the "Company").

3. Q. **HOW LONG HAVE YOU HELD THIS POSITION?**

A. I have held this position since June 28, 2007.

4. Q. **PLEASE OUTLINE YOUR EDUCATIONAL BACKGROUND AND BUSINESS EXPERIENCE UP TO AND INCLUDING YOUR PRESENT POSITION.**

A. I hold a Bachelor of Science degree in Accounting with an emphasis in Management and Computer Science from Ball State University.

Since joining the American Water System in 1977, I have held various positions at the Company. From 1981 to 1984, I worked in my first management assignment as the Operations Manager for Ohio-American Water Company's, Lawrence County District. Following that position, I served as District Manager for Ohio-American Water Company's Tiffin District for over 8 years. I next served as the Corporate Office Manager at the Ohio-American Water Company and worked in Marion, Ohio in the Corporate Office for over four years, which was followed by my serving as the

Operations Manager at Virginia American Water Company's Hopewell District facility for seven years. I moved to TAWC in July 2004 as Vice-President and General Network Manager, and held that position until June 2007, when I was promoted to my current position as President of TAWC.

During my professional history, I have held a Class I Water Operators License in the State of Ohio and participated in the National Association of Regulatory Utility Commissioners (NARUC) Western Utility Rate School. I have also participated in and attended a number of Company training and professional development programs supporting the water utility industry. I have also attended and made presentations at various trade organization meetings, company meetings, and seminars on a variety of topics including management development, materials management, government contracting, and water utility management.

5. Q. ARE YOU AFFILIATED WITH ANY PROFESSIONAL ORGANIZATIONS?

A. Yes. I am a member of the American Water Works Association, and an active member of the Kentucky/Tennessee Section thereof, as well as the National Association of Water Companies. I actively attend conferences sponsored by the NARUC as well as the South East Association of Regulatory Utility Commissioners (SEARUC).

6. Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE ANY REGULATORY AGENCIES REGARDING WATER UTILITY COMPANIES?

A. Yes. I testified before the Tennessee Regulatory Authority on behalf of TAWC in Dockets 08-00039, 06-00290, and 04-00288. I have also testified in various matters before the Public Utilities Commission of Ohio and the State Corporation Commission in Virginia.

7. Q. WHAT ARE YOUR DUTIES AND RESPONSIBILITIES AS PRESIDENT OF TAWC?

A. As President, I serve as the chief executive officer for the Company in Tennessee, which involves overseeing the Company's strategic planning, local policy processes, and decision making. I also generally oversee the day-to-day operations of the Company, including the overall financial performance, operational performance and regulatory compliance. In this capacity, I am accountable to the Company's Board of Directors and the stockholders of the Company.

8. Q. WHAT IS THE GENERAL AREA SERVED BY TAWC?

A. TAWC supplies water service and public and private fire service to over 75,300 customers in the City of Chattanooga and surrounding areas plus four large sale for resale ("SFR") customers that receive service under special contracts approved by the TRA: Signal Mountain, Fort Oglethorpe, Catoosa Utility District Authority, and Walden's Ridge Utility District.

9. Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. My testimony will (1) introduce the Company witnesses and the subject(s) of their testimony, (2) introduce the rate increase proposed by the Company, (3) discuss the overall operations of the Company, (4) discuss residential customer billing practices currently in place, and changes that may have occurred since the Company's last rate request, (5) discuss the Company's Capital Investment activity, and major capital improvement undertaken since the last rate request, (6) discuss the Company's Non Revenue Water Study, (7) discuss the Company's cost control efforts since the last rate request, (8) discuss the increased costs to TAWC which have occurred due to legislation or other increases approved by local government: such as property taxes, waste disposal (sewer service) expense, increases for electricity costs from EPB and TVA, increased storm water fees, street restoration, and paving requirements from the City of Chattanooga, and (9) briefly discuss the American Water Business Transformation Project..

10. Q. WOULD YOU PLEASE IDENTIFY EACH WITNESS AND THE SUBJECTS EACH WILL ADDRESS IN DIRECT TESTIMONY?

A. Six witnesses will assist me in support of this Petition as follows:

- Michael Miller, Director of Rates and Regulation - Capital structure, capital costs, overall rate of return, management fees, management audit, income taxes, OPEBs and pensions.
- Sheila Miller, Manager of Rates and Regulation - Operations and maintenance expenses, taxes other than income and rate base including the Company's accounting exhibits included in its filing.
- Dr. James Vander Weide, Consultant - Cost of equity and rate of return.
- Patrick Baryenbruch, Consultant - Service Company costs and billings.
- Paul Herbert (Gannett Fleming), Consultant - Cost of Service and rate design.
- Dr. Edward Spitznagel, Consultant - Weather normalization.

11. Q. PLEASE EXPLAIN THE INCREASE IN RATES THAT THE COMPANY IS SEEKING IN THIS PROCEEDING?

A. The Company is requesting an increase in annual revenues of $9.984 million, or about 26.77%. As shown in the Company's Petition in this proceeding, the last increase in base rates occurred on October 1, 2008. This rate request is divided between the Chattanooga tariff, the Lakeview tariff, the Lookout Mountain tariff, the Suck Creek tariff, and the Lone Oak tariff, and requests that individual rates be set for SFR customers at the following locations: Town of Signal Mountain, TN, Walden's Ridge

Utility District, TN, City of Fort Oglethorpe, GA, and Catoosa Utility District Authority, Catoosa County, GA.

12. Q. WILL ALL OF THE UTILITY PLANT WHICH THE COMPANY HAS INCLUDED AS RATE BASE TREATMENT IN THIS CASE BE USED AND USEFUL?

A. Yes. Two major projects constitute the bulk of the Company's increase in Rate Base, as presented to the Authority in this Docket. First, TAWC's rate base will include significant additions to utility plant for the Citico Treatment Plant upgrade, Phase 1A. This project includes the construction of raw water piping improvements, chemical mixing equipment, flocculation equipment in two sedimentation basins, chemical off-loading facilities, and electrical improvements for these equipment items. The Citico Treatment Plan project includes construction of chemical off-loading facilities and the flocculation equipment facilities in accordance with recommendations from the Tennessee Department of Environment and Conservation (TDEC). As the state regulatory agency that oversees environmental quality and water quality compliance, TDEC has made findings regarding the need for the chemical off-loading facilities and the flocculation equipment facilities in this project. TAWC's facilities have been designed and constructed in accordance with TDEC's permit approvals. Project costs are estimated to total approximately $6.7 million.

The second significant construction project involves TAWC's Lookout Mountain service area, which includes replacing the water mains that provide the entire supply of drinking water to residents within the municipalities of Lookout Mountain, TN and Lookout Mountain, GA (combined population of approximately 10,000 people). This project involves the replacement of one existing 8-inch steel water main and one existing 12-inch water main that traverse the mountainside area up to the escarpment of Lookout Mountain to serve these customers. These mains have been in service approximately 67 and 90 years respectively and are located above ground. They have been replaced with two 12-inch welded steel water mains that cross National Park Service Property (thereby requiring easements) and involving private residential property. Both ultimately connect with existing TAWC utility facilities on East Brow Road at the crest of the escarpment of the mountain. The estimated cost of this project is $1.6 million.

The Company also continues to add and replace property and items of utility plant including: water mains of various sizes and lengths, valves, service lines, meters and meter settings, water utility equipment and tools, office equipment, fire hydrants, components of water storage facilities, booster station pumping facilities, treatment plant pumping equipment, computer and peripheral equipment, treatment plant equipment and structures, filter media replacement, transportation equipment, etc. These items represent assets that have been or are expected to be placed in service within the historical test year and through the end of the attrition year period of December 31, 2011.

13. Q. MR. WATSON, WHAT DOES TAWC DO AS A PART OF ITS DAY-TO-DAY OPERATIONS TO CONTROL COSTS?

A. The first element of cost control begins with the Operating & Maintenance ("O&M") plan for the upcoming year. The O&M Plan is prepared, reviewed, and approved at multiple levels. The O&M Plan is developed utilizing a zero-based approach with reliance on historical cost of service elements, and looks at ways through technology/productivity/value-based management decisions to provide lower costs and maximum value to our customers. The process also includes the Capital Expenditure Plan, which together with the O&M Plan make up the Annual Business Plan. The Business Plan is prepared utilizing cost center concepts, which allow: 1) specific, proposed expenditures to be reviewed, 2) actual expenditures to be compared to those planned, and 3) the need for particular expenditures to be tested. Each month the Business Plan detail is compared to actual results which permit the Company to monitor and control its costs. As part of the monthly Business Plan review process results are reviewed relative to current operating conditions and an appropriate forecast is developed for the remainder of the year regarding any expected changes in revenues or expenses.

Other benchmarks are constantly reviewed by the Company to assure cost control and efficient operations. For instance, customers served per employee provides a benchmark of productivity gains. Additionally, Business Plan operating revenues, which are based upon historic water use and adjusted for known or expected changes, are reviewed each month to determine the causes of variations and to determine the likely level of revenue for the remainder of the year. Changes in revenue usage patterns are also included in the monthly reforecast process so that the Company can adjust its costs and operations accordingly. Similarly, Total Operating Expenses ("TOE") are scrutinized throughout the budget review process and throughout the monthly review of budget to actual variance activity. TOE are extensively reviewed with operating personnel and senior management in an effort to: 1) keep year to year increases at or below the rate of inflation, and 2) assure that expenses necessary to maintain compliance with all laws, regulations, policies and good water works practices are performed. TAWC believes these efforts have been successful as, over the last eight years, our operating and maintenance costs have increased only 2.50% per year on average, compared to an inflation rate of 2.59% during the same timeframe.

Capital expenditures are likewise thoroughly reviewed each month to assure that needed facilities are identified, that facilities are scheduled for construction within an acceptable time frame to meet service requirements, and that they are cost-effectively constructed considering proper engineering standards of design.

TAWC continuously strives to make technological advances that improve efficiency, improve service and add to the value of the service we provide our customers. For example:

- In 1998 and 1999 the accounting department implemented new J.D. Edwards payroll, inventory, accounts payable, purchase order, fixed asset and job cost systems as well as FAMS system and the In Source CS for Income Taxes. This automated many manual systems, thereby improving efficiency and reducing associated labor costs.
- The Production Department added radio telemetry capabilities to the production facilities and the distribution system, which further enhance the control and capability of the Company's booster stations, storage tanks and pressure control/monitoring stations.
- The Network Department installed laptop computers with wireless communication capabilities to transmit orders to and from field vehicles. These capabilities increase the responsiveness to the external customer. This automated customer order system ("ServiceFirst") provides real-time data from the field that permits our operation to respond to customers via the Centralized Call Center while monitoring the progress of field personnel locations to respond to emergency work, assure their safety, and capture productivity measurements for planning purposes. This equipment is routinely upgraded to assure we are leveraging the most currently available technology and software.
- TAWC began using electronic surveying equipment for leak detection, which required the purchase and installation of approximately 1,400 permalogger devices located across roughly 80% of the service area. This equipment permits mobile patrolling of the distribution system to detect potential leakage points before the leakage would surface and develop into a

main break. As needed, TAWC supplements the electronic system with manual surveys and leak pin-pointing equipment to accurately identify leakage and efficiently repair facilities.

- TAWC employs a web-based tool to review and analyze electric and other utility service billings in order to analyze power usage at out treatment plant and booster stations, as well as at our operations and office facilities. This equipment permits us to develop trends in energy consumption, demand charges, unit costs from the power companies and how demand for water use at each of these locations affects our expenses, and to then make modifications to our operation to improve efficiencies and lower costs.
- The Company implemented a program to install radio-based meters and meter reading equipment to enable automatic meter reading. Currently, approximately 35% of the customer meters in service have this technology.
- The Company has recently added web-based access for many basic customer service needs such as bill payment, electronic funds transfer, updating account information, and the turning on/off of service.

14. Q. WHY DOES TAWC SEEK A RATE INCREASE AT THIS TIME?

A. TAWC's goals are threefold: (1) TAWC strives to satisfy its customers' needs by providing quality water service at an affordable price. (Notably, TAWC consistently meets or surpasses all water quality standards established by both TDEC and the United States Environmental Protection Agency.) (2) TAWC seeks to fairly compensate employees for their work. (3) TAWC seeks to allow the Company's shareholders to make an adequate return on their financial investment in the Company.

Critically, the welfare of the communities in which TAWC operates is dependent upon TAWC's ability to meet these goals as well as future growth and water quality requirements. Presently, current rates do not provide adequate revenue to cover the cost of providing adequate service or to meet the needs and expectations of our customers including a reasonable return on the capital supplied to the Company's by its investors. Thus, TAWC's requested increase reflects the overall increasing costs of providing quality water service to our customers, including the revenues necessary to support the company's operating expenses and all required capital improvements.

Specifically contributing factors include: (1) increased operating costs such as power costs and waste disposal expense; (2) increased labor costs related to wages and salaries, pensions, group insurance and payroll taxes and other benefit plan expenses; (3) increased O&M expenses, which (when combined in the aggregate) represent approximately 41% of the requested increase; and (4) the continuous need to make capital investments that enhance the integrity of service to its customers, as demanded by federal and state regulations, customer expectations, and the water quality and service goals of the Company.

15. Q. PLEASE EXPLAIN THE COMPANY'S REDUCTION IN ESTIMATED BILLS.

A. The Company has worked diligently since its last rate filing to obtain actual meter readings on customer meters. To that end, over the past twenty-six months, the Company has focused on leveraging the use of electronic meter reading equipment and hiring additional field service representatives to achieve the Company goal of 98% actual meter readings. Since 2005, TAWC employees have focused on and obtained actual meter readings on average from 99.2% of the Company's meters (See Exhibit JSW-1). We also have made a concerted effort to reinforce the importance of the meter reading function and customer service by conducting formal training sessions with all field services personnel during this same period of time.

16. Q. PLEASE EXPLAIN THE COMPANY'S SERVICE ORDER COMPLETION METRIC AND THE USE OF SERVICE FIRST TECHNOLOGY.

A. The Company has worked diligently to utilize real-time tracking of customer service order execution through the use of Service First mobile laptop computers in its service vehicles. Service First allows each field service representative (FSR) to see all service requests on their laptops, and as each service request is completed, the Centralized Call Center updates the customer's service record. Service First mobile technology allows TAWC to determine the location of each FSR along their route so that emergency service orders may be dispatched electronically to the nearest FSR. TAWC also equips each FSR with a cell phone to call within 30 minutes of arriving at the customer's premise in case the customer desires to be on site when the FSR arrives. As each service order is completed, the Service First technology also allows FSRs to receive their next order from the Field Resource Customer Center if they are progressing quicker than expected, and likewise, orders can be moved to other FSRs if an FSR is delayed. See Exhibit JSW-1 attached. Since implementation of Service First in 2005, TAWC's FSR's have completed service orders on average above 99% within the scheduled appointment time, greatly increasing the efficiency of the FSR's and improving the service and convenience to our customers. In addition, this software has reduced or eliminated the use of paper-based service orders that were dispatched and completed by back-office personnel. This technology and equipment is routinely upgraded through additional capital investments to TAWC's "mobile workforce application." The Service Suite v8.1 (formerly known as Service First) will not change service order operations and processing, but it will provide several improvements to help dispatch service orders more quickly and respond more quickly to customers by coordinating assignments based on geography and priority. The new screens for FSRs will be easier to use. Additionally, improved security features added to the

Toughbook mobile devices will protect the confidentiality, integrity and availability of company information.

CAPITAL INVESTMENT

17. Q. ARE THERE PROJECTS PLANNED AND CONSTRUCTED BY OR ON BEHALF OF MUNICIPALITIES, HIGHWAY DEPARTMENTS, CITIES OR OTHER ENTITIES WHICH REQUIRE FUNDING FOR REPLACEMENT OR RELOCATION OF EXISTING INFRASTRUCTURE?

A. Yes. As in past years and addressed in past rates cases, there are on-going road and highway projects, storm water and sewer enhancement/replacements, and street rehabilitations including street widening, sidewalks, curbs and gutters, paving, and other projects that require TAWC to undertake underground water utility asset relocation. Several of these projects are federally or state funded highway projects by the Tennessee Department of Transportation (TDOT). These projects require the Company to relocate or replace existing infrastructure within the public right of way or in existing easements where our water utility assets conflict with the proposed work. In the attrition year January 2011 through December 2011, some of these projects will be reimbursable through state, local, or federal project funds related to utility relocation projects or from federal stimulus funding or local matching funds. However, many projects may not be reimbursable under TDOT guidelines. For instance, if a TDOT project is constructed in conjunction with a participating municipality and the municipality does not contribute matching funds to TDOT for utility relocation, Company funding of the water facilities relocation becomes necessary. Similarly, the cost our Company incurs to design the relocation of our facilities is often not reimbursable from TDOT.

In addition to highway projects, some of the cities we serve are undertaking street, sidewalk and sewer improvements that require funding for relocation or renewal of our infrastructure grid. In addition, we have been notified of a relocation project in Chattanooga as part of the Holman Springs Bridge Project relocation that requires the installation of 8-inch ductile iron pipe with the goal of connecting the existing mains on either side of the bridge. Also, a 12-inch water main and associated facilities along Cummings Highway at Lookout Creek in Lookout Valley is currently being replaced with a 16-inch main due to a bridge relocation project. Another project, Noah Reid Rd Project remains pending until the RR Protective Liability Insurance Certificate is received before moving to construction. Scheduled for December 2010 completion, TAWC is also engaged in designing utility relocation at East Brainerd Road in coordination with TDOT which will move forward as TDOT controls the schedule.

Other TDOT projects scheduled for design and construction for which TAWC will be actively involved in design or construction phases during the Attrition Year includes:

- St. Elmo Avenue at Holman Springs Bridge (under construction)
- Cummings Highway at Lookout Creek (under construction)
- Shallowford Road at S Chickamauga Creek (design and construction)
- East Brainerd Road widening from Graysville Rd south (design)
- Lee Highway at CSX railroad bridge (design and construction)
- Shallowford Road widening from Gunbarrel to Jenkins Road (design and construction)

18. Q. WHAT MAJOR INVESTMENT PROJECTS HAVE BEEN INSTALLED SINCE THE LAST RATE CASE?

A. In 2009 and 2010, the Company undertook investment projects, although at a reduced amount than originally planned. Those investment projects include: (1) fire protection upgrades and replacements at a cost of $0.099 million, (2) normal reoccurring construction programs for installing new and replacing meters, services, and equipment at a cost of $1.589 million, (3) the Lookout Mountain Supply Mains at a total cost of $1.6 million, (4) the installation and replacement of water meters that exceed the periodic meter change timeline, (5) the replacement of 6,733 water meters, with an additional 2,471 slated for replacement by the end of 2010, (6) the Citico Water Treatment Plant Improvement Project, Phase 1A will be substantially completed by October 31, 2010 and placed in-service by December 31, 2010 at a total cost of $6.7 million, and (7) TDOT relocation work of approximately $0.192 million. Also, the Company has been focused on a water main replacement program in the following locations:

Rollingwood Drive From Woodbrook Drive North And East To Juandale Drive	980'
Meadow Falls Lane From Isbelle Rd. West To Dead-end.	437'
Hanover St. From Winthrop St. Southeast 532'	532'
Winthrop St. From Hanover St. West 300'	300'
N. Willow St. Between Milne St. And Rawlings St.	105'

From September 2009 and through December 31, 2011, the Company will have spent $1.15 million to replace approximately 12,800 feet of 2"-16" mains. The focus of these projects are on strategically replacing cast iron and galvanized steel water mains in different sections of the service area as the pipelines reach the end of their economic useful life and to meet the service needs of our customers. However, due to financial constraints on capital investment since the last rate order, the replacement of water mains has been reduced substantially.

19. Q. DESCRIBE THE TYPES OF PROJECTS THAT THE COMPANY HAS HAD TO DEFER OR CANCEL FROM THEIR CONSTRUCTION PLANS AS A RESULT OF INADEQUATE EARNINGS OVER THE LAST TWO YEARS.

A. TAWC has had a proud legacy of providing quality water service and a regular program of infrastructure construction and replacement in its service area. Projects are traditionally developed and funded based upon the need to meet regulatory requirements, reduce maintenance costs, and to address expansion and redevelopment in the Chattanooga area. However, the ability to attract funds for capital investment in the water system is determined by acceptable financial performance. As demonstrated in the testimony of Mr. Miller, the Company's financial performance for 2008-2010 has not been adequate and the Company has had to limit capital investment until its financial performance improves.

Consequently, TAWC has deferred making investment in capitalized tank painting. Specifically, from 2008-2010, none of TAWC's approximately 33 steel storage tanks were repainted. The last tank painting work completed at TAWC involved the repainting of two (2) of the Company's Aldrich units at the Citico Water Treatment Plant at a cost of approximately $1.1 million in 2008. Currently, four of the Aldrich units are in need of repainting, and several of these steel tanks show signs of corrosion, internally and externally, and typically require repainting on a 15 to 20 year lifecycle. Additionally, we have a 300,000 gallon steel ground storage tank serving the Elder Mountain area, which was last repainted in 1982. TAWC obtained a bid of $236,000, but made the decision to delay this work until earnings improved. We also planned to repaint and make necessary improvements to a 100,000 gallon steel elevated tank acquired in 2006 as part of the Suck Creek Water system acquisition, but postponed the repainting for the same reason. Still other steel tanks have been identified that require repainting to prevent interior and exterior corrosion. While none of the delayed tank painting have resulted in service issues in the short-term, these improvements to the system need to be addressed or the structural integrity could be impacted and they will become service issues in the future.

TAWC also has nearly 400 miles of small diameter 2-inch, 2-1/4 inch and 2-1/2-inch cast iron and galvanized steel water mains that were of common construction in the 1920's, 1930's and 1940's that need replacement. These types of mains account for nearly 70% of the main breaks that we repair each day across the TAWC distribution system. In 2008, due to capital funding constraints following the rate case decision, the Company made the decision that it could not make the investment in small diameter main replacement that it had remaining in the capital expenditure plan. Further, we notified all of our currently working independent contractors that remaining work would be suspended until further notice. Since 2008, main replacements have been limited to mains impacting service and emergency unscheduled water main replacements.

Additional projects deferred from 2009 include the Citico Water Treatment Plant Improvements Phase I. The Company instead elected to reforecast the project into multiple phases and delay the construction of any work for at least a year to limit even further erosion of the Company inadequate earnings. The reforecasted Citico Treatment Plant improvements were revised to only construct the portion that had been required due to the recommendations of the TDEC sanitary survey report and the Company would consider funding Phase 1A in 2010. The remaining work would be considered for funding in later years.

The Company has also deferred vehicle replacements and the automatic meter replacement program. The Company has limited meter purchases to non-AMR meters because they are less costly than the radio frequency meters. The AMR meters would result in future labor and labor-related savings but the additional capital was not available to continue this program at the present time.

The Company has in effect delayed most of its major capital projects which included the design and construction of a new storage tank for the Missionary Ridge area. This project would improve and stabilize pressures in this service area and would provide improved storage. The Company also delayed construction for the replacement of the Lookout Mountain Supply Mains project for nearly a full year from 2009 to 2010, due in part to constraint of capital funds in 2009, but this project was of such a critical nature it had to be undertaken in 2010. This delay and reforecasting of the projects mentioned above have in turn reduced the amount of capital investment available for other projects that we had planned for scheduled work in 2010. Several of the projects planned were to address Non-Revenue Water capital improvements identified in the Non-Revenue Water Study from 2007 such as: (1) placing pressure reducing valve stations in specific locations to reduce the potential for catastrophic leaks, and (2) installing or upgrading district zone metering to create segments of the distribution system that would permit improved prioritization of main replacements in areas with high water loss.

20. Q. WHY IS IT IMPORTANT THAT THE COMPANY BE PROVIDED ADEQUATE RATES TO PROVIDE ADDITIONAL CAPITAL IMPROVEMENTS?

A While in the short-term the Company has been able to maintain adequate service with the reduced capital investment, that can not continue without impacting the Company's ability to meet its service obligations. Through continuing maintenance activities the Company has worked hard and smartly to make sure water quality parameters are continuing to be in compliance with all standards. Without additional capital investment, however, this will become more problematic. The impact of delaying or deferring capital investment will cause some of these assets to require increased maintenance, and eventually the assets as they deteriorate will result in increased service issues, repairs, obsolesce of parts, and in some cases, temporary disruptions in service to water customers. The Company for the last two years has tightened its belt and has undertaken a concerted effort to work within the revenue generated from the tariffs approved by the Authority in the 2008 Rate Case. However, the Company cannot operate at a loss and be expected to attract the capital necessary to replace aged facilities and maintain adequate service levels. That is why this rate case is very important to the Company, so that it can continue its long history of quality water service and to attract the capital required to meet its public service obligation. The Company has a history of quality service and believes it to be in the best interest of its customers that it be provided adequate rates to meet the level of service expected by our customers.

21. Q. HAVE THERE BEEN REPORTS ABOUT THE CRITICAL NATURE OF INFRASTRUCTURE REPLACEMENT NEEDS IN THE WATER UTILITY BUSINESS?

A. Yes. Many municipal water and wastewater systems have been and continue to be written on as the subject of news media reports or research reports such as the American Society of Civil Engineers 2009 Report Card on America's Infrastructure which states on Page 26 of the report:

> The Congressional Budget Office (CBO) concluded in 2003 that "current funding from all levels of government and current revenues generated from ratepayers will not be sufficient to meet the nation's future demand for water infrastructure"
>
> The CBO estimated the nation's needs for drinking water investments at between $10 billion and $20 billion over the next 20 years.

The ASCE Report continues: "New solutions are needed for what amounts to nearly $1 trillion in critical drinking water and wastewater investments over the next two decades. Not meeting the investment needs of the next 20 years risks reversing public health, environmental, and economic gains of the past three decades. Clean and safe water is no less a national priority than are national defense, an adequate system of interstate highways, and a safe and efficient aviation system."

USEPA's Clean Water and Drinking Water Infrastructure Gap Analysis from 2003 addressed to the U.S. Congress discusses the funding gap and the needs of water and wastewater utilities that are created and currently exist and are going to continue to exist because there is a lack of funding and rates for service that do not cover the investment needed in water utility infrastructure.

According to ASCE in their 2009 Report, "America's drinking water systems face an annual shortfall of at least $11 billion to replace aging facilities that are at or near the end of their useful lives and to comply with existing and future federal water regulations. In 2002, the US Environmental Protection Agency (EPA) issued the Clean Water and Drinking Water Infrastructure Gap Analysis, which identified potential funding gaps between projected needs and spending from 2000 through 2019. This analysis estimated the potential 20-year funding gap for drinking water capital expenditures as well as operations and maintenance, ranging from $45 billion to $263 billion, depending on spending levels. Capital needs alone were pegged at $161 billion." The ASCE report goes on to state that the Congressional Budget Office (CBO) concluded in 2003 that "current funding from all levels of government and current revenues generated from ratepayers will not be sufficient to meet the nation's future demand for water infrastructure." The CBO estimated the nation's needs for drinking water investments at between $10 billion and $20 billion over the next 20 years.

22. Q. HAS THE COMPANY HISTORICALLY BEEN IN THE POSITION OF INADEQUATE CAPITAL INVESTMENT MENTIONED IN THE PREVIOUS ANSWER?

A. No. Consistent with the realities set forth in these reports, TAWC has until recently been able to work proactively to make capital investments in a timely fashion to address the infrastructure needs of our community, but can no longer sustain its infrastructure replacement and construction because of the limited capital investment funding available to it following TAWC's last rate order. Consequently, until TAWC secures adequate rates that will permit TAWC to achieve a fair and reasonable rate of return on equity and a fair return on its investment, the Company's ability to undertake these necessary capital investments will continue to be compromised. This coupled with the age of the TAWC system and the attributes of the service area, warrant the investment to maintain and improve TAWC's assets.

I do not believe based upon the above reports that TAWC customers will be better served by the constraints placed on the Company by inadequate revenues needed to meet its public service obligation. Not providing for the necessary and needed capital improvements in one of Tennessee's largest communities is not in the best interest of the community or its customers. I respectfully ask the Authority to review the current financial condition of the Company and to set adequate rates in this rate case to provide for the cost of service, including a fair and reasonable return on the investment of the shareholders. Otherwise, the Company will continue to have difficulty in attracting additional capital needed to maintain its water infrastructure.

23. Q. WHAT MAJOR INVESTMENTS PROJECTS ARE PLANNED FOR THE 2011 ATTRITION YEAR?

A. In 2011, TAWC will have to spend $4.910 million on normal reoccurring expenditures such as water main installation, fire hydrant replacement and renewal, construction of new services, meters and other equipment, and other miscellaneous items. Additionally, TAWC will move forward with the following investment projects:

- Begin Phase 1B of the Citico Water Treatment Plant Improvements Project, which will replace and upgrade Sedimentation Basin Number 3. Sedimentation Basin Number 3 was originally constructed in 1926 and contains no modern flocculation or sedimentation equipment. The basin will be replaced with a new basin which has channel flow vertical flocculation mixers and the basin will be equipped with stainless steel plate settlers to enhance and improve applied water turbidities to the 20 conventional filters in Filter Building Number 2. This improvement is also necessary to comply with the Disinfection/Disinfection By-Product Rule margin of safety, which will become effective in 2012. This project will cost an estimated $2.490 million in 2011 and 6.71 million in 2012, for a total of $9.2 million (2011 and 2012 combined).
- Improve the East Ridge finished water reservoir by adding effluent valves. This will improve operating pressures to East Ridge customers, and allow for further growth in the eastern portion of the TAWC distribution system south of Interstate 24. The project will improve fire protection service in that pressure zone. The estimated cost for this improvement is $350,000
- Continue the business transformation project at an estimated cost of $0.972 million.

- Replace the GAC filter media at Citico WTP at an estimated cost of $1.0 million.
- Various Non-Revenue Water Reduction projects at an estimated cost of $1.0 million.
- TDOT relocation expenses estimated at $150,000.

Additionally, in 2011, the following main replacements are planned for construction:

• Wilcox Drive From Patterson Road North To Dead-end	430'
• Shannon Street Between Gillespie Road and Phoenix Avenue	820'
• Glenwood Parkway From Curve @ Vine Street North	660'
• Liberty Street from Boylston Street South and East to Boylston Street.	1,050'

OPERATING EXPENSES

24. Q. PLEASE EXPLAIN TAWC'S ORGANIZATIONAL CHART IN THIS CASE.

A. As of September 12, 2010, TAWC employs 103 employees directly in its daily operations. This number is six less than the number of employees granted by the Tennessee Regulatory Authority in Docket 08-00039. The Company seeks to recover fully loaded labor and labor-related expenses for 110 full-time employees in this rate request. Each of these employees is directly and integrally involved in the provision of water service to the customers of TAWC.

The workforce is presently comprised of seventeen (17) personnel employed in the Production Department who are engaged in "around the clock" supervision, operation, and maintenance of the water pumping station, filtration and treatment plant, main treatment facilities, booster stations, and water storage tank facilities.

There are currently two (2) vacant positions in that department for a total of 19 personnel required. The Water Quality Group consists of six (6) personnel engaged in conducting water quality wet chemistry and bacteriological sampling, analysis and reporting. They are also engaged in addressing the requirements of existing and future water quality regulations, execution of the Company's cross connection and backflow prevention program, and enforcement. The Distribution Department is currently comprised of thirty-five (35) personnel engaged in the supervision and operation of the installation, maintenance, and repair of water distribution facilities. This includes (1) repair of water mains, (2) service line installation, repair and replacement, (3) fire hydrant inspection, repair and flushing, (4) valve inspection and repair, (5) leak detection and repair, and (6) material and supplies inventory and ordering. There are currently seven (7) vacant positions in the Distribution Department for a total of forty-two (42) personnel required. The Outside Commercial Department consists of twenty-eight (28) personnel engaged in the supervision and operations of meter reading, customer service requests, meter installation, replacement, testing and repair. There are two (2) vacant positions in the Outside Commercial Department for a total of thirty (30) personnel required. The Engineering Department consists of six (6) employees that supervise and provide support for capital improvement projects, permits, applications for new service installations, bidding and scheduling pipeline, and other construction work with outside contractors and developers. Finally, the Administrative Group consists of eleven (11) personnel that are engaged in general management, administrative support, human resources, budgeting, finance and accounting, government affairs, safety and health/loss control, non-revenue water, and communications.

25. Q. PLEASE EXPLAIN THE INCREASE IN LABOR COSTS FOR TAWC IN THIS CASE.

A. TAWC continually reviews the appropriate level of employees it needs to provide service at a level that meets the needs of the business and the needs of its customers. TAWC also must identify and fill, as must all businesses, any operational gaps that it deems are necessary to satisfy all laws, regulations, and company policies. The Company has identified seven (7) positions for which vacancies currently exist and two (2) new positions that the Company has already filled. The seven (7) vacant positions (generally the result of retirements) are going to be filled before the beginning of the attrition year because filling these positions is necessary for TAWC to meet the day-to-day service needs of our customers. The first position the Company already filled was the position of Finance Manager for Tennessee in December 2009. This role was formerly performed by a financial and planning analyst located in Charleston, WV who was employed by AWWSC. It was determined that there is a need for a full-time senior level Finance Manager dedicated exclusively to TAWC. Transferring this role from AWWSC to a full-time TAWC Finance Manager will enhance financial controls, improve internal and external reporting, identify cost containment measures, improve financial reporting, enhance the preparation for the annual business plan, improve the monitoring of actual financial results against the annual business plan, and provide support on rate case filings and Sarbanes Oxley compliance matters.

The Company also already filled a Government Affairs Specialist position on August 30, 2010. This is a new position at TAWC that replaces a previously contracted service position. This position is critical in that it will provide the Company a way to (i) work closely with municipal officials on local issues, (ii) work with customers and constituents, (iii) help build relationships with state officials regarding the Company's activities, plans, and construction projects, and (iv) improve local or state issues management. Perhaps most important, the

Government Affairs Specialist will monitor changes in municipal, county, state, and federal laws and regulations so that the Company can remain abreast of any upcoming regulatory or legislative changes on water and wastewater issues.

The Company is currently in the process of backfilling hourly positions due to the retirement of one (1) Field Services Representative, three (3) Truck Driver/Utility Workers, and one (1) Heavy Equipment Operator in the Field Services Department or function. These positions involve meter reading, executing customer service orders, installing and replacing meters, testing meters, making repairs to distribution system assets including water mains, water valves, fire hydrants, meter settings or other public components of the water system. These individuals also are responsible individually or as part of a work crew to operate field equipment, excavate pipe to make repairs, and install facilities.

The Company is also in the process of hiring one (1) Laborer Relief/Process Technician Apprentice, which will give the Company a total of two (2) personnel in this job classification in the Production Department. The Company requires these training level positions because these personnel will gain experience and obtain a Class IV Tennessee Water Operators License, making them fully qualified to eventually replace one of the four (4) existing Water Treatment Plant (WTP) Process Technicians at the Citico WTP or be promoted into the Laborer/Relief Process Technician positions that currently relieve the Process Technician position. The replacement of licensed water plant operators who hold a Class IV Water Operators License is of high importance because TAWC's water plants are integral to assuring that drinking water standards are achieved at all times and that TAWC's large distribution system operates correctly. TAWC's 65 MGD water Citico treatment plant requires qualified Class IV Operators who can manage the plant processes, water quality analyses, adjust water treatment parameters to optimize water quality in the treatment plant, and also be responsible for monitoring and adjusting process parameters through remote operation of approximately twenty-eight (28) booster pumping stations and twenty-two (22) water storage tank levels. This position reports to the Production Supervisor for Plant Operations. In the last rate case, the Laborer Relief/Process Technician Apprentice position was known by the title Laborer/ Process Technician in Training.

Finally, the Company is also filling the position of Master Maintenance Mechanic in the Production Department due to a vacancy as the result of the retirement of a Maintenance Mechanic on August 1, 2010.

26. Q. PLEASE EXPLAIN THE INCREASE IN FUEL AND POWER COST FOR TAWC IN THIS CASE.

A. TAWC is billed for nearly all of its electric service costs in the Chattanooga area by the Electric Power Board of Chattanooga (EPB). EPB is a municipal electric distribution utility which relies exclusively upon the Tennessee Valley Authority (TVA) as the generating entity for its electric distribution grid to the Chattanooga area. TAWC requires EPB's electric services to operate its business and provide water service to its customers. TAWC's Citico Water Treatment and Pumping Station is the Company's largest and primary treatment facility and this Station requires electricity to operate it – electricity which is purchased exclusively on a retail basis from EPB. TAWC also relies on EPB electricity to operate TAWC's twenty-eight (28) booster stations, which must be operated on a continuous basis so that there is sufficient pressure and flow to service customers' general water needs and fire protection (public or private) needs at various elevations across the service area. Indeed, many of these facilities must operate continuously in order to meet customer demands. TAWC also requires electric service to its buildings and facilities for lighting, heating, cooling and for powering treatment plant equipment. Because electrical service to these facilities is an absolute necessity, it is impossible to insulate TAWC's fuel and power cost expenses from any increased costs implemented by EPB.

Since the Company's 2008 rate case filing, EPB has increased or adjusted the fuel cost component of its electric service approximately 13 times. These changes, in part, are related to a change in the frequency of TVA Board of Director's policies, which have resulted in more frequent adjustments to EPB's fuel costs. These changes are completely beyond the control of TAWC. Since the 2008 rate case filing, EPB also has had two general rate increases (10/1/2008 and 10/1/2009) due to other cost increases and increases from the TVA. According to information provided to the Company, these increases were largely the result of increases in the cost of fuel for generating electricity and for generating station costs, as well as other operating cost increases due to events such as the Kingston Coal Ash Spill event in December 2008. EPB already has passed each of these cost increases on to TAWC and its other customers.

These EPB rate increases, which were passed on to TAWC, became effective beginning on October 1, 2008. The increase to TAWC from the October 1, 2008 was approximately 20%. Subsequent additional rate adjustments from the EPB in 2009 were netted in the aggregate and became effective against TAWC, further increasing TAWC's electric service costs by approximately 13%. The increases appear in TAWC's Fuel and Power costs, and are detailed in Exhibit JSW-2.

The Company contacted EPB in the summer of 2010 to determine whether they had any intentions of increasing rates going forward. The Company's account representative at EPB advised that TAWC should expect a 6% increase October 1, 2010 and a 6% increase on October 1, 2011. Further, the account representative advised that the Fuel Cost Adjustments (FCA) would continue to occur for the remainder of calendar year 2010 (monthly), with the possibility of some leveling off or slight decrease in the last quarter of 2010.

Witness Sheila Miller's testimony describes the calculation of the Company's fuel and power costs, which were based on current EPB tariffs adjusted for expected increases for the attrition year as indicated to TAWC by the EPB.

27. Q. PLEASE EXPLAIN TAWC'S ADJUSTMENT IN CHEMICAL EXPENSE RELATED TO WATER TREATMENT IN THIS CASE.

A. The Company competitively bids for the purchase of its water treatment chemicals at least annually to obtain the lowest possible price from suppliers. Due to increases in the cost of petroleum, which is one of the costs our suppliers incur in manufacturing these products, the suppliers' prices have increased. This increase affects the suppliers' transportation costs as well. These increased costs are reflected in the higher costs TAWC now has to pay to purchase these chemicals from the suppliers. In 2008, chemical unit prices increased dramatically. Since that shocking increase, unit prices have moderated for many water treatment chemicals such as liquid chlorine, liquid caustic soda, hydrofluoric acid, zinc orthophosphate, filter aid, and poly-aluminum chloride. TAWC will continue to purchase these chemicals in bulk quantities.

TAWC has determined the appropriate dosage of water treatment chemicals that will be needed during the attrition year by examining the average historic dosages required at the Citico Treatment Plant during the test year. The dosage levels are based on known historical averages of the Tennessee River's raw water quality. The Company has competitively bid each specific chemical at the estimated quantity that will be needed during the attrition year period.

Sheila Miller's testimony explains the level of chemical expense requested in this case and the schedules and exhibits prepared to calculate that expense for the attrition year.

28. Q. PLEASE EXPLAIN THE INCREASE IN TAWC'S WASTE DISPOSAL EXPENSES IN THIS CASE.

A. TAWC, as a result of its treatment plant operations, must dispose of the water used from filter backwash operations, sedimentation basin cleaning, and also water treatment residuals as measured in total suspended solids (TSS) and biological oxygen demand (BOD). This is discharged to the City of Chattanooga Sewer System based upon an approved permit entered into between the City of Chattanooga and the Company. The City of Chattanooga then bills TAWC for the materials discharged to the city sewer system based on two criteria. First, the volume of water that is discharged as "monthly flow volume" is billed under the rates established by the City of Chattanooga in city ordinances. City Ordinance 11344 set the rates at the time of TAWC's last approved rate increase in September 2008. Since that time, various ordinances have been passed increasing the amount billed to TAWC. For example: City Ordinance 12166 became effective October 2008 and provided for increased sewer rates on October 1, 2008 and April 1, 2009; City Ordinance 12327 became effective January 1, 2010; City Ordinance 12410 became effective July 1, 2010 and provided for rate increases on October 1, 2010 and April 1, 2011. Indeed, TAWC has experienced at least 5 increases in the rates from the City of Chattanooga since TAWC was last granted its increase in water service rates. Each of the City of Chattanooga Ordinances involving rates increases of the City of Chattanooga Sanitary Board since the Company's 2008 Rate Case are attached to this testimony as Exhibit JSW-3. Second, the Company incurs a charge based on the TSS quantity as an industrial user of the city sewer system.

The Company seeks to recover waste disposal expense for the attrition year based on historical test-year waste disposal costs adjusted for the increases from January 2010 through April 2011. Sheila Miller's testimony provides the necessary adjustment that is required for the Company to recover this expense level in the attrition year.

29. Q. PLEASE DESCRIBE THE INCREASE IN THE COMPANY'S EXPENSES RESULTING FROM THE PAVING AND STREET RESTORATION ORDINANCE AND ITS CHANGED REQUIREMENTS.

A. The Company is asking in this rate case for recovery of expenses associated with Street Restoration and Street Paving Ordinance 12337 (a copy of the approved ordinance is attached as Exhibit JSW–4), which was passed on January 5, 2010 by the Chattanooga City Council. The ordinance requires an increase to the street permit fee the City charges utilities and other contractors who must excavate to maintain and replace their facilities. Second, and more importantly, the ordinance requires all who excavate paved streets in the city of Chattanooga to repair the street in a new, more stringent manner. Instead of backfilling the street excavation with select stone backfill and then compact the material (gravel-based backfill material) to restore the asphalt or concrete surface to its previous condition, utilities are now required to backfill the excavation with flowable fill, which is a cement or concrete material used to ensure that the street repair does not settle in the future.

This new requirement, and the increased expenses associated with it, actually began in August 2009 when street inspectors began requiring the new materials and new process. The ordinance enforcing the change was not approved until almost six (6) months later; however, these increased costs were incurred beginning in August 2009.

The impact of this new requirement on the Company has been two-fold. First, the Company has, and will continue to incur, increased materials costs because the Company does not own the equipment that can deliver and install flowable fill. Second, the Company must pay its paving contractors who perform the work increased labor and supply charges. These increased excavation costs, coupled with the City's increase in fees for obtaining street permits, has increased the Company's operating and maintenance expenses.

Sheila Miller has performed the analysis associated with the increase in these costs, and appropriately increased the historical test-year maintenance costs to reflect these increases. In addition, the additional street permit and paving costs from the City of Chattanooga have been absorbed in the Company's capital investment levels included in the attrition year rate base.

30. Q. PLEASE DESCRIBE THE CITY OF CHATTANOOGA'S PROPERTY TAX INCREASE THAT HAS RECENTLY BEEN PASSED AND THE EFFECT THAT IT WILL HAVE UPON TAWC'S OPERATING EXPENSES.

A. The City of Chattanooga made a determination during its most recent budgeting process that an increase in the city property tax rate was appropriate in order to finance its municipal budget. The Chattanooga City Council included in its budget a 19.0% increase in the property tax rate for TAWC's City of Chattanooga property taxes due in 2010 and payable by February 2011. The Chattanooga City Council passed this budget as part of City Ordinance 12410 (a copy of the ordinance is attached as Exhibit JSW-5) and the budget became effective July 1, 2010. The City of Chattanooga's decision constitutes a substantial increase in property taxes that TAWC must pay during the attrition year. Ms. Sheila Miller and Mr. Mike Miller have also described the impact on the Company's expenses from changes in charges billed to TAWC from the City of Chattanooga in their testimony.

31. Q. PLEASE DESCRIBE THE CITY OF CHATTANOOGA'S STORMWATER TAX OR "WATER QUALITY FEE" INCREASE THAT HAS RECENTLY BEEN PASSED AND THE EFFECT THAT IT WILL HAVE UPON TAWC'S OPERATING EXPENSES.

A. Due to compliance issues in the storm water system, TDEC's chief enforcement officer for water quality, as well as the EPA and the U.S. Department of Justice, became involved in enforcement and compliance related to the country's storm water systems. Four years ago, the City of Chattanooga was cited for a list of twenty-three (23) deficiencies related to storm water. Subsequently, an inspection in September 2008 identified fifty-seven (57) violations of the City's storm water permit. The City of Chattanooga is currently operating under a consent order from the USEPA.

Before October 2009, the City never had raised the storm water fees it adopted in 1993. On October 6, 2009, however, Chattanooga's Mayor and City Council increased storm water fees in an attempt to address these compliance issues through City Ordinance 12294 (attached as Exhibit JSW-6), which revised the "Water Quality Fee (Formerly known as the Storm water User's Fee) Rate Structure, and Provide a Schedule of Charges for the Funding of the Operation, Maintenance, and Improvement of the Storm Water System within the City Limits" of Chattanooga.

The Ordinance established that there would be two classifications of users, residential and non-residential. For purposes of City Ordinance 12294, TAWC's property is designated as non-residential property. Non-residential users' water quality fee is based upon "Equivalent Residential Unit (ERU)," which equals 3,200 square feet of measured impervious area, at a rate of $115.20 per ERU ($9.60/month). TAWC was assessed and paid these fees at these rates through its property tax bills. On February 9, 2010, City Ordinance 12347 (attached as Exhibit JSW-7) was approved to extend the time in which to file a notice to protest concerning the accuracy of water quality fees imposed in 2009 only from March 1, 2010 to June 1, 2010. TAWC did not file a notice of protest and instead chose to pay the Water Quality Fees imposed.

On April 20, 2010, the Chattanooga City Council amended the Ordinance to reduce the rates charged to non-residential users from $9.60 a month to $6.15 month. Still, TAWC's total storm water fees payable for 2009 increased to approximately $21,000 per year, an expense the Company seeks to recover. Ms. Miller has included the adjustment in the Property Taxes section of her testimony.

32. Q. PLEASE DESCRIBE THE COMPANY'S CHALLENGES, EFFORTS, SUCCESSES AND EFFICIENCIES IN COST CONTAINMENT THAT HAVE BEEN PUT IN PLACE SINCE THE LAST RATE CASE.

A. TAWC has been forced to make changes in its operations in order to reduce costs and to offset the impact of the TRA's 2008 Order on the Company's financial results. The Company has worked diligently to keep service levels high and the quality of water service high, while at the same time reducing operating expenses and capital expenditures in the short-term. The areas of cost containment can only be maintained on a short-term basis because of inflationary pressures in other costs that I have described elsewhere in this testimony, and as described by other

Company witnesses. Over time, the cost containment measures employed by TAWC will eventually have an effect on the quality and condition of its facilities, and will result in TAWC having to make the difficult decision of whether to incur costs for increased maintenance or make capital investments to replace assets.

In the area of Company labor, the Company has worked both to reduce and to avoid, where possible, work performed on an overtime basis. During the past two years, supervisors have limited the amount of emergency work performed on an overtime basis to work that is necessary to prevent property damage, to avoid the loss of water service, or work needed to prevent water quality excursion which could violate Tennessee's Safe Water Act. To the extent that a water leak or a main break was only causing low pressure or causing water to escape through storm water drainage, and not otherwise causing a safety issue such as ice forming on streets or sidewalks, then the repair would be deferred until normal working hours. In some cases, this has resulted in non-revenue water loss being greater because the repair of leakage was delayed until normal working hours.

Likewise, the Company made a decision in April 2010 that it would park a portion of the vehicle fleet previously assigned to supervisors, and limited company vehicle access to only those supervisors on-call for emergencies or for response to other after-hours business needs. TAWC chose to require those vehicles to be parked at Company facilities and reduced the coverage of the number of on-call supervisors to two supervisors for the entire 75,000 customer base. Those supervisors who might provide support or who are not the primary "on-call" supervisor are now required to travel in a personal vehicle to their assigned work location and then drive a Company vehicle to the emergency or other assigned work locations for further orders. This savings resulted in twelve (12) Company vehicles no longer being used for daily "commuting" to and from home.

Second, in light of the City of Chattanooga's change in street restoration ordinances, the Company found that it could avoid retaining hourly employees to backfill street repairs in the pavement with stone backfill materials. Instead, the Company has utilized its street paving contractor to provide steel plates to cover the open excavations until the contractor can backfill the street excavation with "flowable fill," and the contractor restores the street at a unit cost basis. Likewise, TAWC has worked to reduce the number of dump trucks it needs to operate daily during normal operations, which were previously assigned to a crew performing repair work. The Company decided that it would instead park three or more dump trucks on a daily basis and would run the remaining dump trucks between multiple job sites on a given day to transport soils and smaller amounts of granular backfill materials (stone and soil) to save on diesel fuel and maintenance costs associated with the mileage previously incurred by these vehicles. Prior to the new paving ordinances, this decision resulted in savings to stone backfill costs that the Company transported to and from the job sites.

The Company has also reviewed all of its communication expenses from telephone and other devices, making sure that all phone circuits were identified, that they were necessary, that the phones were VOIP phones for land lines, and that cellular phones and other PDA devices are optimized to the most cost effective calling plan available from the vendor.

The Company made the difficult choice to selectively not replace employees who left the business in Tennessee during the past twenty-four (24) months, or to not fill vacancies even if those vacancies created more overtime work. These vacancies created situations when there was no employee to report for an overtime work assignment, and the Company then called in a contractor's employee to fill the assignment. . In some instances, the Company chose not to complete all customer service orders assigned to a FSR because the work would require overtime or there were less than the number of FSRs required to perform the work on a given day. Those orders were then re-scheduled to a later date when sufficient personnel were available.

Due to constraints in the capital spending program on a daily or weekly basis, and to prevent a lay-off or reduction in force, in certain cases the Company sought and was able to obtain temporary work rule changes in the union contract with UWUA. These changes allowed for the transfer of employees between departments, such as reassigning FSRs who change meters to instead assist with maintenance activities in the Production Department.

Business travel for supervisor employees has been restricted for certain meetings and other work–related assignments in favor of conducting more meetings by teleconference. In some cases, training activities have been conducted via webcast or via teleconference using computers and local training facilities in place of on-site training.

The Company has also required employees to travel further in Company vehicles to avoid the cost of airfare. The Company has also reduced the number of staff that it would train for a particular process and instead have individual employees learn the process through "train-the-trainer" and report back to provide training to local employees.

Even with these significant efforts to reduce both O&M and capital costs, the Company's financial condition has deteriorated after the 2008 Rate Case Order. The Company's current and expected revenues at present rates simply do not cover the cost of providing service even with the cost savings. The only reasonable solution with further impairment of service and needed infrastructure replacement is to seek adequate rates in this case.

33. Q. PLEASE DESCRIBE SOME OF THE COMPANY'S CHALLENGES IN TERMS OF OPERATIONAL REQUIREMENTS AND MEETING CUSTOMER EXPECTATIONS GIVEN THE LOCAL ECONOMY.

A. Since the last rate case, the Company has experienced the effects of the credit crisis that impacted much of the nation, including Chattanooga. The Company experienced an increase in the number and amount of customers' bills which required significant efforts to work through payment and collections activities, including a number of bankruptcies and business closures. A large industrial customer, Pilgrim's Pride, declared bankruptcy. Another large industrial customer, R.L. Stowe, closed its business. According to information provided by those customers to the Company, each of these events were the result of business-related challenges from the economy, and not related in any way to the cost of their water service. The number of residential customer accounts has not increased, but instead has actually remained flat or declined in each of the past two calendar years. The decline in residential water usage per customer has also had an impact on the Company. In addition, non-payment order activity has increased substantially during the past three years. Likewise, one of our largest SFR customers, Catoosa Utility District Authority, stopped purchasing water from TAWC in December 2008, when its formal contract to purchase water from TAWC expired.

The winter of 2009/2010 presented special challenges to TAWC, including the TVA's coal ash spill and long periods of unusual extremely cold temperatures. On December 23, 2008, TAWC became aware of a situation involving potential environmental concerns impacting water supplies when the Tennessee Valley Authority issued a news release indicating that a coal ash storage pond at its Kingston Coal Fire Generating Plant had breached. The TVA reported that the contents of this storage pond, some 5 billion pounds of coal ash, had entered the Clinch River, a tributary of the Tennessee River. The impact of the spill was unknown at the time and the TVA reported that it was working to address the immediate emergency in the local area around Kingston. Because TAWC is the largest water utility that draws water from the Tennessee River, TAWC implemented its emergency response plan and began daily river sampling and water plant effluent sampling to inform customers, local officials, environmental and economic regulators, and the local news media regarding the effects, if any, to Chattanooga's drinking water. The cost of sampling was not contained in any budget, but nonetheless we assumed the obligation in order to ensure public health was being protected and our customers' concerns were being addressed. Our customers' main concern was the continued and uninterrupted supply of drinking water for daily needs, including public fire protection, and assurance that water quality at the tap was not impacted by the coal ash spill.

During December 2009 and January 2010, TAWC experienced a large increase in main breaks. Due to near zero degree temperatures for several weeks, TAWC experienced a 168% increase in main breaks and service line repairs, which impacted water customers during this period and in extreme cases, caused unavoidable service interruptions of hours or days. The extreme cold weather led to added costs in maintenance materials and capital spending, as well as manpower requirements and street restoration costs. Finally, the extreme cold also required additional water to be processed from the Citico Treatment Plant during that period because of additional leakage and the fact that customers ran their water to prevent freezing in their service lines. This contributed to TAWC's Non Revenue Water, Unaccounted For Water usage, and water losses which should not be counted against the Company as a result of the extreme weather conditions of December 2009 and January/February 2010.

34. Q. PLEASE DESCRIBE THE COMPANY'S NON-REVENUE WATER PROGRAM AND THE NON-REVENUE WATER STUDY THAT THE COMPANY HAS COMPLETED.

A. The Company has operated a non-revenue water program for several years. The purpose of the program is to develop a comprehensive water loss management strategy and implement a plan under which the Company can identify and improve non-revenue producing water levels. In the past, such losses were in part termed "unaccounted-for water." Even though water loss is part of a functioning water system, it is important to quantify the non-revenue water being used for legitimate consumption and the portion of water loss which is unaccounted for. When water losses are effectively managed, the Company can achieve not only a savings in production costs, but potentially in-network operating expenses as well. This proactive long-term solution would reduce the number of leaks and reduce certain expenses. As such, strategic planning is necessary for the reduction of non-revenue water.

The reduction of unbilled or non-revenue water (NRW) has not only become the focus of TAWC but also of the water utility industry. The program requires considerable investment in the way of capital investment, manpower, and time.

TAWC has adopted water audit methods that have been endorsed by the International Water Association (IWA) and the American Water Works Association (AWWA). A revised AWWA publication, *Water Audits and Leak Detection*, was published in 2006. This publication is also included in the American Water Works Association Manual M36, Third Edition 2009, used by TAWC. This international water loss strategy is relatively new in this country, but TAWC has used many of the best practices from this strategy to reduce water losses, address leakage and measure non-revenue water. Utilizing the IWA standard definitions, the new standards dictate moving away from the old "unaccounted for" water definitions and measures. Instead, the new standards favor water balance and uniform methods of collecting reliable data which can be benchmarked through a standard method with other utilities around the world. The strategy for TAWC incorporates those international standards included in Malcolm Farley and Stuart Trow's publication "Losses in Distribution Networks." Finally, AWWA in its monthly OPFLOW publication in July 2010 (attached as Exhibit JSW-8) has published an article that speaks to changes that AWWA's Water Loss Committee have identified for water utilities in states that are working to address the challenges of non-revenue water, including those located and operating in the state of Tennessee. Municipal water systems are not subject to state regulatory agencies jurisdiction, leaving them free to set their own level of non-revenue water losses, subject to the general oversight of TDEC.

TAWC also has a local NRW team which was formed and meets monthly to focus on water loss management and to identify and minimize water that is identified as non-revenue water. The NRW team has developed a database of information including immediate best practices of surveys, manual inspections of rights-of way, stream crossings, river crossings, and private fire services. The NRW team also tracks un-metered, unbilled authorized losses including fire hydrant flushing, water main flushing, and municipal uses. Leaks from water mains, customer service lines, services replaced, parallel mains retired, and small diameter main replacement have been tracked and are accounted for in the NRW database. Although these are water loss prevention best practices, they cannot by themselves fully eliminate NRW. More long-term proactive solutions were still necessary so that the number of leaks could be reduced, including significant additional investment in main and service replacement programs. Accordingly, an analysis of NRW was formulated to provide for an implementation plan that could be the basis for a needs assessment.

As a result, TAWC and other AWW subsidiaries developed a plan to further study and adopt best practices.

The plan reviewed the following areas:

- Water Audits
- Water Balance
- Leakage Control and Prevention
- Pressure Management
- District Metering
- Night Flow
- Water Main and Service Replacement
- System Flow Monitoring
- Meter Accuracy Monitoring
- Meter Reading and Billing Monitoring
- Authorized Un-Metered Monitoring
- Recordkeeping

- Monthly Reports
- Accountability for the process

The plan included the Water Balance Report for the assessment of volumes that can be compared and benchmarked and is provided as Exhibit JSW-9. The Water Audit has been completed yearly utilizing the IWA standards for each of the three operating districts (Chattanooga, Suck Creek, and Lone Oak) of TAWC.

In addition, TAWC has set up and implemented a NRW Activity Report which has been utilized for the purpose of collecting data for the Water Balance and the Water Audit using the AWWA Water Audit Software. The Water Audit Software is a spreadsheet-based water audit tool designed to help quantify and track water losses associated with water distribution systems and to identify areas for improved efficiency and cost recovery. Data collected by the water system using the AWWA Water Audit Software is then entered into the spreadsheet. This data includes: Authorized Consumption, Apparent Losses, Real Losses, System Data, and Cost Data for operating the water system. The Water Audit Software provides metrics, or Performance Indicators, which calculate the Water Balance and determine the individual water system Infrastructure Leakage Index ("ILI"), which is defined as the ratio of Current Annual Real Losses to the Unavoidable Annual Real Losses ("UARL"). The AWWA Water Loss Control Committee has provided a table to assist water utilities in determining their water loss standing. The Target ILI Range will be between 1.0 and 8.0. The lower the amount of leakage and real losses that exist in the system, the lower the ILI value will be. The ILI performance factor is a highly effective performance indicator for comparing (benchmarking) performance among water utilities. The AWWA Water Audit Software worksheets, definitions, and reports are attached as Exhibit JSW-10. The Water Balance and the Water

Audit has been completed for years 2006 through 2009. The ILI performance indicator for TAWC each year has been between 1.7 and 1.9 and for 2009 is 1.71, which indicates that TAWC has a very favorable score. Some of the reasons for the favorable score are the relatively low cost of water treatment per million gallons delivered, the abundance of a stable and reliable source of supply, and the relative age of pipe and materials used in construction. Other reasons for TAWC's favorable score include the relatively high cost of repair and construction costs in the mountainous geography of Chattanooga and the high variability of pressure zones in the Company's service area versus the likelihood of operational cost savings to repair all water losses, real and apparent, including street repair, permitting, and other expenses associated with reduction in water loss.

TAWC commissioned the consulting engineering firm of Black and Veatch in Nashville, TN in November 2007 to further study NRW. That study, *Analysis of Non-Revenue Water: Technical Memoranda* is attached as Exhibit JSW-11.

35. Q. PLEASE SUMMARIZE THE SCOPE OF THE NON-REVENUE STUDY PREPARED BY BLACK AND VEATCH FOR TAWC.

A. The study addresses five primary areas, including: (1) Main Break Analysis; (2) Non-Revenue Water Reduction - Sub-Metering Zones; (3) Non-Revenue Water Reduction-Reduced Pressure Zones; (4)(a) Chattanooga Signal Mountain Area Water Distribution System Transient Analysis; (4)(b) Rossville Area Distribution System Transient Analysis; and (5) Small Meter Inaccuracies and Testing.

36. Q. PLEASE DESCRIBE THE ESTIMATED COSTS ASSOCIATED WITH IMPLEMENTING THE RECOMMENDATIONS FROM THE NON-

REVENUE WATER STUDY AND ANY CAPITAL IMPROVEMENTS NEEDED IN ORDER TO REDUCE NON-REVENUE WATER.

A. The Company has identified capital investments needed to improve its distribution system as outlined in the study.

The study recommended that the Company set up and maintain a main break analysis database. Such a database has been developed and implemented. The database requires utilizing existing Company resources and contracted service pipeline inspectors must enter the data recorded in the field from main breaks into this MS Excel and MS Access database.

The Company currently has a NRW supervisor and two full-time employees dedicated to the program. The costs of the program include 100% of their time plus fully loaded benefits, the existing leak detection equipment which has been in service from 3 to 9 years depending upon purchase date, and the cost to install the leak detection equipment in the field. Using the findings of the leak detection survey, we have begun prioritized replacement of 2-inch and 2-1/2 inch water mains, as well as other mains of a variety of sizes. By using the water main leak database the Company has been able to assign an estimated water loss value to each leak at the time it is repaired. It is currently estimated that TAWC will need to increase funding levels of small diameter pipe replacement substantially to address the replacement needs for this type of pipe where the majority of main breaks and leakage occur. The existing small diameter water mains identified in the B & V study (2-inch and 2-1/2 inch main breaks combined) represented on average approximately 70% of the actual water main breaks of TAWC from 1989 through 2006, the period in which the consultant reviewed TAWC's data. The replacement program would eventually reduce the footage of these types of mains in the future.

The Company has also identified the need to construct pressure-reducing valve stations and to segregate the distribution system into sub-metering zones as described in Memorandum #2 and Memorandum #3. The Company has currently budgeted $500,000 in 2010 and $1 million in 2011 to begin to press forward on PRV stations to create Pressure Reduction Zones as identified in the study.

A Distribution System Improvement Charge ("DSIC") program is currently operating in a number of American Water subsidiary states, and examples of this program have been approved by regulators in Pennsylvania, Ohio, Illinois, New York, and Indiana. The DSIC programs have assisted those companies through a DSIC program similar in scope and structure to the Pennsylvania American DSIC Program, which is currently approved for PAWC, and those states have helped these utilities to fund the cost of infrastructure replacement for their utilities. Given the magnitude of the need to replace aged small diameter mains at TAWC, the Company would suggest that a DSIC program should be considered for TAWC. Such a program would provide systematic surcharges for infrastructure replacement investments which would provide incentive to water utilities to undertake those costly expenditures and potentially extend the time between costly general rate case filings.

TEST YEARS

37. Q. PLEASE DESCRIBE THE TEST YEAR PERIOD AND THE ATTRITION YEAR PERIOD THAT THE COMPANY WILL BE USING IN THIS RATE CASE.

A. Company Witness Mike Miller has described the historic test year and the attrition year the Company has adopted, so I will not repeat this explanation. I would, however, like to have considered for the record in this case the direct testimony of

William H. Novak who provided testimony on behalf of the Tennessee Public Service Commission in TPSC Case No. U-87-7534 (Mar. 1988) and have this document noted as Exhibit JSW-12.

I would also like to point out that Mr. Novak describes in some detail the overall procedures used by the staff of the TPSC in that case on page 2 starting a line 10. At line 17, page 2, Mr. Novak states:

> Our normal approach is to adjust the historic test period to compensate for the net effects of all known and reasonably anticipated changes which might occur. The primary concern of the Commission in setting rates is to set rates which are just and reasonable, i.e., rates which are sufficient to cover the operating expenses of a utility, and to allow a reasonable return on its investments used in providing services to its customers. The Staff normally analyzes a twelve month historical period of operations called a "test period" which is based upon the Company's books, to test a utility's earnings under present rates. The revenues, expenses, and rate base may then be adjusted as necessary to properly reflect the Company's historical earnings. Since rates are set for the future, the Staff then attempts to determine what future events are likely to transpire which will change or alter the historical test period results. Changes can occur which cause either an increase, or a decrease in earnings. Changes can also occur which cause the company's investment to increase or decrease. The historical test period is therefore adjusted in order to compensate for the net effects of all known and reasonably anticipated changes which might occur.

Mr. Novak then goes on in his testimony to explain how the "attrition period" is determined and that changes or adjustments have been made for the attrition period because the attrition period would be the first year in which any new rates granted by the Commission would be in effect.

I wish to include this exhibit as an example of the straightforward approach the Tennessee Public Service Commission and the Tennessee Regulatory Authority utilized in setting rates for TAWC through the 2006 TAWC rate case No. 2006-00290 which established rates that become effective May 22, 2007. I believe that the process of setting a single historic test year and attrition year was both helpful and appropriate in setting the water service rates. That process is the process that I have been accustomed to for rate making in the states of Indiana, Ohio, and Virginia before the commissions which regulated our operations in those states. The Company does not believe this was the same process that was utilized in the 2008 TAWC rate case No. 2008-00039. Accordingly, the Company respectfully requests that the Authority consider returning to that methodology in setting rates for TAWC in this rate request.

BUSINESS TRANSFORMATION PROJECT

38. Q. WILL YOU PLEASE EXPLAIN WHAT BUSINESS TRANSFORMATION MEANS?

A. The term "Business Transformation" was developed by American Water for its internal audiences to frame the project that will improve the Company's business process and technology systems. Internal audiences will need to understand and support the effort since it will change the way they perform their work. In essence, the term is being used to maximize the benefits of the program for the business and our customers. Overall, Business Transformation will address American Water's needs to improve processes, rationalize data and upgrade our information technology systems.

39. Q. WILL YOU BRIEFLY OUTLINE THE SCOPE OF THE COMPANY'S BUSINESS TRANSFORMATION PROJECT?

A. The systems at American Water, which support many of our processes, are at the end of their useful life cycle. They were designed to accommodate a much smaller customer base than the Company now serves and are increasingly costly and more difficult to maintain and support since the vendors have issued newer versions that are not compatible with our current systems.

Customer expectations for service are far greater today than when our current systems were acquired. The lack of sufficient automation limits opportunities for customers to conduct many basic self-service tasks or employees to effectively service customers by obtaining appropriate information quickly and consistently from across multiple non-integrated systems. The demand for information to satisfy increasing customer needs is beyond the capability of our existing systems and requires a high degree of manual involvement.

TAWC is currently participating in a program to modernize its financial and customer service systems and to eliminate inefficient manual tasks where possible so that our business can build efficiencies and provide more cost-effective service to our customers.

1. The program aims to optimize workflow throughout field operations, improve our back-office operations, and enhance our customer service capabilities, which the Company believes is necessary and appropriate.

2. TAWC participated in a Comprehensive Planning study ("CPS") during 2009 and early 2010 to assess existing internal capabilities to satisfy customer and other stakeholder expectations. The study also included a review of technology options currently offered to enhance and automate processes, as appropriate, to improve customer service and efficiently comply with regulatory requirements.

3. The scope of the study encompassed a range of functional areas, including: human resources; finance and accounting; purchasing and inventory management; capital planning; cash management; and customer and field services.

4. An evaluation of appropriate software solutions was designed to identify the investments necessary to replace, upgrade, enhance and/or redesign specific business processes and applicable system components.

In the first quarter of 2010, the Company has finalized the CPS, complete the evaluation of appropriate software solutions, selected SAP as the software vendor integrator, and develop a strategy to transfer existing data to new system applications. Currently the system analysis, design and roadmap are being developed. Then, configuration of the system applications to meet the Company's business needs will begin. Configuration is slated to start in late 2010.

The overall Business Transformation program is expected to span approximately five years. As we make changes to enhance our business processes, we will incur incremental expenses, including costs to upgrade or replace outdated information systems, prior to realizing the full benefits from these investments.

By enhancing our key business processes and the systems that support them, the Company will be able to continue to provide high-quality water and wastewater service to our customers. Over the next five years, there will be three primary areas of focus:

- **Improve our processes:** We will improve or redesign the key business processes we use to run our business and serve our customers.
- **Rationalize our data:** Utilization of relational databases will allow improvements in efficiency and effectiveness in how we capture, use and maintain critical business information, making it easier to access, share across systems, and use every day to support our customers' needs.
- **Upgrade our technology:** We are going to simplify, consolidate, and upgrade our computer applications, as well as enhance the technology that supports them, so we have the right infrastructure to effectively support our business and our customers.

37. Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

TENNESSEE REGULATORY AUTHORITY

STATE OF TENNESSEE

COUNTY OF HAMILTON

BEFORE ME, the undersigned authority, duly commissioned and qualified in and for the State and County aforesaid, personally came and appeared John S. Watson, being by me first duly sworn deposed and said that:

He is appearing as a witness on behalf of Tennessee-American Water Company before the Tennessee Regulatory Authority, and if present before the Authority and duly sworn, his testimony would set forth in the annexed transcript consisting of 49 pages.

John S. Watson

Sworn to and subscribed before me
this 14 day of September 2010.

Pamela Buehler
Notary Public

My commission expires 3-17-12.

Tennessee-American Water Company
Report on Field Service Operations

	Service Metric		Year	January	February	March	April	May	June	July	August	September	October	November	December
4 A	Number of Service Orders Worked Monthly		2005	4,971	4,328	5,162	4,556	4,680	5,113	4,506	4,698	5,051	6,356	6,022	5,726
			2006	6,053	6,836	7,540	8,667	7,900	7,419	7,235	7,391	6,786	6,783	6,652	7,064
			2007	7,909	6,378	7,290	6,831	8,006	7,994	7,243	8,448	7,516	8,124	6,931	6,333
			2008	8,258	7,093	6,507	7,758	6,945	7,171	7,340	5,922	6,518	6,528	4,849	4,859
			2009	7,854	8,275	7,518	7,906	8,705	7,637	7,457	7,305	7,337	7,075	6,156	6,087
			2010	5,981	6,535	5,756	6,216	6,234	6,932	8,567	7,604				
4 B	Appointments-% appointment orders on time		2005	99.13%	99.40%	99.40%	99.78%	99.72%	99.73%	99.71%	99.49%	99.49%	99.56%	99.55%	99.60%
			2006	99.77%	99.65%	99.83%	99.82%	99.84%	99.60%	99.22%	99.85%	99.60%	99.62%	99.68%	99.89%
			2007	99.76%	99.78%	99.73%	99.87%	99.69%	99.84%	99.35%	98.96%	99.57%	99.77%	99.84%	99.70%
			2008	99.70%	99.69%	99.89%	99.91%	99.87%	99.87%	99.88%	99.61%	99.66%	99.89%	99.92%	99.86%
			2009	99.78%	99.82%	99.84%	99.87%	99.78%	99.69%	99.80%	99.64%	99.75%	99.73%	99.74%	98.59%
			2010	99.20%	99.48%	99.50%	99.60%	98.62%	98.75%	97.49%	99.36%				
4 C	# appointments missed		2005	43	26	31	10	13	14	13	24	26	23	27	23
			2006	14	24	13	12	13	23	13	10	27	12	21	8
			2007	19	14	20	9	25	13	45	88	32	19	25	19
			2008	25	22	7	7	9	9	10	11	22	7	4	7
			2009	17	15	12	10	15	24	15	26	18	19	16	86
			2010	56	34	34	25	86	17	165	49				
4 D a.	Total # of Meters in Accounts (Active 5/2006 to present) Active and Inactive incl Meters in Shop-2005/April 2006		2005	78,179	78,179	78,338	78,553	78,756	79,025	79,223	79,508	79,736	80,082	80,433	80,712
			2006	81,095	81,502	82,152	82,551	83,353	83,993	84,278	85,084	85,654	85,940	86,436	86,777
			2007	87,464	87,819	88,465	89,484	89,872	89,905	89,923	89,938	89,971	89,983	89,997	90,825
			2008	93,181	93,221	93,760	94,393	74,178	N/A	74,251	74,214	74,048	73,887	73,860	73,562
			2009	73,618	73,546	73,648	73,740	73,854	74,020	73,892	73,856	73,823	73,519	73,355	73,432
			2010	73,512	73,713	73,929	73,920	74,147	74,314						
b.	# of meters read		2005	76,487	49,215	77,782	67,679	68,344	78,572	60,764	65,048	73,466	69,736	66,204	41,313
			2006	97,287	57,283	86,674	64,483	88,653	80,139	67,114	71,228	83,391	68,968	78,873	70,170
			2007	80,378	70,389	74,207	71,046	70,418	72,853	75,370	81,464	68,778	81,708	71,826	71,968
			2008	82,129	75,145	65,140	76,261	68,137	73,783	77,738	75,509	72,316	82,567	62,397	78,707
			2009	74,653	72,678	79,020	58,545	70,701	76,811	79,340	76,750	75,756	75,592	68,124	81,868
			2010	74,648	69,639	80,641	73,342	71,698	79,316	75,718					
c.	# meters estimated		2005	9,108	8,364	8,990	6,168	3,420	4,131	3,099	3,032	8,412	9,449	3,797	5,045
			2006	6,413	1,675	1,112	798	1,172	882	733	700	817	2,390	3,024	1,134
			2007	1,077	716	822	535	540	412	476	606	458	488	565	497
			2008	583	475	366	516	352	417	401	380	423	443	281	689
			2009	491	263	333	249	384	361	303	403	339	470	414	695
			2010	542	2,070	356	400	258	398	330					
d.	% of meters estimated		2005	10.64%	14.53%	10.36%	8.33%	4.77%	5.12%	4.85%	4.45%	10.27%	11.93%	5.42%	12.77%
			2006	6.18%	2.71%	1.27%	1.22%	1.30%	1.09%	1.08%	0.97%	0.97%	3.35%	3.59%	1.58%
			2007	1.32%	1.01%	1.10%	0.75%	0.76%	0.56%	0.63%	0.74%	0.65%	0.57%	0.79%	0.69%
			2008	0.70%	0.63%	0.56%	0.66%	0.51%	0.56%	0.51%	0.50%	0.58%	0.53%	0.45%	0.87%
			2009	0.65%	0.36%	0.42%	0.42%	0.54%	0.46%	0.39%	0.53%	0.45%	0.62%	0.60%	0.84%
			2010	0.72%	2.89%	0.44%	0.54%	0.36%	0.50%	0.43%					
e.	# of meters not billed:		2005	0	0	0	0	0	0	0	0	0	0	0	0
			2006	0	0	0	0	0	0	0	0	0	0	0	0
			2007	0	0	0	0	0	0	0	0	0	0	0	0
			2008	1	1	0	1	0	1	1	0	0	0	0	0
			2009												
			2010												
		for 3 months	2005	0	0	0	0	0	0	0	0	0	0	0	0
			2006	0	0	0	0	0	0	0	0	0	0	0	0
			2007	0	0	0	1	0	0	1	0	1	0	0	0
			2008	0	0	0	0	0	0	0	0	0	0	0	0
			2009												
			2010												
		for 6 months	2005	0	0	0	0	0	0	0	0	0	0	0	0
			2006	0	0	0	0	0	0	0	0	0	0	0	0
			2007	0	0	0	0	0	0	0	0	0	0	0	0
			2008	0	0	0	0	0	0	0	0	0	0	0	0
			2009												
			2010												
		for 12 months	2005	0	0	0	0	0	0	0	0	0	0	0	0
			2006	0	0	0	0	0	0	0	0	0	0	0	0
			2007	0	0	0	2	0	0	0	0	0	0	0	0
			2008	0	0	0	0	10	1	1	0	0	0	0	0
			2009												
			2010												

Fuel Cost Adjustment

Rate Class	FCA 07/01/08	FCA 10/01/08	FCA 01/1/09	
Residential	$0.00723	$0.01904	$0.01401	All kWh
GSA-1	$0.00715	$0.01881	$0.01384	All kWh
GSA-2	$0.00715	$0.01881	$0.01384	First 15,000 kWh
	$0.00705	$0.01856	$0.01366	Additional kWh
GSA-3	$0.00705	$0.01856	$0.01366	All kWh
GSB	$0.00707	$0.01860	$0.01369	All kWh, Block 1 & 2
GSC	$0.00707	$0.01860	$0.01369	All kWh, Block 1 & 2
GSD	$0.00707	$0.01860	$0.01369	All kWh
MSB Part 1	$0.00707	$0.01860	$0.01369	All kWh, Block 1 & 2
MSB Part 2	$0.00707	$0.01860	$0.01369	All kWh, Block 1 & 2
MSC	$0.00707	$0.01860	$0.01369	All kWh, Block 1 & 2
MSD	$0.00707	$0.01860	$0.01369	All kWh
OL	$0.00723	$0.01904	$0.01401	All kWh
DPS	$0.00715	$0.01881	$0.01384	All kWh

GSA Rate Schedule Summary

Effective October 1, 2008

Availability

This rate applies to the firm power requirements of commercial and manufacturing customers with contract demands of 5,000 kW or less.

Base Electric Charges

GSA-1 and 2

These rates apply to customers whose contract demand or highest billing demand in the latest 12 months is not more than 1,000 kW.

Monthly Customer Charge:	$9.90 per delivery point (account)
Monthly Demand Charge:	First 50 kW – no charge Over 50 kW – $13.12 per kW
Monthly Energy Usage Charge:	First 15,000 kWh – 8.823¢ per kWh * Additional kWh over 15,000 – 4.599¢ per kWh*

GSA-3

This rate applies to customers whose contract demand or highest billing demand in the latest 12 months is greater than 1,000 kW. Manufacturers with Standard Industrial Classification (SIC) codes 20 – 39 and demands above 1,000 kW receive a Manufacturing Credit.

Monthly Customer Charge:	$160.63 per delivery point (account)
Monthly Demand Charge:	First 1,000 kW - $12.87 per kW Additional kW over 1,000 - $14.80 per kW
Monthly Energy Usage Charge:	4.599¢ per kWh*
Excess Demand Charge:	If the customer's billing demand is greater than 2,500 kW, there will be an additional charge of $14.80 per kW of the demand amount by which their billing demand exceeds the higher of 2,500 kW or their contract demand.
Manufacturing Credit:	This credit is only for manufacturers with SIC codes 20 through 39 who are above 1,000 kW (but less than or equal to 5,000 kW) metered demand. The credit is calculated as follows: • First 1,000 kW, a credit of $1.38 per kW is applied • Remaining kW, a credit of $1.63 per kW is applied • For all energy usage, a credit of 0.54¢ per kWh is applied

* Subject to current fuel cost adjustment.
Current fuel cost adjustment available at www.epb.net

Determination of Demand

EPB meters the demand in kW for customers who have the ability to exceed 50 kW. The billing demand will be the higher of:

1) the metered kW,
2) 85% of the metered kVA,
3) 30% of the contract demand, or
4) 30% of the highest billing demand in the latest 12 months

Minimum Bill

When a customer significantly reduces their electric energy consumption, but chooses to keep their account active, EPB will calculate a minimum bill based on the terms and conditions of the contract.

Seasonal Service

Seasonal service is for customers below 2,500 kW demand who have a need for electric service, but do not run their operation very often during the year. With seasonal service, the Determination of Demand and Minimum Bill sections of the rate schedule do not apply. However, the customer would need to operate infrequently because the demand and energy usage charges are higher than normal. Specifically, 1.03¢ per kWh is added to the Monthly Energy Usage Charge and $3.09 per kW is added to the Monthly Demand Charge (where applicable).

Contract Requirement

Customers whose demand exceeds 50 kW shall have a power contract with an initial term of one (1) year.

Complete Rate Information

This GSA Rate Schedule Summary is a condensed version of the official October 2008 rate schedule and is only intended to be used for informational purposes. For more complete and specific details, please call EPB at 648-1BIZ (1249) to request the more comprehensive Rate Schedule for October 2008. Please note that all bills are calculated based on the official rate schedule and fuel cost adjustment formula and electric service is subject to EPB's Rules and Regulations.

Fuel Cost Adjustment

Rate Class	FCA 10/01/08	FCA 01/01/09	FCA 04/01/09	Energy Amount
Residential	$0.01904	$0.01401	$0.00854	All kWh
GSA-1	$0.01881	$0.01384	$0.00844	All kWh
GSA-2	$0.01881	$0.01384	$0.00844	First 15,000 kWh
	$0.01856	$0.01366	$0.00832	Additional kWh
GSA-3	$0.01856	$0.01366	$0.00832	All kWh
GSB	$0.0186	$0.01369	$0.00834	All kWh, Block 1&2
GSC	$0.0186	$0.01369	$0.00834	All kWh, Block 1&2
GSD	$0.0186	$0.01369	$0.00834	All kWh
MSB Part 1	$0.0186	$0.01369	$0.00834	All kWh, Block 1&2
MSB Part 2	$0.0186	$0.01369	$0.00834	All kWh, Block 1&2
MSC	$0.0186	$0.01369	$0.00834	All kWh, Block 1&2
MSD	$0.0186	$0.01369	$0.00834	All kWh
OL	$0.01904	$0.01401	$0.00854	All kWh
DPS	$0.01881	$0.01384	$0.00844	All kWh

TENNESSEE VALLEY AUTHORITY

TVA Fuel Cost Adjustment To Reduce Rates in January

November 13, 2008

TVA today announced a decrease in its fuel cost adjustment effective Jan.1, 2009.

Because the fuel cost adjustment is a per kilowatt-hour charge, amounts that consumers will save depends on the amount of energy they use. While savings will vary across the Tennessee Valley, residential consumers can expect a decrease ranging from about $4 to $8 in their monthly power bills. Since retail billing periods for TVA power distributors vary across the Valley, some January bills will include December usage at the lower FCA amount.

"We are glad for the relief this decrease will bring to rate payers across the Valley," said TVA Chief Financial Officer Kim Greene. "Recent reductions in purchased power and natural gas prices have helped reduce our actual costs and forecast for the second quarter of 2009. Unfortunately, coal prices remain significantly higher than they were a year ago, and sustained drought conditions across the Tennessee Valley have cut TVA's hydro generation by more than 50 percent, preventing TVA's fuel costs from dropping further."

Greene said economic conditions led to a decrease in wholesale power sales July through September, which also helped lower the FCA by reducing TVA's reliance on its most expensive power sources.

About 60 percent of TVA's power supply comes from fossil fuels – primarily coal, along with oil and natural gas. When fuel prices increase, TVA's cost to produce electricity for the 9 million consumers across the seven-state Valley region increases as well.

Overall, the decrease represents about a 6-percent reduction on total average wholesale rates, and is a 25-

percent reduction from the current quarter's FCA amount. The second quarter FCA will decrease from 1.8 cents per kilowatt-hour to just over 1.3 cents per kilowatt-hour or 1.329 cents.

TVA began using a fuel cost adjustment mechanism in October 2006 after experiencing a spike in fuel costs caused by Hurricanes Katrina and Rita. Utilities across the country use such mechanisms to help recover the costs they must pay for fuel and purchased power. The adjustment is part of consumer power bills and can go up or down, depending on quarterly increases or decreases in these costs.

TVA is working with local power distributors to develop new energy efficiency products to help residents, businesses and large industries in the Valley save energy and money on power costs. In cooperation with participating power distributors, TVA will begin offering new initiatives early next year.

TVA is the nation's largest public power provider and is completely self-financing. TVA provides power to large industries and 159 power distributors that serve approximately 9 million consumers in seven southeastern states. TVA also manages the Tennessee River and its tributaries to provide multiple benefits, including flood damage reduction, navigation, water quality and recreation.

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TVA News Bureau, Knoxville, (865) 632-6000

TVA Newsroom

Fuel Cost Adjustment

Rate Class	FCA 01/01/09	FCA 04/01/09	FCA 07/01/09	Energy Amount
Residential	$0.01401	$0.00854	$0.00554	All kWh
GSA-1	$0.01384	$0.00844	$0.00548	All kWh
GSA-2	$0.01384	$0.00844	$0.00548	First 15,000 kWh
	$0.01366	$0.00832	$0.00540	Additional kWh
GSA-3	$0.01366	$0.00832	$0.00540	All kWh
GSB	$0.01369	$0.00834	$0.00542	All kWh, Block 1&2
GSC	$0.01369	$0.00834	$0.00542	All kWh, Block 1&2
GSD	$0.01369	$0.00834	$0.00542	All kWh
MSB Part 1	$0.01369	$0.00834	$0.00542	All kWh, Block 1&2
MSB Part 2	$0.01369	$0.00834	$0.00542	All kWh, Block 1&2
MSC	$0.01369	$0.00834	$0.00542	All kWh, Block 1&2
MSD	$0.01369	$0.00834	$0.00542	All kWh
OL	$0.01401	$0.00854	$0.00554	All kWh
DPS	$0.01384	$0.00844	$0.00548	All kWh

Fuel Cost Adjustment

Rate Class	FCA 07/01/09	FCA 10/01/09	FCA 11/01/09	Energy Amount
Residential	$0.00554	($0.00221)	($0.00326)	All kWh
GSA-1	$0.00548	($0.00219)	($0.00322)	All kWh
GSA-2	$0.00548	($0.00219)	($0.00322)	First 15,000 kWh
	$0.00540	($0.00216)	($0.00318)	Additional kWh
GSA-3	$0.00540	($0.00216)	($0.00318)	All kWh
GSB	$0.00542	($0.00216)	($0.00318)	All kWh, Block 1&2
GSC	$0.00542	($0.00216)	($0.00318)	All kWh, Block 1&2
GSD	$0.00542	($0.00216)	($0.00318)	All kWh
MSB Part 1	$0.00542	($0.00216)	($0.00318)	All kWh, Block 1&2
MSB Part 2	$0.00542	($0.00216)	($0.00318)	All kWh, Block 1&2
MSC	$0.00542	($0.00216)	($0.00318)	All kWh, Block 1&2
MSD	$0.00542	($0.00216)	($0.00318)	All kWh
OL	$0.00554	($0.00221)	($0.00326)	All kWh
DPS	$0.00548	($0.00219)	($0.00322)	All kWh

GSA Rate Schedule Summary

Effective October 1, 2009

Availability

This rate applies to the firm power requirements of commercial and manufacturing customers with contract demands of 5,000 kW or less.

Base Electric Charges

GSA-1 and 2

These rates apply to customers whose contract demand or highest billing demand in the latest 12 months is not more than 1,000 kW.

Monthly Customer Charge: $9.90 per delivery point (account)

Monthly Demand Charge: First 50 kW – no charge.

Over 50kW – $14.04 per kW

Monthly Energy Usage Charge: First 15,000 kWh – 9.499¢ per kWh*

Additional kWh over 15,000 – 4.981¢ per kWh*

GSA-3

This rate applies to customers whose contract demand or highest billing demand in the latest 12 months is greater than 1,000 kW. Manufacturers with Standard Industrial Classification (SIC) codes 20 – 39 and demands above 1,000 kW receive a Manufacturing Credit.

Monthly Customer Charge:	$160.63 per delivery point (account)
Monthly Demand Charge:	First 1,000 kW - $13.85 per kW Additional kW over 1,000 - $15.95 per kW
Monthly Energy Usage Charge:	4.981¢ per kWh*
Excess Demand Charge:	If the customer's billing demand is greater than 2,500 kW, there will be an additional charge of $15.95 per kW of the demand amount by which their billing demand exceeds the higher of 2,500 kW or their contract demand.
Manufacturing Credit:	This credit is only for manufacturers with SIC codes 20 through 39 who are above 1,000 kW (but less than or equal to 5,000 kW) metered demand. The credit is calculated as follows:

- First 1,000 kW, a credit of $1.38 per kW is applied
- Remaining kW, a credit of $1.63 per kW is applied
- For all energy usage, a credit of 0.54¢ per kWh is applied

*Subject to current fuel cost adjustment.
Current fuel cost adjustment available at www.epb.net

Determination of Demand

EPB meters the demand in kW for customers who have the ability to exceed 50 kW. The billing demand will be the higher of:

1) the metered kW,
2) 85% of the metered kVA,
3) 30% of the contract demand, or
4) 30% of the highest billing demand in the latest 12 months

Minimum Bill

When a customer significantly reduces their electric energy consumption, but chooses to keep their account active, EPB will calculate a minimum bill based on the terms and conditions of the contract

Seasonal Service

Seasonal service is for customers below 2,500 kW demand who have a need for electric service, but do not run their operation very often during the year. With seasonal service, the Determination of Demand and Minimum Bill sections of the rate schedule do not apply. However, the customer would need to operate infrequently because the demand and energy usage charges are higher than normal. Specifically, 1.03¢ per kWh is added to the Monthly Energy Usage Charge and $3.09 per kW is added to the Monthly Demand Charge (where applicable).

Contract Requirement

Customers whose demand exceeds 50 kW shall have a power contract with an initial term of one (1) year.

Complete Rate Information

This GSA Rate Schedule Summary is a condensed version of the official October 2009 rate schedule and is only intended to be used for informational purposes. For more complete and specific details, please call EPB at 648-1BIZ (1249) to request the more comprehensive Rate Schedule for October 2009. Please note that all bills are calculated based on the official rate schedule and fuel cost adjustment formula and electric service is subject to EPB's Rules and Regulations.

Business Electrical Rates

EPB's firm commercial rates are determined by the type of business and its total demand for energy. All rates are effective October 1, 2009. View the current fuel cost adjustment by rate classification.

You can download rates for each customer class below or a summary of all rate classes. You will need **Acrobat Reader** to view the rate information.

Customer Rate Classification	Demand	Rate Summary
Small Commercial (GSA1)	less than 50 kW	View Rates
Commercial (GSA2)	50 kW - 1000 kW	View Rates
Commercial / Manufacturing (GSA3)	1001 kW - 5000 kW	View Rates
Large Commercial (GSB)	5001 kW - 15,000 kW	View Rates
Very Large Commercial (GSC)	15,001 kW - 25,000 kW	View Rates
Extra Large Commercial (GSD)	greater than 25,000 kW	View Rates
Large Manufacturers (MSB)	5001 kW - 15,000 kW (SIC codes 20 -39)	View Rates
Very Large Manufacturers (MSC)	15,001 kW - 25,000 kW (SIC codes 20 -39)	View Rates
Extra Large Manufacturers (MSD)	greater than 25,000 kW (SIC codes 20 -39)	View Rates

Interruptible Pricing

For customers who qualify, EPB offers interruptible demand credits in exchange for the customer's ability to suspend using specified amounts of power upon five or sixty minutes' notice. The products are known as 5 MR and 60 MR and require a demand of at least 1,000 kW and at least a 50% load factor to be eligible. Contact an EPB Key Customer Representative for details or fill out our Business Service Request form.

Time of Use Rates

EPB offers restrictive time of use rates. Please contact an EPB Key Customer Representative for details.

Other Commercial Rates

Pumping Station:
Monthly Customer Charge - $9.90
Usage Charge (per kWh) - $0.05002

Outdoor Lighting:
(Street and Park Lighting Systems, Traffic Signal Systems, Athletic Field Lighting Installations)
Monthly Customer Charge (excludes Street and Park Lighting Systems) - $2.94
Usage Charge (per kWh) - $0.06214

Retail Fuel Cost Adjustment

Rate Class	FCA 03/01/10	FCA 04/01/10	FCA 05/01/10	Energy Amount
Residential	($0.00582)	($0.00203)	($0.00138)	All kWh
GSA-1	($0.00575)	($0.00201)	($0.00136)	All kWh
GSA-2	($0.00575)	($0.00201)	($0.00136)	First 15,000 kWh
	($0.00567)	($0.00198)	($0.00135)	Additional kWh
GSA-3	($0.00567)	($0.00198)	($0.00135)	All kWh
GSB	($0.00569)	($0.00199)	($0.00135)	All kWh, Block 1&2
GSC	($0.00569)	($0.00199)	($0.00135)	All kWh, Block 1&2
GSD	($0.00569)	($0.00199)	($0.00135)	All kWh
MSB Part 1	($0.00569)	($0.00199)	($0.00135)	All kWh, Block 1&2
MSB Part 2	($0.00569)	($0.00199)	($0.00135)	All kWh, Block 1&2
MSC	($0.00569)	($0.00199)	($0.00135)	All kWh, Block 1&2
MSD	($0.00569)	($0.00199)	($0.00135)	All kWh
OL	($0.00582)	($0.00203)	($0.00138)	All kWh
DPS	($0.00575)	($0.00201)	($0.00136)	All kWh

Retail Fuel Cost Adjustment

Rate Class	FCA 07/01/10	FCA 08/01/10	FCA 09/01/10	Energy Amount
Residential	$0.00425	$0.00536	$0.00695	All kWh
GSA-1	$0.00420	$0.00529	$0.00687	All kWh
GSA-2	$0.00420	$0.00529	$0.00687	First 15,000 kWh
	$0.00414	$0.00522	$0.00677	Additional kWh
GSA-3	$0.00414	$0.00522	$0.00677	All kWh
GSB	$0.00415	$0.00523	$0.00679	All kWh, Block 1&2
GSC	$0.00415	$0.00523	$0.00679	All kWh, Block 1&2
GSD	$0.00415	$0.00523	$0.00679	All kWh
MSB Part 1	$0.00415	$0.00523	$0.00679	All kWh, Block 1&2
MSB Part 2	$0.00415	$0.00523	$0.00679	All kWh, Block 1&2
MSC	$0.00415	$0.00523	$0.00679	All kWh, Block 1&2
MSD	$0.00415	$0.00523	$0.00679	All kWh
OL	$0.00425	$0.00536	$0.00695	All kWh
DPS	$0.00420	$0.00529	$0.00687	All kWh

ORDINANCE NO. 11344

AN ORDINANCE TO AMEND PART II, CHATTANOOGA CITY CODE, CHAPTER 31, ARTICLE II, SECTIONS 31-36, 31-41 AND 31-43, RELATIVE TO SEWER SERVICE CHARGES AND FEES.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHATTANOOGA, TENNESSEE:

SECTION 1. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36(a), be and the same is hereby deleted and the following substituted in lieu thereof:

(a) Enumeration of charges; quantity of water used. Sewer service charges shall be based upon the quantity of water used as shown by water meter readings and shall be the dollar amount derived by applying the total charge in dollars per one thousand (1,000) gallons for the quantities of water shown in the following table:

User Class (gallons)	Fiscal Year 2002/2003 Total Charges ($/1,000 gallons)	Fiscal Year 2003/2004 Total Charges ($/1,000 gallons)	Fiscal Year 2004/2005 Total Charges ($/1,000 gallons)
First 100,000	$ 3.68	$ 3.94	$ 4.04
Next 650,000	2.70	2.91	2.99
Next 1,250,000	2.18	2.36	2.42
Next 30,000,000	1.59	1.74	1.79
Over 32,000,000	1.40	1.52	1.56

In addition, the total charges derived from the above chart for residential users consuming 100,000 gallons of water or less per month will be multiplied by ninety (90) percent to compensate for water use not going to the sewer such as lawn and garden watering.

SECTION 2. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-37, be and the same is hereby deleted and the following substituted in lieu thereof:

Minimum sewer service charges based upon water meter connection size shall be as follows:

Monthly Minimum Sewer Service Charges

Meter Size (inches)	Fiscal Year 2002/2003 Charge per Month	Fiscal Year 2003/2004 Charge per Month	Fiscal Year 2004/2005 Charge per Month
5/8	$ 7.62	$ 8.15	$ 8.36
3/4	27.20	29.10	29.83
1	47.52	50.85	52.12
1-1/2	106.36	113.80	116.65
2	188.32	201.50	206.54
3	441.44	472.34	484.15
4	815.79	872.89	894.72
6	1,943.09	2,079.10	2,131.08
8	3,436.97	3,677.56	3,769.50

The minimum sewer service change for residential users with various meter size shall be multiplied by ninety (90) percent to compensate for water use not going to the sewer such as lawn and garden watering.

SECTION 3. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36(c), be and the same is hereby deleted and the following substituted in lieu thereof:

(c) Billable flow. The amount due from the regional user shall be the dollar amount derived by applying the total charge shown in the table below per one thousand (1,000) gallons of water sold.

	Regional Operation & Maintenance Charge ($/1,000 gallons)	Regional Debt Charge ($/1,000 gallons)	Regional Total Charge (Wheelage and Treatment) ($/1,000 gallons)
Wheelage and Treatment	$ 0.9714	$ 0.4922	$ 1.4636

If regional customers are billed directly through the water company, the rate to be charged shall be one dollar and forty-seven cents ($1.47) per one thousand (1,000) gallons.

SECTION 4. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36(d), be and the same is hereby deleted and the following substituted in lieu thereof:

(d) Total flow. The amount due from the regional user shall be the dollar amount derived by applying the total charge shown in the table below applied to the quantity of water measured by a flow meter installed and maintained at or near the point of connection between the system of the regional user and the Chattanooga system. In the event of any malfunction of said meters, flow shall be estimated, interpolated and/or projected in the most equitable manner possible. Such estimates, along with available readings for periods where there was no malfunction, shall be the basis for billing.

	Regional Operation & Maintenance Charge ($/1,000 gallons)	Regional Debt Charge ($/1,000 gallons)	Regional Total Charge (Wheelage and Treatment) ($/1,000 gallons)
Wheelage and Treatment	$ 0.5393	$ 0.2733	$ 0.8126

SECTION 5. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-41(c), be and the same is hereby deleted and the following substituted in lieu thereof:

(c) Rates. Based upon the current cost of treating wastewater containing constituents with concentrations in excess of "normal wastewater," numerical rates are hereby established for Bc and Sc as follows:

Bc = $0.089 per pound of BOD for concentrations in excess of three hundred (300) milligrams per liter.

Sc = $0.065 per pound of total suspended solids for concentrations in excess of four hundred (400) milligrams per liter.

SECTION 6. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-43(b), be and the same is hereby deleted and the following substituted in lieu thereof:

> (b) Fees for garbage grinders. Any user of a garbage grinder, except users in a premise used exclusively for an individual residence, shall be charged at a rate of one hundred-five dollars and twenty-four cents ($105.24) per month. The superintendent shall bill users on a bi-monthly basis and the bills shall be due and payable within thirty (30) days following the last day of the billing period. The fee for Fiscal Year 2003/2004 shall be one hundred fourteen dollars and sixty-five cents ($114.65) per month. The fee for Fiscal Year 2004/2005 shall be one hundred nineteen dollars and sixty-eight cents ($119.68) per month.

SECTION 7. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-43(f), be and the same is hereby deleted and the following substituted in lieu thereof:

> (f) Fees for septic tank discharge. All persons discharging concentrated, domestic septic tank sewage waste from a truck under the provisions of Article III of this Chapter shall be charged at the rate of twenty-six dollars and nineteen cents ($26.19) per one thousand (1,000) gallons of such waste. The fee for Fiscal Year 2003/2004 shall be twenty-eight dollars and fifty-three cents ($28.53) per one thousand (1,000) gallons of such waste. The fee for Fiscal Year 2004/2005 shall be twenty-nine dollars and seventy-nine cents ($29.79) per one thousand (1,000) gallons of such waste.

SECTION 8. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-43(g), be and the same is hereby deleted and the following substituted in lieu thereof:

> (g) Fees Holding tank wastes.. All persons discharging any other holding tank waste authorized pursuant to division to division 6 of this article shall be charged at the rate of three dollars and sixty-eight cents ($3.68) per one thousand (1,000) gallons of such discharge, plus any surcharge rate authorized by Article III of this chapter for concentrations of pollutants in excess of normal waste water without regard to the definition of the industrial user or other limitations set forth in said section. The superintendent may

also require a chemical analysis of such waste and charge therefore. The fee for Fiscal Year 2003/2004 shall be three dollars and ninety-four cents ($3.94). The fee for Fiscal Year 2004/2005 shall be four dollars and four cents ($4.04).

SECTION 9. That this Ordinance shall become effective two (2) weeks from and after its passage as provided by law, but that the operative dates of the changes in rates specified herein shall be July 1, 2002 and that the operative dates for the users billed through the water suppliers shall be December 1, 2002.

SECTION 10. Notwithstanding any other provision of this Ordinance to the contrary, water providers within the City of Chattanooga shall bill according to the new Chattanooga sewer service charges effective on the following dates:

(1) For the Fiscal Year 2002/2003 - For service rendered beginning on the 1st day of December, 2002, and until the 30th day of September, 2003;

(2) For Fiscal Year 2003/2004 - For service rendered beginning on the 1st day of October, 2003, and until the 30th day of September, 2004; and

(3) For Fiscal Year 2004/2005 - For service rendered beginning the 1st day of October, 2004, and until further notice.

PASSED on Third and Final Reading

November 5, 2002.

S/ ____________________
CHAIRPERSON

APPROVED: X DISAPPROVED: ____

DATE: November 10, 2002

S/ ____________________
MAYOR

Reviewed By: s/ ____________________
James S. Boney

jcm/ffk/pm

1ST READING 9-16-08
2ND READING 9-23-08
INDEX NO.

ORDINANCE NO. 12166

AN ORDINANCE TO AMEND ORDINANCE NO. 12139, ENTITLED "AN ORDINANCE, HEREINAFTER ALSO KNOWN AS 'THE FISCAL YEAR 2008-2009 BUDGET ORDINANCE', TO PROVIDE REVENUE FOR THE FISCAL YEAR BEGINNING JULY 1, 2008, AND ENDING JUNE 30, 2009, AND APPROPRIATING SAME TO THE PAYMENT OF EXPENSES OF THE MUNICIPAL GOVERNMENT; FIXING THE RATE OF TAXATION ON ALL TAXABLE PROPERTY IN THE CITY, AND THE TIME TAXES AND PRIVILEGES ARE DUE, HOW THEY SHALL BE PAID, WHEN THEY SHALL BECOME DELINQUENT; PROVIDING FOR INTEREST AND PENALTY ON DELINQUENT TAXES AND PRIVILEGES," SO AS TO SET FORTH THE BUDGET OF THE INTERCEPTOR SEWER SYSTEM AND TO AMEND CHATTANOOGA CITY CODE, PART II, CHAPTER 31, SECTIONS 31-36, 31-37, 31- 41 and 31- 43.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHATTANOOGA, TENNESSEE:

SECTION 1. That Ordinance No. 12139, entitled as set forth in the caption hereof, be and the same is amended as provided hereinafter.

SECTION 2. That there be and is hereby added a new Section 6(d) establishing the operating budget for the Interceptor Sewer System (Fund 5100) for Fiscal Year 2008-2009.

5100 INTERCEPTOR SEWER SYSTEM Estimated Revenues:	FY 07 Actual	FY 08 Projected	FY 09 Proposed
Sewer Service Charges	$30,507,080	$32,404,211	$35,034,044
Industrial Surcharges	3,737,690	3,672,798	2,900,000
Septic Tank Charges	285,254	299,886	225,568
Wheelage and Treatment:			
Lookout Mountain, TN	155,004	149,187	$172,341
Dade County	6,199	10,842	13,540
Walker County, GA	357,611	398,104	439,225
Collegedale, TN	218,022	246,620	291,670
Soddy-Daisy, TN	124,731	135,893	165,948
East Ridge, TN	977,987	886,612	1,017,255
Windstone	23,193	21,373	27,147
Hamilton County, TN	540,500	606,775	680,676
[illegible]	[illegible]	[illegible]	[illegible]

	FY 07 Actual	FY 08 Projected	FY 09 Proposed
Lookout Mountain, GA	55,991	57,081	65,238
Rossville, GA	324,184	337,060	393,056
Ringgold, GA	87,247	203,244	254,742
Red Bank, TN	443,443	436,164	498,199
Debt Service Northwest Georgia	441,074	447,000	447,353
Industrial User Permits	40,500	38,500	41,000
Industrial User Fines	12,900	3,300	-
Miscellaneous	20,121	66,770	-
Garbage Grinder Fees	41,773	41,129	50,220
Operating Revenue:	$38,959,700	$41,010,282	$43,382,028
Fund Balance (P540)	2,321,695	1,239,260	7,500,000
Interest Earnings	1,746,502	1,630,149	375,000
	$43,027,897	$43,879,691	$51,257,028
Appropriations:			
Operations & Maintenance:			
Administration	2,238,790	2,270,518	2,463,483
Laboratory	540,449	566,651	642,928
Engineering	249,648	324,675	367,728
Plant Maintenance	1,260,536	1,301,138	1,529,036
Sewer Maintenance	1,810,396	2,105,793	2,807,774
Moccasin Bend - Liquid Handling	6,587,538	8,515,155	7,860,615
Inflow & Infiltration	788,805	1,100,737	1,248,463
Safety & Training	119,881	129,768	134,825
Pretreatment/Monitoring	318,214	391,552	441,007
Moccasin Bend - Solid Handling	3,843,507	2,720,281	4,184,563
Landfill Handling	1,403,183	1,606,636	1,725,000
Combined Sewer Overflow	139,996	155,319	544,400
Total Operations & Maintenance	$19,300,943	$21,188,223	$23,949,822
Pumping Stations:			
Mountain Creek Pump Station	22,904	24,979	$21,535
Citico Pump Station	296,344	360,543	297,810
Friar Branch Pump Station	106,871	124,172	197,140
Hixson 1, 2, 3, & 4 Pump Stations	75,520	124,098	92,323
19th Street Pump Station	48,948	29,555	51,825
Orchard Knob Pump Station	57,194	38,462	56,460
South Chickamauga Pump Station	356,966	422,162	332,800
Tiftonia 1 & 2 Pump Stations	25,444	47,084	48,650
23rd Street Pump Station	128,548	142,562	189,630
Latta Street Pumping Stations	5,977	7,412	18,505
Residential Pump Stations	20,116	20,853	70,500
Murray Hills Pump Station	8,576	10,030	17,460
Highland Park Pump Station	9,660	9,600	13,760

	FY 07 Actual	FY 08 Projected	FY 09 Proposed
Big Ridge 1-5 Pump Stations	50,784	73,831	95,723
Dupont Parkway Pump Station	15,745	19,085	30,915
VAAP Pump Station	1,648	2,504	5,110
Northwest Georgia Pump Station	37,337	32,750	85,425
Brainerd Pump Station	12,532	47,038	16,215
East Brainerd Pump Station	30,091	70,607	101,590
North Chattanooga Pump Station	13,829	15,535	20,960
South Chattanooga Pump Station	1,824	3,619	5,405
Ooltewah-Collegedale Pump Station	77,136	79,957	98,470
Odor Control Pump Stations	367,482	668,437	675,000
Enterprise South Pump Station	276	3,104	3,108
River Park Pump Station	-	5,381	4,250
Ringgold Pump Station	7,286	30,937	98,400
Total Pumping Stations	$1,779,040	$2,414,297	$2,648,969
Total Operations & Maintenance	$21,079,983	$23,602,520	$26,598,791
Capital Improvement	108,954	219,966	$627,594
Debt Service Reserve	0	640,049	$935,697
Construction Trust Fund (P540)	2,321,695	1,239,260	7,500,000
Debt Service			
Principal	10,854,522	11,196,580	$11,484,348
Interest	4,696,538	4,806,086	4,110,598
	$15,551,060	$16,002,666	$15,594,946
Total Appropriations:	$39,061,692	$41,704,461	$51,257,028

SECTION 3. That Section 7(b) of said Ordinance be amended as hereinafter set out:

ADDITIONS:

INTERCEPTOR SEWER SYSTEM

ADMINISTRATION

C00575	1	Director Waste Resources		29	B
C00590	1	Waste Resources Plant Engineer		22	B
C01301	2	Inventory Clerk	(each)	5	H
C04009	1	IT Specialist		19	B
C04011	1	Fiscal Analyst		17	B
C04028	1	Inventory Coordinator		13	B
C04037	1	Administrative Support Spec		10	B
C04047	1	Adm Support Assistant 2		7	B

C04051	1	Inventory Technician		7	B
C04052	1	Personnel Assistant		7	B
C04057	1	Adm Support Assistant 1		4	B
C04071	1	Project Engineer		22	B

LABORATORY

C00591	1	Manager Laboratory Services		23	B
C00594	1	Chemist		17	B
C04091	1	Laboratory Technician 2		13	B
C04094	4	Laboratory Technician 1	(each)	12	B

ENGINEERING

C00596	1	Construction Inspector Supv		18	B
C00597	1	Waste Resources Sys Engineer		25	B
C00598	2	Sewer Project Coordinator	(each)	15	B
C01301	1	Inventory Clerk		5	B

PLANT MAINTENANCE

C00601	1	Plant Maintenance Supervisor		21	B *
C00603	1	Chief Electrical Instmnt Techn		19	H *
C00605	2	Chief Maintenance Mechanic	(each)	19	H *
C00610	11	Plant Maintenance Mechanic	(each)	11	H *
C00618	3	Plant Maintenance Lubricator	(each)	5	H *
C04018	7	Electrician 2	(each)	14	H *
C04038	1	Crew Supervisor 2		12	H *
C04040	1	Bldg Maintenance Mechanic 1		9	B *
C04058	1	Crew Worker 2		4	H

* *denotes positions authorized to receive a tool allowance based on City of Chattanooga, Department of Public Works, Interceptor Sewer System policy.*

SEWER MAINTENANCE

C04010	1	General Supervisor		18	B
C04030	5	Crew Supervisor 3	(each)	14	H
C04058	2	Crew Worker 2	(each)	4	H
C04100	5	Equipment Operator 4	(each)	10	H
C04102	4	Equipment Operator 3	(each)	8	H

MOCCASIN BEND TREATMENT PLANT – LIQUID HANDLING

C00630	1	Plant Superintendent		27	B
C00633	5	Chief Plant Operator	(each)	15	H
C00636	5	Plant Operator 3	(each)	13	H
C00638	7	Plant Operator 1	(each)	9	H

C04006	1	Plant Operations Supervisor		21	B
C04034	9	Plant Operator 2	(each)	11	H
C04057	1	Adm Support Assistant 1		4	B
		INFLOW AND INFILTRATION			
C04010	1	General Supervisor		18	H
C04030	3	Crew Supervisor 3	(each)	14	H
C04058	3	Crew Worker 2	(each)	4	H
C04102	6	Equipment Operator 3	(each)	8	H
		SAFETY & TRAINING			
C04014	1	Occupational Safety Specialist		17	B
C04058	1	Crew Worker 2		4	H
		PRETREATMENT/MONITORING			
C00652	1	Pretreatment Supervisor		19	B
C00653	4	Monitor Technician	(each)	12	B
C00655	1	Pretreatment Inspector		12	B
C04047	1	Adm Support Assistant 2		7	B
		MOCCASIN BEND TREATMENT PLANT – SOLID HANDLING			
C00636	1	Plant Operator 3		13	H
C00638	3	Plant Operator 1	(each)	9	H
C04006	1	Plant Operations Supervisor		21	B
C04034	8	Plant Operator 2	(each)	11	H
C04102	1	Equipment Operator 3		8	H

SECTION 4. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36(a), be and the same is hereby deleted and the following substituted in lieu thereof:

(a) Enumeration of charges; quantity of water used. Sewer service charges shall be based upon the quantity of water used as shown by water meter readings and shall be the dollar amount derived by applying the total charge in dollars per one thousand (1,000) gallons for the quantities of water shown in the following table:

User Class (gallons)	Fiscal Year 2008/2009 - 1 Total Charges ($/1,000 gallons)	Fiscal Year 2008/2009 - 2 Total Charges ($/1,000 gallons)
First 100,000	$ 4.98	$ 5.12
Next 650,000	3.69	3.80
Next 1,250,000	2.99	3.08
Next 30,000,000	2.40	2.55
Over 32,000,000	2.30	2.45

In addition, the total charges derived from the above chart for residential users will be multiplied by ninety (90) percent to compensate for water use not going to the sewer such as lawn and garden watering. Any residential location where a separate water meter has been installed for the purpose of lawn and garden watering shall not be entitled to have the multiplier applied to any water consumed through the primary water meter. Each residence or apartment unit shall have a maximum monthly sewer service charge for a volume of no more than 12,000 gallons water used; unless the minimum charge due to water meter size exceeds the 12,000 gallon limit, then the monthly sewer service charge shall be at least the minimum for that particular size water meter.

SECTION 5. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36(c) as relates to sewer service charges and fees be and the same is hereby deleted and the following substituted in lieu thereof:

(c) Billable flow. The amount due from the regional user shall be the dollar amount derived by applying the total charge shown in the table below per one thousand (1,000) gallons of water sold.

	Regional Operation & Maintenance Charge ($/1,000 gallons)	Regional Debt Charge ($/1,000 gallons)	Regional Total Charge (Wheelage and Treatment) ($/1,000 gallons)
Wheelage and Treatment	$ 1.5317	$ 0.6738	$ 2.2055

If regional customers are billed directly through the water company, the rate to be charged shall be two dollars and twenty one cents ($2.21) per one thousand (1,000) gallons.

SECTION 6. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36 (d), be and the same hereby deleted and the following substituted in lieu thereof:

(d) Total flow. The amount due from the regional user shall be the dollar amount derived by applying the total charge shown in the table below applied to the quantity of water measured by a flow meter installed and maintained at or near the point of connection between the system of the regional user and the Chattanooga system. In the event of any malfunction of said meters, flow shall be estimated, interpolated and/or projected in the most equitable manner possible. Such estimates, along with available readings for periods where there was no malfunction, shall be the basis for billing.

	Regional Operation & Maintenance Charge ($/1,000 gallons)	Regional Debt Charge ($/1,000 gallons)	Regional Total Charge (Wheelage and Treatment) ($/1,000 gallons)
Wheelage and Treatment	$ 0.8627	$ 0.3661	$ 1.2288

SECTION 7. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-37, be and the same is hereby deleted and the following substituted in lieu thereof:

Minimum sewer service charges based upon water meter connection size shall be as follows:

Monthly Minimum Sewer Service Charges

Meter Size (inches)	Fiscal Year 2008/2009 -1 Charge per Month	Fiscal Year 2008/2009 - 2 Charge per Month
5/8	$ 10.28	$ 10.58
3/4	36.67	37.74
1	64.08	65.94
1-1/2	143.41	147.58

2	253.92	261.31
3	595.20	612.53
4	1,099.94	1,131.98
6	2,619.88	2,696.19
8	4,634.10	4,769.07

The minimum sewer service change for residential users with various meter size shall be multiplied by ninety (90) percent to compensate for water use not going to the sewer such as lawn and garden watering. Any residential location where a separate water meter has been installed for the purpose of lawn and garden watering shall not be entitled to have the multiplier applied to any water consumed through the primary water meter.

SECTION 8. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-41(c), be and the same is hereby deleted and the following substituted in lieu thereof:

(c) Rates. Based upon the current cost of treating wastewater containing constituents with concentrations in excess of "normal wastewater," numerical rates are hereby established for Bc and Sc as follows:

Bc = $0.096 per pound of BOD for concentrations in excess of three hundred (300) milligrams per liter.

Sc = $0.065 per pound of total suspended solids for concentrations in excess of four hundred (400) milligrams per liter.

SECTION 9. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-43 (b), (f) and (g) be and the same are hereby deleted and the following substituted in lieu thereof:

(b) *Fees for garbage grinders.* Any user of a garbage grinder, except users in a premise used exclusively for an individual residence, shall be charged at a rate of one hundred fifty five dollars ($155.00) per month. The superintendent shall bill users on a bi-monthly basis and the bills shall be due and payable within fifteen (15) days following the last day of the billing period.

(f) *Fees for septic tank discharge.* All persons discharging concentrated, domestic septic tank sewage waste from a truck under the provisions of Article III of this Chapter shall be charged at the rate of fifty seven dollars ($57.00) per one thousand (1,000) gallons of such waste. The minimum charge for septic tank discharges shall be one half (1/2) of the rate for one thousand (1,000) gallons of the rate in effect at the time of such discharge. All persons discharging grease trap or grease interceptor waste or loads where septic tank waste has been mixed or blended with grease trap or grease interceptor waste shall be charged at the rate two (2) times the rate for septic tank wastes.

(g) *Fees holding tank wastes.* All persons discharging any holding tank waste authorized pursuant to division 6 of this article shall be charged at the rate of four dollars and ninety-eight cents ($4.98) per one thousand (1,000) gallons of such discharge, plus any surcharge rate authorized by Article III of this chapter for concentrations of pollutants in excess of normal waste water without regard to the definition of the industrial user or other limitations set forth in such section. The superintendent may also require a chemical analysis of such waste and charge therefore. The fee for fiscal year 2008/2009 – 2 shall be five dollars and twelve cents ($5.12). The minimum charge for holding tank wastes shall be the fee for one thousand (1,000) gallons of said discharge of the rate in effect at the time of such discharge.

SECTION 10. That this Ordinance shall be operative, as distinguished from its effective date, on and after July 1, 2008.

SECTION 11. Notwithstanding any other provision of this Ordinance to the contrary, water providers within the City of Chattanooga shall bill according to the new Chattanooga sewer service charges effective on the following dates:

(1) For the Fiscal Year 2008/2009 - 1 - For service rendered beginning on the 1st day of October, 2008, and until the 31st day of March, 2009;

(2) For Fiscal Year 2008/2009 - 2 - For service rendered beginning on the 1st day of April, 2009, and until further notice.

SECTION 12. That if any section, sentence, word or figures contained in this Ordinance should be declared invalid by a final decree of a Court of competent jurisdiction, such holding shall not affect the remaining sentences, sections, words or figures contained in this Ordinance, but the same shall remain in full force and effect.

SECTION 13. That this Ordinance shall take effect two (2) weeks from and after its passage.

PASSED on Second and Final Reading

September 23, 2008.

Linda L Bennett
CHAIRPERSON

APPROVED: x DISAPPROVED: ______

DATE: 10/3/08, 2008

MAYOR

1ST READING 11-17-09
2ND READING 11-24-09
INDEX NO.

ORDINANCE NO. 12327

AN ORDINANCE TO AMEND ORDINANCE NO. 12288, ENTITLED "AN ORDINANCE, HEREINAFTER ALSO KNOWN AS 'THE FISCAL YEAR 2009-2010 BUDGET ORDINANCE', TO PROVIDE REVENUE FOR THE FISCAL YEAR BEGINNING JULY 1, 2009, AND ENDING JUNE 30, 2010, AND APPROPRIATING SAME TO THE PAYMENT OF EXPENSES OF THE MUNICIPAL GOVERNMENT; FIXING THE RATE OF TAXATION ON ALL TAXABLE PROPERTY IN THE CITY, AND THE TIME TAXES AND PRIVILEGES ARE DUE, HOW THEY SHALL BE PAID, WHEN THEY SHALL BECOME DELINQUENT; PROVIDING FOR INTEREST AND PENALTY ON DELINQUENT TAXES AND PRIVILEGES," SO AS TO SET FORTH THE BUDGET OF THE INTERCEPTOR SEWER SYSTEM AND TO AMEND CHATTANOOGA CITY CODE, PART II, CHAPTER 31, SECTIONS 31-36, 31-37, 31-41 and 31-43.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHATTANOOGA, TENNESSEE:

SECTION 1. That Ordinance No. 12288, entitled as set forth in the caption hereof, be and the same is amended as provided hereinafter.

SECTION 2. That there be and is hereby added a new Section 6(e) establishing the operating budget for the Interceptor Sewer System (Fund 5100) for Fiscal Year 2009-2010.

5100 INTERCEPTOR SEWER SYSTEM

	FY 08 Actual	FY 09 Projected	FY10 Proposed
Estimated Revenues:			
Sewer Service Charges	$33,719,554	$34,293,838	$33,933,848
Industrial Surcharges	3,786,624	3,585,652	2,500,000
Septic Tank Charges	353,817	420,516	307,335
Wheelage and Treatment:			
Lookout Mountain, TN	149,210	176,294	$188,282
Dade County	10,860	12,343	13,920
Walker County, GA	396,277	445,780	413,859
Collegedale, TN	246,690	300,379	291,538
Soddy-Daisy, TN	135,868	149,098	162,146
East Ridge, TN	866,384	1,047,336	1,081,977
Windstone	22,024	35,955	27,069

	FY 08 Actual	FY 09 Projected	FY10 Proposed
Hamilton County, TN	571,451	729,768	640,609
Northwest Georgia	621,950	632,094	641,584
Lookout Mountain, GA	57,075	66,369	62,376
Rossville, GA	337,306	430,749	422,655
Ringgold, GA	191,788	305,334	307,271
Red Bank, TN	436,981	489,023	484,533
Debt Service Northwest Georgia	372,794	447,353	447,353
Industrial User Permits	38,500	39,000	41,000
Industrial User Fines	3,300	700	0
Miscellaneous	78,939	16,394	0
Garbage Grinder Fees	49,130	47,580	51,840
Operating Revenue:	$42,446,522	$43,671,555	$42,019,195
Fund Balance (P540)	-	7,500,000	10,804,000
Interest Earnings	1,630,150	971,071	300,000
	$44,076,672	$52,142,626	$53,123,195
Appropriations:			
Operations & Maintenance:			
Administration	2,434,463	2,492,744	2,492,653
Laboratory	582,023	590,629	603,444
Engineering	340,620	365,999	455,897
Plant Maintenance	1,338,616	1,333,337	1,491,720
Sewer Maintenance	2,089,454	3,050,363	3,522,309
Moccasin Bend - Liquid Handling	7,943,862	9,714,110	8,176,257
Inflow & Infiltration	1,082,659	1,028,588	1,199,812
Safety & Training	132,364	128,055	127,666
Pretreatment/Monitoring	403,806	462,241	447,634
Moccasin Bend - Solid Handling	3,223,784	3,071,739	3,865,084
Landfill Handling	1,606,636	1,506,614	1,482,000
Combined Sewer Overflow	149,071	177,834	434,150
Total Operations & Maintenance	$21,327,358	$23,922,253	$24,298,626
Pumping Stations:			
Mountain Creek Pump Station	24,979	19,121	$18,835
Citico Pump Station	360,587	348,931	269,335
Friar Branch Pump Station	124,172	205,181	143,040
Hixson 1, 2, 3, & 4 Pump Stations	123,487	116,677	99,623
19th Street Pump Station	29,555	36,458	45,325
Orchard Knob Pump Station	38,462	57,408	53,260
South Chickamauga Pump Station	422,817	311,500	305,800

	FY 08 Actual	FY 09 Projected	FY10 Proposed
Tiftonia 1 & 2 Pump Stations	31,180	60,342	57,975
23rd Street Pump Station	142,852	150,521	137,780
Latta Street Pumping Stations	7,412	9,085	14,560
Residential Pump Stations	22,574	23,406	79,000
Murray Hills Pump Station	10,030	13,705	20,860
Highland Park Pump Station	9,600	9,804	13,760
Big Ridge 1-5 Pump Stations	73,831	63,145	91,373
Dupont Parkway Pump Station	19,085	30,286	29,725
VAAP Pump Station	2,505	4,310	9,760
Northwest Georgia Pump Station	32,750	41,292	123,725
Brainerd Pump Station	47,038	16,371	20,350
East Brainerd Pump Station	70,608	42,630	37,615
North Chattanooga Pump Station	15,534	20,872	26,260
South Chattanooga Pump Station	3,980	3,507	6,955
Ooltewah-Collegedale Pump Station	80,018	92,813	93,020
Odor Control Pump Stations	668,437	800,074	710,000
Enterprise South Pump Station	3104	1,161	4,120
River Park Pump Station	5381	-	4,250
Ringgold Pump Station	31076	77,817	54,350
Total Pumping Stations	$2,401,054	$2,556,417	$2,470,656
Total Operations & Maintenance	$23,728,412	$26,478,670	$26,769,282
Capital Improvement	197,456	219,966	$1,242,285
Debt Service Reserve	0	935,697	$1,059,825
Construction Trust Fund (P540)	0	7,500,000	10,804,000
Debt Service			
Principal	10,854,522	10,985,096	$9,492,618
Interest	4,367,087	4,110,598	3,755,185
	$15,221,609	$15,095,694	$13,247,803
Total Appropriations:	$39,147,477	$50,230,027	$53,123,195

SECTION 3. That Section 7(b) of said Ordinance be amended as hereinafter set out:

ADDITIONS:

INTERCEPTOR SEWER SYSTEM

ADMINISTRATION

C00575	1	Director Waste Resources		29	B
C00590	1	Waste Resources Plant Engineer		22	B
C01301	2	Inventory Clerk	(each)	5	H
C04009	1	IT Specialist		19	B
C04011	1	Fiscal Analyst		17	B
C04028	1	Inventory Coordinator		13	B
C04037	1	Administrative Support Spec		10	B
C04047	1	Adm Support Assistant 2		7	B
C04051	1	Inventory Technician		8	B
C04052	1	Personnel Assistant		8	B
C04057	1	Adm Support Assistant 1		4	B
C04071	1	Project Engineer		22	B

LABORATORY

C00591	1	Manager Laboratory Services		23	B
C00594	1	Chemist		17	B
C04091	1	Laboratory Technician 2		13	B
C04094	4	Laboratory Technician 1	(each)	12	B

ENGINEERING

C00596	1	Construction Inspector Supv		18	B
C00597	1	Waste Resources Sys Engineer		25	B
C00598	3	Sewer Project Coordinator	(each)	15	B
C01530	1	Crew Scheduler		8	B

PLANT MAINTENANCE

C00601	1	Plant Maintenance Supervisor		21	B *
C00603	1	Chief Electrical Instmnt Techn		19	H *
C00605	2	Chief Maintenance Mechanic	(each)	19	H *
C00610	11	Plant Maintenance Mechanic	(each)	11	H *
C00618	3	Plant Maintenance Lubricator	(each)	5	H *
C04018	7	Electrician 2	(each)	14	H *
C04038	1	Crew Supervisor 2		12	H *
C04040	1	Bldg Maintenance Mechanic 1		9	B *
C04058	1	Crew Worker 2		4	H

* *denotes positions authorized to receive a tool allowance based on City of Chattanooga, Department of Public Works, Interceptor Sewer System policy.*

SEWER MAINTENANCE

C04010	1	General Supervisor		18	B
C04030	5	Crew Supervisor 3	(each)	14	H
C04058	2	Crew Worker 2	(each)	4	H
C04100	5	Equipment Operator 4	(each)	10	H
C04102	4	Equipment Operator 3	(each)	8	H

MOCCASIN BEND TREATMENT PLANT – LIQUID HANDLING

C00630	1	Plant Superintendent		27	B
C00633	5	Chief Plant Operator	(each)	15	H
C00636	5	Plant Operator 3	(each)	13	H
C00638	7	Plant Operator 1	(each)	9	H
C04006	1	Plant Operations Supervisor		21	B
C04034	9	Plant Operator 2	(each)	11	H
C04057	1	Adm Support Assistant 1		4	B

INFLOW AND INFILTRATION

C04010	1	General Supervisor		18	H
C04030	3	Crew Supervisor 3	(each)	14	H
C04058	3	Crew Worker 2	(each)	4	H
C04102	6	Equipment Operator 3	(each)	8	H

SAFETY & TRAINING

C04014	1	Occupational Safety Specialist		17	B
C04058	1	Crew Worker 2		4	H

PRETREATMENT/MONITORING

C00652	1	Pretreatment Supervisor		19	B
C00653	4	Monitor Technician	(each)	12	B
C00655	1	Pretreatment Inspector		14	B
C04047	1	Adm Support Assistant 2		7	B

MOCCASIN BEND TREATMENT PLANT – SOLID HANDLING

C00636	3	Plant Operator 3		13	H
C00638	3	Plant Operator 1	(each)	9	H
C04006	1	Plant Operations Supervisor		21	B
C04034	6	Plant Operator 2	(each)	11	H
C04100	1	Equipment Operator 4		10	H

SECTION 4. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36(a), be and the same is hereby deleted and the following substituted in lieu thereof:

(a) Enumeration of charges; quantity of water used. Sewer service charges shall be based upon the quantity of water used as shown by water meter readings and shall be the dollar amount derived by applying the total charge in dollars per one thousand (1,000) gallons for the quantities of water shown in the following table:

User Class (gallons)		Fiscal Year 2009/2010 Total Charges ($/1,000 gallons)
First	100,000	$ 5.28
Next	650,000	3.92
Next	1,250,000	3.18
Next	30,000,000	2.68
Over	32,000,000	2.60

In addition, the total charges derived from the above chart for residential users will be multiplied by ninety (90) percent to compensate for water use not going to the sewer such as lawn and garden watering. Any residential location where a separate water meter has been installed for the purpose of lawn and garden watering shall not be entitled to have the multiplier applied to any water consumed through the primary water meter. Each residence or apartment unit shall have a maximum monthly sewer service charge for a volume of no more than 12,000 gallons water used; unless the minimum charge due to water meter size exceeds the 12,000 gallon limit, then the monthly sewer service charge shall be at least the minimum for that particular size water meter.

SECTION 5. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36(c) as relates to sewer service charges and fees be and the same is hereby deleted and the following substituted in lieu thereof:

(c) Billable flow. The amount due from the regional user shall be the dollar amount derived by applying the total charge shown in the table below per one thousand (1,000) gallons of water sold.

	Regional Operation & Maintenance Charge ($/1,000 gallons)	Regional Debt Charge ($/1,000 gallons)	Regional Total Charge (Wheelage and Treatment) ($/1,000 gallons)
Wheelage and Treatment	$ 1.4954	$ 0.5682	$ 2.0636

If regional customers are billed directly through the water company, the rate to be charged shall be two dollars and twenty one cents ($2.21) per one thousand (1,000) gallons.

SECTION 6. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36 (d), be and the same hereby deleted and the following substituted in lieu thereof:

(d) Total flow. The amount due from the regional user shall be the dollar amount derived by applying the total charge shown in the table below applied to the quantity of water measured by a flow meter installed and maintained at or near the point of connection between the system of the regional user and the Chattanooga system. In the event of any malfunction of said meters, flow shall be estimated, interpolated and/or projected in the most equitable manner possible. Such estimates, along with available readings for periods where there was no malfunction, shall be the basis for billing.

	Regional Operation & Maintenance Charge ($/1,000 gallons)	Regional Debt Charge ($/1,000 gallons)	Regional Total Charge (Wheelage and Treatment) ($/1,000 gallons)
Wheelage and Treatment	$ 0.8518	$ 0.3125	$ 1.1643

SECTION 7. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-37, be and the same is hereby deleted and the following substituted in lieu thereof:

Minimum sewer service charges based upon water meter connection size shall be as follows:

Monthly Minimum Sewer Service Charges

Meter Size (inches)	Fiscal Year 2009-2010 Charge per Month	
5/8	$ 10.90	$
3/4	38.89	
1	67.96	
1-1/2	152.09	
2	269.29	
3	631.25	
4	1,166.56	
6	2.778.56	
8	4,914.78	

The minimum sewer service change for residential users with various meter size shall be multiplied by ninety (90) percent to compensate for water use not going to the sewer such as lawn and garden watering. Any residential location where a separate water meter has been installed for the purpose of lawn and garden watering shall not be entitled to have the multiplier applied to any water consumed through the primary water meter.

SECTION 8. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-41(c), be and the same is hereby deleted and the following substituted in lieu thereof:

(c) Rates. Based upon the current cost of treating wastewater containing constituents with concentrations in excess of "normal wastewater," numerical rates are hereby established for Bc and Sc as follows:

Bc = $0.099 per pound of BOD for concentrations in excess of three hundred (300) milligrams per liter.

Sc = $0.067 per pound of total suspended solids for concentrations in excess of four hundred (400) milligrams per liter.

SECTION 9. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-43 (b), (f) and (g) be and the same are hereby deleted and the following substituted in lieu thereof:

(b) *Fees for garbage grinders.* Any user of a garbage grinder, except users in a premise used exclusively for an individual residence, shall be charged at a rate of one hundred sixty dollars ($160.00) per month. The superintendent shall bill users on a bi-monthly basis and the bills shall be due and payable within fifteen (15) days following the last day of the billing period.

(f) *Fees for septic tank discharge.* All persons discharging concentrated, domestic septic tank sewage waste from a truck under the provisions of Article III of this Chapter shall be charged at the rate of fifty nine dollars ($59.00) per one thousand (1,000) gallons of such waste. The minimum charge for septic tank discharges shall be one half (1/2) of the rate for one thousand (1,000) gallons of the rate in effect at the time of such discharge. All persons discharging grease trap or grease interceptor waste or loads where septic tank waste has been mixed or blended with grease trap or grease interceptor waste shall be charged at the rate two (2) times the rate for septic tank wastes.

(g) *Fees holding tank wastes.* All persons discharging any holding tank waste authorized pursuant to division 6 of this article shall be charged at the rate of five dollars and twenty-eight cents ($5.28) per one thousand (1,000) gallons of such discharge, plus any surcharge rate authorized by Article III of this chapter for concentrations of pollutants in excess of normal waste water without regard to the definition of the industrial user or other limitations set forth in such section. The superintendent may also require a chemical analysis of such waste and charge therefore.

SECTION 10. That this Ordinance shall be operative, as distinguished from its effective date, on and after July 1, 2009.

SECTION 11. Notwithstanding any other provision of this Ordinance to the contrary, water providers within the City of Chattanooga shall bill according to the new Chattanooga sewer service charges effective on the following dates:

For service rendered beginning on the 1st day of January 2010 and until further notice

SECTION 12. That if any section, sentence, word or figures contained in this Ordinance should be declared invalid by a final decree of a Court of competent jurisdiction, such holding shall not affect the remaining sentences, sections, words or figures contained in this Ordinance, but the same shall remain in full force and effect.

SECTION 13. That this Ordinance shall take effect two (2) weeks from and after its passage.

PASSED on Second and Final Reading

November 24, 2009.

W. Jack Benson
CHAIRPERSON

APPROVED: x DISAPPROVED: _____

DATE: ________________, 2009

MAYOR

1ST READING 12-15-09
2ND READING 1-5-10
INDEX NO.

ORDINANCE NO. 12337

AN ORDINANCE TO AMEND CHATTANOOGA CITY CODE, PART II, CHAPTER 32, ARTICLE III, SECTIONS 32-61 THROUGH 32-85, RELATIVE TO EXCAVATION AND RESTORATION OF PAVING.

SECTION 1. BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHATTANOOGA, TENNESSEE, That Chattanooga City Code, Part II, Chapter 32, Article III, Sections 32-61 through 32-85, be and is hereby amended by deleting said sections in their entirety and substituting in lieu thereof the following:

Sec. 32-61. Definitions.

Building Official - The person who shall serve as the supervisor for the Inspection Section of the Land Development Office or in his or her absence, the subordinate assigned or delegated direct responsibility for the administration of this Article.

City Engineer - The person holding the position referred to in Chattanooga City Code, Part I, Section 3.76 and 3.80, or such assistant engineers assigned or delegated direct responsibility for the administration of this Article.

City Inspector - A person employed by the City to physically inspect any excavation for conformity with the permit and other provisions of this Article.

Emergency - A sudden or unexpected occurrence or condition calling for immediate action. The repair of a broken or malfunctioning utility line or services shall be deemed an emergency if a repair is reasonably warranted under existing circumstances prior to the next working day.

Excavation - Any excavation or tunneling of any public street right-of-way including, but not limited to, excavation in, cutting of, or tunneling of any street, sidewalk or curb for purposes of constructing or maintaining pipes, lines, driveways, private streets, poles, guy wires, signs, or other utilities, private structures, or facilities.

Traffic Engineer - The person holding the position referred to in Chattanooga City Code, Part II, Section 24-97, or such assistant engineer as shall be assigned or delegated direct responsibility for the administration of this Article.

Working Day - Any day when the City Engineer's office is open for the transaction of normal business.

Sec. 32-62. Permit required.

It shall be unlawful for any person to make any excavation in or to tunnel under any street, curb, alley, or public right-of-way in the City without first having obtained a permit from the Building Official and complying with the provisions of this Article. It shall be unlawful to violate or to vary from the terms of any such permit; provided, however, any person maintaining pipes, lines, driveways, or other facilities in or under the surface of any public right-of-way may proceed with an excavation without a permit when emergency circumstances demand the work to be done immediately, and provided further that the person shall apply for a permit on the next working day.

Sec. 32-63. Applications.

Applications for such permits shall be made to the Building Official and shall state thereon the location of the intended excavation or tunnel, the size thereof, the purpose thereof, the name of the person doing the actual excavating, and the name of the person for whom the work is being done. The applicant shall disclose any foreseeable lane or sidewalk closures or detours during excavation. As a condition of issuing a permit, all applicants must agree in writing as part of the application to comply with all ordinances and laws relating to the work to be done. The Building Official or his designee shall consider each application for a permit filed under this Article, under all facts and circumstances, shall grant or refuse the permit within five (5) working days and shall endorse his action on the application. The Building Official shall refer such application to the City Engineer or Traffic Engineer for review and comment when a professional opinion on the propriety of issuing a permit or conditions to attach thereto is needed. The action of the Building Official in granting or refusing a permit shall be final, except as it may be subject to review at law. A permit may be refused for the following reasons:

a. The proposed excavation should be redesigned to mitigate a potential safety hazard;
b. The proposed excavation should be redesigned to mitigate damage within the right-of-way;
c. The proposed excavation cannot be safely made in the public right-of-way;
d. The proposed restoration plan does not meet the minimum standards for restoration;
e. The applicant has willfully failed to comply with conditions of prior permits issued to the applicant; provided that such disqualification shall be removed upon correction of any such defects;
f. For other good cause in the discretion of the Building Official.

Provided that as to an excavation done in emergency circumstances the application shall be completed on the next working day; and the Building Official shall review the actual work completed for conformity with the requirements hereof.

Sec. 32-64. Application Fee.

Each application shall be accompanied by a fee as follows:

a. Permit fee of $300.00 for transverse cuts in pavement.
b. For longitudinal cuts in pavement the permit fee of $1.00 per foot shall be charged ($300.00 minimum).
c. Permit fee of $50.00 for cuts in the sidewalk.
d. Permit fee of $100.00 for cuts in the curb and/or curb and gutter.
e. Street Cut Permit is not required for cuts outside the sidewalk and street pavement.
f. Written notification of intent to work in a City right-of-way must be received at least 24 hours prior to beginning work, even if a permit is not required, except in emergencies. E-mail is considered a written notice.
g. Permits for relocation or installation of fire hydrants will be required when requested by the City, but no fee (including administrative fees) will be required.
h. Multiple cuts, each not exceeding 25 square feet in area, when required in a single block or within a work zone distance of 250 feet as part of a single project, are considered as one cut. Permit and fee will be required for a single cut under these conditions. If the cut exceeds 250 feet, or multiple cuts within a block or a work zone greater than 250 feet, then the entire lane that is disturbed by construction shall be repaved from intersection to intersection.
i. Neither permits or fees will be required when work in the right-of-way is conducted as part of a City street improvement project, including resurfacing, where the utility is required to move their facilities as a result of the City project.
j. Fees shall not be waived under any other conditions.
k. When it is determined that non-emergency work in the City Right-of-Way has proceeded without the purchase of a permit, the contractor or utility shall immediately purchase a street cut permit, and the fee for the permit shall be double the normal fee; no further permits shall be issued to the contractor or utility until such time as the improper work is removed and replaced in accordance with this Code.
l. Where work in the City Right-of-Way is self-performed by one of the following entities, or by one of the entity's approved contractors, the fee for each permit shall be invoiced monthly. Invoicing may be provided for:
    (1) Electric Power Board of Chattanooga;
    (2) Tennessee-American Water Company;
    (3) Chattanooga Gas Company;
    (4) A T & T;
    (5) Comcast Cable Company;

(6) Hixson Utility District; and
(7) Eastside Utility District.

Sec. 32-65. Manner of excavating - barricades and lights.

Any person making any excavation or tunnel shall do so according to the specifications and standards issued by the City Engineer. In accordance with the Manual on Uniform Traffic Control Devices (MUTCD) sufficient and proper barricades, lights and other traffic control devices shall be maintained to prevent accidents and injury to persons or property. If any sidewalk is blocked a temporary sidewalk shall be provided which shall be safe for travel and convenient for users. No work shall be done which deviates from the approved plans and until a change of plans has been secured from the Building Official. All expenses of such safety measures and temporary sidewalk shall be borne by the applicant or owner.

Sec. 32-66. Bond required.

When permits are required to excavate or in any way obstruct any street in the City, the Building Official shall require from such applicant, before granting a permit, a bond with good and sufficient sureties, conditioned to secure the City against all loss, damage or injury of any kind which may result to the City by reason of such excavation or obstruction; provided, that persons engaged in the business of contracting shall be allowed to give an annual bond, instead of a bond for each obstruction such annual bond in every instance to be renewed at least once every twelve (12) months.

Sec. 32-67. Manner of excavating street.

a. In excavating any street, all material for paving or ballasting must be removed with the least possible injury or loss of the same and, together with the excavated materials from the trenches, must be placed where they will cause the least possible inconvenience to the public. All pavement, where trench excavations are to be made, shall be saw cut. Cutting the street with a jackhammer or a hoe-ram is not permitted.

b. The permittee shall carry on the work authorized by the permit in such manner as to cause a minimum of interference with traffic. He shall provide adequate warning signs and devices to warn and guide traffic, and shall place the signs and warning devices in a position of maximum effectiveness. The latest editions of the Manual on Uniform Traffic Control Devices, copies of which are on file in the Traffic Engineer's Office, may be used as a guideline for proper positioning of signs and devices.

c. Where difficult or potentially hazardous conditions exist, competent flagmen shall be provided to effect a safe and orderly movement of traffic. Where insufficient traffic lanes exist because of street openings, adequate bridging shall be supplied by the permittee. When traffic congestion occurs in spite of all precaution, the permittee shall be responsible for providing a flagman. In the event the Building

Official, Traffic Engineer or City Engineer shall discover any hazardous excavation or unwarranted traffic congestion where flagmen have not been provided, he shall direct the permittee to immediately post flagmen. A failure to post flagmen following a directive shall be a violation of this Article.

d. On main thoroughfares and in congested districts, sufficient traffic lanes shall be kept open at all times to permit substantially normal traffic flow. Unless this can be accomplished, work shall be done only during the period between 9:00 a.m. and 4:00 p.m. or between 7:00 p.m. and 7:00 a.m., as the City Engineer may designate.

e. For backfill in roadway areas, the contractor shall provide six-inches (6") of graded aggregate base above the utility's main line. From top of graded aggregate base backfill to bottom of paving, the backfill material shall be flowable fill with a compressive strength of 200-250 psi in 48 hours. Flowable fill shall be placed a minimum of forty-eight (48) hours prior to the placing of the asphalt or concrete topping. Where it is impractical to use flowable fill because of terrain, slope, width of trench, or other situations, the material for the backfill in the roadway areas may be approved for cement treated aggregate base at the sole discretion of the City Engineer. Each 8" layer of backfill shall be thoroughly compacted by means of a mechanical tamp. Other backfill materials may be acceptable, but prior approval for the substitution shall be determined by the City Engineer or his designee.

f. Backfill for trenches within the sidewalk areas shall be compacted graded aggregate base instead of loose washed stone. Each 8" layer of graded aggregate base shall be thoroughly compacted by means of mechanical tamp.

g. If a perpendicular cut reaches the centerline of the roadway, the asphalt must be replaced from curb to curb and a minimum of ten (10) feet on each side of the centerline of the excavation.

Sec. 32-68. Liability and responsibility for repair.

Any person who shall properly make any excavation or other change to the street right-of-way, and shall have same inspected by the Building Official or his designee and shall be relieved from any liability for any defects due to inadequate workmanship or defective materials provided the excavation shall remain free from defects for twelve (12) months following installation.

If a contractor, utility, or other entity makes five or more excavations within one block of a City right-of-way or within a work zone distance of 250 feet within the City right-of-way, whichever is shorter, causing disruption to any part of the pavement within two years after said right-of-way has been resurfaced or constructed, said contractor, utility or other entity shall repave the entire street for the distance of the City block or 250 feet, said distance being the distance utilized to require the repaving. Said repaving shall be done to the standards approved by the City Engineer and shall be done under the supervision and control and at the direction of the City. The contractor, utility, or other entity shall bear the entire cost of such repaving. In the event any such contractor, utility, or other entity fails to repave as required herein, then such contractor, utility or other entity shall be prohibited from acquiring any permits for additional excavations in any City right-of-way until such time as the repaving required by this section is completed and approved by the City Engineer.

Sec. 32-69. Inspection.

It shall be the responsibility of any person granted a permit to schedule an inspection of the permitted work by the City's Inspector upon such conditions as may be specified in the permit. The utility or contractor making any changes to a City right-of-way, shall, at a minimum, have the following inspections performed by the City's Inspector:

a. After the repairs or installation of the new conduit or piping and before the graded aggregate base fill over the pipe has been placed;

b. During the placement of the flowable fill or other approved fill in the sole discretion of the City Engineer; and

c. Final completion.

d. Should inspections be required after normal working hours or on weekends, the contractor or utility making the changes to the City right-of-way, shall reimburse the City for the inspector's time at a rate to be determined in accordance with the personnel policies in effect at the time the repairs are performed.
When it is determined that improper work has been performed in the City's right of way, the contractor or utility responsible for the work shall remove improper work and reinstall the work in accordance with the City Standards. If a permit was not obtained, the contractor or utility shall purchase a permit and the fee shall be double the normal fee. No future permits will be issued to the violating contractor or utility until the improper work has been corrected.

Sec. 32-70. Specification.

Upon issuance of each permit, the Building Official shall specify minimum restoration standards applicable to the permit. The City Engineer and/or Traffic Engineer shall prepare and provide standard specifications for routine circumstances, which may be specifically referenced in the permit. Provided that where the work involved is greater in scope than provided for by standard specifications as determined by the Building Official, the City Engineer or the Traffic Engineer, the permittee shall be required to submit suitable plans of installation and street restoration for approval prior to issuance of a permit.

Sec. 32-71. Insurance.

Each person applying for a permit shall file a certificate of insurance (or provide other proof in form and substance to be approved by the City Attorney) indicating that he is insured, or the applicant shall provide an indemnity agreement with security satisfactory to the City Attorney, against claims of personal injury or property damage which may arise from or out of the performance of the work, whether such performance be by the applicant, a contractor or subcontractor, or anyone employed by him. Such insurance or indemnity agreement shall cover collapse, explosive hazards, and underground work by equipment on the street, and shall include protection against liability arising from completed operations. The minimum amount of the liability insurance for bodily injury shall not be in an amount less than $300,000 for each person and $700,000 for each accident and for property damages in an amount not less than $100,000, unless other limits are established by the Tennessee Governmental Tort Liability Act.

Sec. 32-72. Supervision.

The Building Official, or his designee, shall from time to time inspect all excavations and see to the enforcement of the provisions of this ordinance. The permittee shall give notice to the Building Official, or his designee, before refilling any such excavation or tunnel and said work may not commence until the Inspector arrives at the site or otherwise gives permission to proceed.

Secs. 32-73 -- 32-85. Reserved.

SECTION 2. BE IT FURTHER ORDAINED, That this Ordinance shall take effect two (2) weeks from and after its passage.

PASSED on Second and Final Reading

January 5, 2010

CHAIRPERSON

APPROVED: x DISAPPROVED: ______

DATE: 1-12, 2009.

MAYOR

PAN/kac/mms

1ST READING 6-29-10
2ND READING 7-6-10
V5 INDEX NO.

ORDINANCE NO. 12410

AN ORDINANCE, HEREINAFTER ALSO KNOWN AS "THE FISCAL YEAR 2010-2011 BUDGET ORDINANCE", TO PROVIDE REVENUE FOR THE FISCAL YEAR BEGINNING JULY 1, 2010, AND ENDING JUNE 30, 2011; APPROPRIATING SAME TO THE PAYMENT OF EXPENSES OF THE MUNICIPAL GOVERNMENT; FIXING THE RATE OF TAXATION ON ALL TAXABLE PROPERTY IN THE CITY, AND THE TIME TAXES AND PRIVILEGES ARE DUE, HOW THEY SHALL BE PAID, WHEN THEY SHALL BECOME DELINQUENT; PROVIDING FOR INTEREST AND PENALTY ON DELINQUENT TAXES AND PRIVILEGES; AND TO AMEND CHATTANOOGA CITY CODE, PART II, CHAPTER 2, SECTION 2-267, RELATIVE TO PAID LEAVE FOR ACTIVE-DUTY TRAINING AND TO AMEND CHATTANOOGA CITY CODE, PART II, CHAPTER 31, SECTIONS 31-36, 31-37, 31- 41, 31- 43, 31-39 and 31-40.

WHEREAS, Pursuant to and in compliance with the provisions of the Charter of the City of Chattanooga, Tennessee, the revenue has been estimated for operating the Municipal Government for the fiscal year 2010-2011 from all sources to be as follows:

	FY09 Actual	FY10 Projected	FY11 Proposed
PROPERTY TAXES			
Current Taxes on Real & Personal Property	$ 87,144,122	$87,873,620	$107,932,400
Taxes on Real & Personal Property - Prior Years	3,716,741	3,500,000	3,500,000
PAYMENTS IN LIEU OF TAXES			
Chattanooga Housing Authority	$ 50,509	$331,398	$143,400
Tennessee Valley Authority	1,534,726	1,754,192	1,780,500
Burner Systems	1,789	395	400
Kenco Group, Inc	57,857	57,857	57,900
Regis Corporation	10,265	10,265	10,265
Chatt Labeling System	7,745	7,745	7,700
Chattem, Inc	15,840	15,288	15,300
Signal Mountain Cement	91,878	76,733	76,700
Covenant Transport	22,673	21,449	21,400
LJT of Tennessee	26,098	36,705	36,700
Unum	9,764	9,809	9,800
American Plastic Ind. Inc.	50,784	48,426	48,400
Custom Baking Co.	19,374	14,713	14,700
Dupont-Sabanci Intl.	22,594	17,049	17,000

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	FY09 Actual	FY10 Projected	FY11 Proposed
Invista	24,966	31,267	31,300
Aerisyn, Inc	31,502	31,275	32,200
Wm Wrigley Jr Co	39,792	53,192	53,200
Astec Incustries	19,897	31,275	31,300
BlueCrossBlueShield	454,454	1,011,332	1,011,300
Roadtec	11,733	22,195	22,200
US Express	47,640	43,738	43,700
United Packers of Cha	17,757	34,050	34,100
Total Other	64,262	352,073	360,835
TOTAL IN LIEU OF TAXES	$ 2,633,899	$4,012,421	$3,860,300
Interest & Penalty on Current Year Taxes	116,718	100,000	100,000
Interest & Penalty on Delinquent Taxes	724,611	725,000	725,000
Delinquent Taxes Collection Fees	174,968	200,000	200,000
TOTAL PROPERTY TAXES	$94,511,059	$ 96,411,041	$ 116,317,700
OTHER LOCAL TAXES			
Liquor Taxes	$ 1,957,073	$1,976,457	$1,976,457
Beer Taxes	5,437,519	4,911,751	4,911,751
Local Litigation Taxes - City Court	3,889	3,258	3,300
Gross Receipts Taxes	3,818,398	3,326,759	3,326,800
Gross Receipts - Interest & Penalty	87,515	76,426	76,400
Corp Excise Taxes – State	275,637	224,020	224,000
Franchise Taxes – ComCast Cable	1,883,462	1,941,254	1,980,100
Franchise Taxes - Century Tel	26,164	26,156	26,400
Franchise Taxes – Chattanooga Gas	301,071	289,232	315,000
TOTAL OTHER LOCAL TAXES	$13,790,728	$ 12,775,314	$12,860,000
LICENSES, PERMITS, ETC.			
Business Licenses (excluding Liquor)	$ 147,820	$147,751	$147,800
Business Licenses – Suspense	6,402	6,400	6,400
Wrecker Permits	5,800	5,800	5,800
Annual Electrical Contractor License	71,950	71,969	72,000
Penalty-electrical fees & licenses	888	887	900
Liquor By the Drink Licenses	142,330	142,287	142,300
Liquor By the Drink – Interest & Penalty	1,562	1,561	1,600
Motor Vehicle Licenses	425,620	425,523	380,000
Building Permits	823,983	1,021,799	1,210,400
Electrical Permits	126,503	132,902	250,600

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	FY09 Actual	FY10 Projected	FY11 Proposed
Plumbing Permits	126,693	149,774	182,800
Street Cut-In Permits	376,612	244,558	244,600
Mechanical Code Permits	68,743	57,573	102,600
Hotel Permits	2,825	2,107	4,100
Gas Permits	3,895	4,138	8,100
Sign Permits	135,665	117,418	123,400
Taxi Permits	7,765	4,382	4,400
Temporary Use Permits	3,990	2,162	2,200
Fees for Issuing Business Licenses & Permits	57,760	53,500	57,000
Plumbing Examiner Fees & Licenses	39,835	35,798	35,000
Electrical Examiner Fees & Licenses	33,675	42,622	35,000
Gas Examination Fees & Licenses	37,970	21,700	35,000
Beer Application Fees	88,350	87,039	87,000
Mechanical Exam Fees & Licenses	57,092	57,994	58,000
Permit Issuance Fees	45,257	44,173	45,000
Exhibitor's Fees	1,133	1,399	1,400
Subdivision Review/Inspection Fees	16,625	9,652	15,000
Zoning Letter	6,425	6,343	6,300
Variance Request Fees	5,376	6,658	6,700
Certificates of Occupancy	17,510	14,299	15,000
Sewer Verification Letter	300	700	500
Code Compliance Letter Fees	700	968	1,000
Modular Home Site Investigation	75	150	200
Plan Checking Fees	171,940	196,976	198,900
Phased Construction Plans Review	8,025	44,694	10,000
Construction Board of Appeals	1,800	1,999	2,000
Sign Board of Appeals	3,450	2,785	2,800
Dead Animal Pick Up Fees	7,280	3,249	900
Fire Department Permits			31,300
Miscellaneous	15,751	30,509	24,600
TOTAL LICENSES, PERMITS, ETC.	$ 3,095,375	$3,202,197	$3,558,600
REVENUES FROM OTHER AGENCIES			
State – Specialized Training Funds	$ 474,600	$469,800	$469,800
State Maintenance of Streets	303,031	318,253	318,300
State Sales Taxes	10,252,124	9,695,218	9,695,200
Hall Income Taxes	3,561,959	1,000,000	1,500,000
State Beer Taxes	81,138	77,086	77,100
State Mixed Drink Taxes	1,763,451	1,891,892	1,910,800

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	FY09 Actual	FY10 Projected	FY11 Proposed
State – Telecommunication Sales Taxes	18,901	12,379	12,600
State Alcoholic Beverage Taxes	96,760	99,988	96,000
State Gas Inspection Fees	334,218	287,348	288,800
Commission from State of TN/Gross Receipts	-	78,280	100,000
Hamilton County Ross' Landing/Plaza	942,561	913,930	936,900
Local Option Sales Taxes-General Fund	25,710,248	24,642,826	24,642,800
Hamilton County – Radio & Electronics	151,108	151,089	-
Miscellaneous	270,219	199,164	127,800
TOTAL REVENUES FROM OTHER AGENCIES	$43,960,318	$ 39,837,253	$ 40,176,100
SERVICE CHARGES FOR CURRENT SERVICES			
Current City Court Costs	$ 279,944	$238,455	$ 240,800
Court Commissions	10,066	10,523	10,500
Clerk's Fees	1,132,099	1,001,547	1,011,600
Service of Process	285	1,145	300
Processing of Release Forms	11,936	11,440	11,600
Court Administrative Costs	19,015	13,697	20,000
Current State Court Costs	2,764	2,677	2,700
Memorial Auditorium Rents	134,210	107,747	121,000
Tivoli Rents	136,395	143,972	130,000
Land & Building Rents	223,119	94,554	95,500
Ballfield Income	2,425	3,938	3,900
Skateboard Park	63,896	50,002	50,500
Carousel Ridership	110,791	100,105	101,100
Walker Pavilion Rents	17,519	20,930	18,200
Walker Pavilion Table Rental	2,350	1,904	1,900
Heritage Park House Rent	-	34,524	34,500
Greenway Facilities Rent	12,250	13,516	12,000
Fitness Center	55,778	52,093	52,100
Dock Rental	96,475	56,236	56,200
Ross' Landing Rent	-	1,250	1,300
Champion's Club	50,113	41,207	42,000
Recreation Center Rental	81,610	66,847	67,500
Preservation Fees	128,697	142,843	105,000
Auditorium Box Office	118,724	118,696	97,000
Tivoli Box Office	62,127	109,256	67,000
Memorial Auditorium OT Reimbursement	6,306	3,086	2,000
Tivoli Theatre OT Reimbursement	5,671	5,698	3,700

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	FY09 Actual	FY10 Projected	FY11 Proposed
Park Event Fee	8,950	10,714	10,700
Kidz Kamp	73,092	69,678	70,400
Sports Program Fees	2,307	28,630	28,600
Non-Traditional Program Fees	6,733	11,608	11,600
OutVenture Fees	28,876	17,679	17,700
Therapeutic Kamp Fees	2,025	2,354	2,400
Swimming Pools	68,039	66,022	70,700
Arts & Culture	14,749	19,341	10,100
Police Reports: Accidents, etc. Fees	81,351	40,511	40,500
Photo/ID Card Fees	2,313	963	1,000
Memorial Auditorium Credit Card Fees	17,976	23,101	24,000
Tivoli Credit Card Fees	9,829	18,445	14,000
Credit Card Processing Fees	33,088	40,000	40,000
Memorial Auditorium Concessions	41,779	52,056	30,000
Tivoli Concessions	30,024	25,008	20,000
Park Concessions	25,070	24,316	15,200
Recreation Center Concessions	-	6,749	-
Charges for Services - Electric Power Board	7,200	7,200	7,200
Fire & Ambulance Service Fees	208	200	200
General Pension Admin. Costs & Other Misc.	40,000	40,000	40,000
Outside Sales – Radio Shop	74,701	279,991	-
Outside Sales – Radio Shop	38,942	108,228	82,200
TOTAL SERVICE CHARGES	$ 3,371,817	$3,340,682	$2,896,400
FINES, FORFEITURES, AND PENALTIES			
City Court Fines	$ 17,155	$ 12,246	$ 12,300
City Fines-Speeding	279,057	212,378	216,600
City Fines-Other Driving Offenses	372,723	348,233	355,200
City Fines-Non Driving Offenses	28,113	24,496	25,000
Criminal Court Fines	135,632	153,511	153,500
Parking Ticket Fines	532,987	439,871	594,000
Delinquent Parking Tickets	58,065	54,406	54,900
Delinquent Tickets – Court Cost	59,935	51,517	51,500
Air Pollution Penalties	6,077	70,814	1,500
Miscellaneous	2,559	5,367	3,300
TOTAL FINES, FORFEITURES AND PENALTIES	$ 1,492,303	$1,372,839	$1,467,800

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	FY09 Actual	FY10 Projected	FY11 Proposed
REVENUES FROM USE OF MONEY OR PROPERTY			
Interest on Investments	$ 1,498,259	$493,815	$493,800
Sale of City Owned Property	-	9,855	9,900
Sale of Back Tax Lots	4,278	30,000	17,000
Sale of Equipment	25	-	-
Sale of Scrap	2,637	4,765	4,800
TOTAL FROM USE OF MONEY OR PROPERTY	$ 1,505,199	$538,435	$525,500
MISCELLANEOUS REVENUE			
Loss & Damage	$ 106,794	$107,435	$ 80,000
Indirect Cost	2,585,866	2,585,866	2,815,900
Payroll Deduction Charges	3,956	3,362	3,400
Plans and Specification Deposits	9,990	9,660	9,700
Condemnation	18,317	12,407	12,400
Purchase Card Rebate	11,899	11,029	11,000
Miscellaneous Revenue	35,893	175,077	15,000
TOTAL MISCELLANEOUS REVENUE	$ 2,772,715	$2,904,836	2,947,400
TRANSFERS IN			
Transfers In-EPB Electric	$ 3,131,950	$3,379,812	$3,877,200
Transfers In-EPB Telecom	334,653	377,070	369,200
Transfers In-EPB Internet	2,193	3,011	121,000
Transfers In-EPB Fiber Optic	-	34,862	71,100
Transfers In-Any Other	-	414,800	-
TOTAL TRANSFERS IN	$ 3,468,796	$4,209,555	$4,438,500
TOTAL GENERAL FUND REVENUE	$ 167,968,310	$ 164,592,152	$ 185,188,000

and,

WHEREAS, it is necessary to base the appropriations to the various departments of the Municipal Government on the above estimated revenues;

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NOW, THEREFORE,

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHATTANOOGA, TENNESSEE:

SECTION 1. That for the purpose of raising revenue to operate the various departments, agencies, boards, commissions, offices, divisions or branches of the Municipal Government, and to pay the interest on and retire bonds of said City as they mature, there be and is hereby levied upon all taxable property within the City of Chattanooga, Tennessee, a tax for the year 2010 at a rate of $2.309 upon every $100.00 in assessed value of such taxable property; and to the extent applicable there is also levied a tax at the same rate upon every $100.00 of Merchant and other Ad Valorem within the corporate limits of the City of Chattanooga, Tennessee.

SECTION 2. That the assessment made by the Assessor of Property of Hamilton County, Tennessee, and by the Tennessee Regulatory Agency for 2010 on all property located within the corporate limits of the City of Chattanooga, Tennessee, be and is hereby adopted as the assessments of the City of Chattanooga.

SECTION 3. That the taxes herein levied on all taxable property within the corporate limits of the City of Chattanooga shall be due and payable at the office of the City Treasurer and Tax Collector OCTOBER 1, 2010, and shall become delinquent MARCH 1, 2011; after which date unpaid taxes shall bear interest at twelve percent (12%) per annum, and a penalty of six percent (6%) per annum, plus other penalties as provided by law, which shall be paid by the taxpayer; provided, that except for taxpayers receiving tax relief under T.C.A. Sections 67-5-702 through 67-5-705.

SECTION 4. That the provisions of the Business Tax Act, Tennessee Code Annotated section 67-4-701, et seq., relative to the authorization of local taxes upon the privilege of engaging in certain types of business activities be and are hereby adopted by reference, and there is hereby levied a Business Tax on all businesses taxable by municipalities under Chapter 387,

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Public Acts of 1971, as amended, at the maximum rates specified therein. The Tennessee Department of Revenue shall collect the Business Tax on behalf of the City as authorized in T.C.A. § 67-4-703(a). The City Treasurer is authorized and directed to collect such fees and taxes as are authorized by said Act to be collected by the City of Chattanooga, a municipality, together with such interest and penalties as may become due thereon, at the maximum rate provided by law. The City Treasurer is hereby authorized and directed, in accordance with the Business Tax Act, to register new businesses located within the City and collect a fee of Fifteen Dollars ($15.00) for issuance of an initial business license upon the City Treasurer's receipt of the application, together with any other information reasonably required, and to issue such license at the time of registration. The City Treasurer is designated as the City official responsible for the registration of businesses located within the City of Chattanooga.

SECTION 5: That the budgets of the various departments, agencies, boards, commissions, offices, divisions, or branches of Municipal Government for the fiscal year beginning July 1, 2010, are fixed as hereafter set out; and the amount so fixed for each is hereby appropriated out of the estimated revenue for said year for the use of that department, agency, board, commission, office, division, branch of government, to-wit:

GENERAL FUND APPROPRIATIONS

	FY09 Actual	FY10 Projected	FY11 Proposed
General Government & Supported Agencies	$42,505,800	$42,405,524	$44,151,952
Executive Department	1,412,858	1,580,112	1,285,583
Department of Finance & Administration	3,776,028	3,520,277	4,278,500
Department of General Services	2,490,660	2,027,087	2,591,292
Department of Personnel	6,612,456	7,153,195	7,258,383
Department of Neighborhood Services	1,990,026	1,967,724	1,904,982
Department of Police	43,384,194	40,840,136	47,060,000
Department of Fire	28,089,123	27,910,374	30,985,500
Department of Public Works	33,269,578	28,403,701	30,183,526
Department of Parks & Recreation	11,781,527	11,408,906	13,204,400
Department of Education, Arts, & Culture	2,086,089	2,208,590	2,283,882
TOTAL	$177,398,339	$169,425,625	$185,188,000

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	FY09 Actual	FY10 Projected	FY11 Proposed
DEPARTMENT OF EXECUTIVE BRANCH			
Mayor's Office	$ 822,445	$ 871,586	$891,984
Multicultural Affairs	301,591	384,284	393,599
Office of Faith Based Initiatives	282,806	324,242	-
Great Ideas Competition	6,016	-	-
TOTAL	$1,412,858	$1,580,112	$ 1,285,583
DEPARTMENT OF FINANCE & ADMINISTRATION			
Finance Office	$2,005,312	$1,922,913	$ 2,383,924
City Treasurer	725,645	698,331	803,400
City Court Clerk – Operations	1,045,071	899,033	1,091,176
TOTAL	$3,776,028	$3,520,277	$ 4,278,500
DEPARTMENT OF GENERAL SERVICES			
Administration	$345,318	$ 317,434	$451,787
Purchasing	730,383	691,874	770,279
Building Maintenance	919,046	940,618	1,126,366
Chatt Mobile Communication Services	416,213	-	173,270
Real Estate	33,899	28,274	21,525
Property Maintenance	31,807	32,122	32,000
CCRC Operations	13,994	16,765	16,065
TOTAL	$2,490,660	$2,027,087	$ 2,591,292
DEPARTMENT OF PERSONNEL			
Personnel Admin	$1,103,537	$1,114,150	$ 1,245,832
Employees Insurance Office	306,173	207,745	280,790
Employees Insurance Program	5,118,057	5,755,048	5,644,761
OJI Admin	69,384	73,852	74,000
Physical Exam - Police	15,305	2,400	13,000
TOTAL	$6,612,456	$7,153,195	$ 7,258,383
DEPARTMENT OF NEIGHBORHOOD SERVICES & COMMUNITY DEVELOPMENT			
Neighborhood Serv - Admin	$ 532,183	$ 547,571	$523,707
Neighborhood Serv - Grants Admin	67,985	42,812	44,028
Neighborhood Serv - Partners Projects	55,000	55,000	55,000
Codes, Community Svcs & Neighborhood Relations	1,334,858	1,322,341	1,282,247
TOTAL	$1,990,026	$1,967,724	$ 1,904,982

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	FY09 Actual	FY10 Projected	FY11 Proposed
DEPARTMENT OF POLICE			
Chief of Police	$1,653,910	$1,915,021	$2,879,000
Internal Affairs	542,248	457,013	380,536
Uniform Services Command Office	333,425	321,569	361,685
Community Services	209,147	232,755	230,208
Special Operations Division	2,393,272	2,124,505	2,482,587
Police Patrol Alpha	2,487,736	2,373,832	2,819,373
Police Patrol Bravo	2,036,706	2,008,994	2,285,345
Police Patrol Charlie	1,936,583	1,842,389	2,230,904
Park Security	246,972	236,620	240,775
Parking	459,976	475,745	532,672
Bike Patrol	592,656	512,075	537,368
Police Patrol Echo	2,135,810	2,147,541	2,492,855
Police Patrol Fox	2,320,184	2,209,388	2,508,702
Police Patrol Delta	2,099,981	2,095,159	2,346,895
Police Patrol George	2,574,823	2,369,496	2,391,645
Investigative Services	531,663	592,183	686,951
Property Crimes	1,526,518	1,585,935	1,544,774
Major Crimes	2,132,431	2,209,932	2,186,729
Special Investigations	1,968,539	2,083,839	2,319,320
Admin & Support Service Command	594,087	216,520	237,428
Administrative Support & Technical Services	1,328,088	1,647,459	1,938,346
Training Recruiting	2,904,322	1,767,594	2,529,176
Budget & Finance	358,154	426,412	455,660
Facilities, Securities	4,566,082	3,343,447	4,695,115
Records Management & Services	915,566	957,127	1,025,689
Polygraph	81,907	83,035	81,453
Police Communications Center	3,281,491	3,113,292	3,120,000
Animal Services	1,171,917	1,491,259	1,518,809
TOTAL	$43,384,194	$40,840,136	$47,060,000

DEPARTMENT OF FIRE			
Fire Admin Staff	$323,587	$243,336	$304,510
Fire Inventory Purchases	-	332,350	304,485
Fire Operations	2,833,180	2,471,851	2,954,255
Fire Station # 1	3,429,807	3,204,985	3,587,650
Fire Station # 4	900,913	856,608	944,076
Fire Station # 5	1,918,321	1,909,901	1,975,469
Fire Station # 6	876,459	942,433	972,609
Fire Station # 8	912,747	924,783	939,332
Fire Station # 9	886,548	813,274	953,645
Fire Station # 10	907,198	749,972	1,013,379
Fire Station # 12	929,294	886,427	974,411

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	FY09 Actual	FY10 Projected	FY11 Proposed
Fire Station # 13	1,815,411	1,661,074	1,708,457
Fire Station # 14	1,860,984	1,796,414	1,757,689
Fire Station # 15	897,633	757,855	948,775
Fire Station # 16	893,136	881,616	962,382
Fire Station # 17	859,797	859,013	945,391
Fire Station # 19	1,813,118	1,820,643	1,718,755
Fire Station # 20	865,819	994,406	1,018,009
Fire Station # 21	985,095	913,724	999,226
Fire Station # 22	875,951	855,591	993,890
Hamilton County Rescue	10,134	8,618	8,800
Fire Station # 7		-	1,847,127
Fire Station # 3	-	-	3,395
Fire Deputy Chief Admin	154,647	139,883	157,738
Fire Safety	71,714	82,512	85,367
Fire Research and Planning	72,885	530	70,848
Fire Tactical Services	168,484	169,171	175,067
Fire Training Division	935,046	1,804,750	771,829
Fire Resource Division	673,597	621,037	634,029
Fire Marshall Staff	145,398	138,511	145,886
Fire Prevention	336,994	439,088	383,344
Fire Public Education	147,760	73,929	146,662
Fire Investigation	306,424	291,580	300,833
Fire Water Supply	73,148	62,266	64,465
Fire Information Technology	132,237	129,406	135,552
Fire Records Division	75,657	72,837	78,163
TOTAL	$28,089,123	$27,910,374	$30,985,500

DEPARTMENT OF PUBLIC WORKS			
Public Works Admin	$1,187,946	$ 853,830	$923,214
City Engineer	2,267,864	2,049,615	2,059,651
Street Paving		-	1,000,000
Public Works Utilities	163,155	163,591	164,000
Solid Waste Subsidy	6,275,560	5,740,775	5,907,775
Water Quality Mgmt Subsidy	683,952	683,952	-
Public Works Summer Work Program	45,206	413	-
CWS Admin	1,014,369	1,014,558	974,752
CWS Emergency	779,286	868,845	824,337
CWS Solid Waste Refuse Collection Center	-	-	48,075
CWS Sewer Construction & Maintenance	2,159,014	-	-
CWS Street Cleaning	2,491,233	2,522,913	2,319,475
CWS Office of Sustainability	-	50,197	-
Brush Pick-up	2,093,320	1,954,669	1,626,577
Garbage Pick-up	4,213,253	3,609,923	4,240,198
Trash Flash Pick-up	428,808	394,518	469,781
Recycle Pick-up	381,618	395,501	529,459
Municipal Forestry	597,280	564,348	579,469

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	FY09 Actual	FY10 Projected	FY11 Proposed
Refuse Inspection	-	-	295,458
Land Development Office	2,635,829	2,324,166	2,523,921
Board of Plumbing Examiners	3,596	3,140	3,750
Board of Electrical Examiners	27,404	22,980	21,850
Board of Mechanical Examiners	1,066	3,082	4,000
Board of Gas Fitters	1,328	1,440	2,980
Board of Appeals & Variances	8,766	9,339	13,200
Traffic Engineering Admin	832,800	759,708	786,247
Street Lighting	3,062,517	2,585,338	2,940,000
Traffic Operations	1,846,734	1,730,559	1,829,057
Brainerd Levee 1, 2, 3	32,071	46,601	46,600
Orchard Knob Storm Station	33,558	38,250	38,250
Minor Storm Station	2,045	11,450	11,450
TOTAL	$33,269,578	$28,403,701	$30,183,526
DEPARTMENT OF PARKS & RECREATION			
Parks & Rec Admin	$ 500,234	$ 430,372	$465,985
Parks & Rec Public Information	87,390	88,212	99,481
Trust For Public Land	100,000	100,000	100,000
Greater Chatt Sports Committee. . . . A.O.	75,000	75,000	75,000
Recreation Admin	1,101,495	973,434	1,264,196
Rec Prog - Kidz Kamp	187,542	201,695	216,313
Rec Prog - Sports	193,755	167,591	185,616
Aquatics Programs	168,700	154,837	182,801
Therapeutic Programs	112,517	107,218	116,586
Fitness Center	209,196	209,513	225,181
Rec Facility - Skatepark	99,081	73,627	90,085
Rec Facility - Champion's Club	261,434	274,716	275,754
Rec Facility - Heritage House	1,564	2,445	-
Rec Facility - Summit of Softball	1,473	183,783	587,138
Rec Ctr - Avondale	135,833	136,140	142,516
Rec Ctr - Brainerd	312,609	323,032	347,040
Rec Ctr - Carver	162,994	169,464	177,061
Rec Ctr - East Chattanooga	176,623	182,748	186,729
Rec Ctr - East Lake	123,410	126,245	132,959
Rec Ctr - Eastdale	185,972	190,279	193,199
Rec Ctr - First Centenary	46,546	46,794	48,523
Rec Ctr - Frances B. Wyatt	74,407	56,572	104,717
Rec Ctr - Glenwood	188,272	189,247	195,991
Rec Ctr - John A. Patten	129,813	131,908	141,157
Rec Ctr - North Chattanooga	113,012	95,167	142,560
Rec Ctr - Shepherd	174,633	180,993	179,879
Rec Ctr - South Chattanooga	222,364	249,874	262,317
Rec Ctr - Tyner	156,800	132,738	170,522
Rec Ctr - Washington Hills	127,514	85,269	190,226

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	FY09 Actual	FY10 Projected	FY11 Proposed
Rec Ctr - Westside Community Ctr	51,131	34,195	53,604
Outdoor Chattanooga	318,519	317,458	367,188
Parks Admin	783,624	801,211	876,110
Parks Maint - Parks & Athletic Fields	783,198	816,518	868,528
Parks Maint - Buildings & Structures	941,584	876,686	905,687
Parks Maint - Landscape	509,406	452,400	485,482
Parks Maint - City-Wide Security	125,091	117,635	148,967
Parks Maint - Athletic Facilities	321,339	337,456	459,943
Shared Maint - TN Riverpark Downtown	1,273,766	1,218,067	1,327,134
Shared Maint - Carousel Operations	126,009	95,122	106,204
Shared Maint - TN Riverpark Security	182,739	193,029	192,151
Shared Maint - Coolidge Park	113,472	61,936	61,411
Shared Maint - Renaissance Park	24,639	17,372	18,931
Shared Maint - Ross' Landing	142,974	97,437	125,716
Shared Maint - Walker Pavilion	1,951	1,003	2,905
Shared Maint - Walnut Street Bridge	22,033	16,409	6,330
Shared Maint - Waterfront Management	40,000	40,000	40,000
Chattanooga Zoo at Warner Park	589,869	576,059	658,577
TOTAL	$11,781,527	$11,408,906	$13,204,400
DEPARTMENT OF EDUCATION, ARTS, & CULTURE			
EAC Administration	$ 325,260	$ 333,859	$344,415
Memorial Auditorium	453,978	446,836	473,441
Tivoli Theatre	296,292	318,145	330,982
Civic Facilities Concessions	50,950	39,617	47,494
Civic Facilities Administration	642,394	768,740	795,927
Arts & Culture North River	90,172	87,816	93,906
Arts & Culture Eastgate Center	111,689	120,361	124,907
Arts & Culture Heritage House	53,674	59,373	69,618
Cultural Arts Programs	61,680	33,843	3,192
TOTAL	$2,086,089	$2,208,590	$ 2,283,882

SECTION 5(a). GENERAL GOVERNMENT & SUPPORTED AGENCIES. The initials "A.O." as they appear in this Section, or elsewhere in the Ordinance, shall mean "Appropriation Only" which is hereby defined to mean that the amount as is shown being appropriated is only the appropriation of the City toward the total budget of such department, agency, board, commission, office or division or branch of government and is not to be construed to mean that such amount is its total budget or appropriation. The initials "A.S.F." as they

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appear in this Section, or elsewhere in this Ordinance, shall mean "Appropriation to Special Fund" which is hereby defined to mean that the amount as is shown being appropriated is to a Special Fund that will not revert to the General Fund at the end of the fiscal year. The amounts shown as appropriations to the Chattanooga Hamilton County Bicentennial Library and the Regional Planning Agency shall be contingent upon an equal amount being appropriated by Hamilton County.

GENERAL GOVERNMENT & SUPPORTED AGENCIES

	FY09 Actual	FY10 Projected	FY11 Proposed
	$		
City Council	664,205	$ 677,214	$ 708,594
City Judges Division 1	341,615	357,691	372,464
City Judges Division 2	329,477	346,913	355,897
City Attorney Operations	1,010,754	852,781	1,237,222
Internal Audit	467,159	475,455	485,037
Information Services	2,756,870	2,990,892	3,268,184
Telephone Systems	174,108	156,223	177,720
Telecommunication Operations	151,847	177,498	170,512
311 Call Center	466,927	466,318	549,985
CARCOG & Economic Dev District . . . . . . A.O.	31,038	31,111	36,038
Allied Arts Council . . . . A.O.	255,000	191,250	161,200
Carter Street Corporation . . . . A. O.	200,000	185,000	161,257
Chattanooga Neighborhood Enterprises . . . . .A.O.	1,000,000	900,000	1,000,000
WTCI-TV-Channel 45 . . . . A.O.	60,000	45,000	50,650
Tennessee RiverPark . . . . A.O.	1,146,481	1,219,775	1,191,180
Homeless Health Care Center . . . . A.O.	17,500	15,750	13,300
Children's Advocacy Center . . . . .A.O.	30,000	22,500	19,000
Community Foundation Scholarships . . . . . . .A.O.	160,000	120,000	101,300
Chattanooga Area Urban League . . . . .A.O.	50,000	50,000	42,200
Downtown Partnership . . . . .A.O.	100,000	80,000	
Bessie Smith Cultural Center . . . . AO.	70,000	64,000	54,000
Chattanooga History Center. . . . . .A.O.	24,000	18,000	15,200
Community Impact Fund. . . . . A.O.	300,000	208,511	175,600
Railroad Authority. A.O.	55,794	67,822	12,281
Enterprise Center. . . . . .A.O.	100,000	237,500	160,500
Enterprise South Nature Park. . . . . A.O.	121,513	283,861	564,697

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Go Fest. . . . . A.S.F.	25,000	15,000	8,440
Front Porch Alliance. . . . . A.O.	30,000	27,000	22,800
Choose Chattanooga . . . . A.O.	25,000	20,000	16,900
Finley Stadium. . . . . A.O.	60,000	60,000	60,000
Friends of Moccasin Bend Nat'l Park. . . . . . . A.O.	-	30,000	25,300
Enterprise South Industrial Park Security. . . . A.O.	19,180	53,021	53,827
Chattanooga Area Food Bank. . . . . A.O.	-	15,000	12,700
Senior Neighbors/Alexian Brothers . . . . A.O.	-	22,094	17,700
RiverCity . . . . A.O.	-	-	67,500
CARTA Subsidy . . . . A.O.	3,851,000	3,851,000	4,231,000
C-HC Bicentennial Public Library . . . . A.S.F.	2,640,000	2,640,000	2,792,400
Debt Service Fund . . . . A.S.F.	10,956,089	10,906,307	15,494,469
Capital Improvements	8,949,717	9,461,261	-
Human Services . . . . A.S.F.	1,333,477	1,233,477	733,477
Air Pollution Control Bureau . . . . A.S.F.	270,820	270,820	270,820
Regional Planning Agency . . . . A.S.F.	990,007	1,115,712	1,378,500
Scenic Cities Beautiful . . . . A.S.F.	22,888	5,000	4,220
Heritage Hall Fund. . . . . A.S.F.	57,019	62,653	62,653
Election Expense	174,098	10,000	25,000
City Code Revision	6,428	-	-
Unemployment Insurance	62,541	116,480	133,000
Contingency Fund Appropriation	114,553	235,634	4,103,051
Chatt Comm Resource Ctr Homeless	2,250	-	-
Renewal & Replacement	533,909	500,000	1,211,177
Audits, Dues & Surveys	143,789	206,000	306,000
Intergovernmental Relations	350,395	357,000	357,000
City Water Quality Mgmt Fees . . . . A.S.F.	81,165	135,000	300,000
Liability Insurance Premiums . . . . A.S.F.	1,700,000	800,000	1,360,000
Tuition Assistance Program	22,187	16,000	20,000
Total	$ 42,505,800	$ 42,405,524	$ 44,151,952

SECTION 6. That there be and is hereby established a budget for each of the following special funds for Fiscal Year 2010-2011:

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1108 MUNICIPAL GOLF COURSE FUND	FY09 Actual	FY10 Projected	FY11 Proposed
ESTIMATED REVENUE			
Pro Shop	$163,074	$149,367	148,129
Green Fees	821,482	758,132	764,814
Memberships	153,549	145,329	150,885
Cart Rentals	579,243	557,212	538,907
Food	85,027	76,334	74,667
Beverage	161,563	141,278	139,958
Total	$1,963,938	$1,827,652	$1,817,360
APPROPRIATIONS			
Brainerd	$1,143,305	$816,857	$855,119
Brown Acres	991,702	1,010,795	962,241
Total	$2,135,007	$1,827,652	$1,817,360

1111 ECONOMIC DEVELOPMENT FUND			
ESTIMATED REVENUE			
City – Only Sales Tax	$9,586,930	$10,011,275	$10,011,275
TDZ – State Sales Tax	-	1,809,793	-
TDZ – County Sales Tax	-	549,755	-
Total	$9,586,930	$12,370,823	$10,011,275
APPROPRIATIONS			
Economic Development Capital Projects	$1,419,467	$2,999,500	$582,131
Appropriation to Capital from Fund Balance	1,506,221	-	-
TN Multicultural Chamber of Commerce	150,000	75,000	150,000
Chattanooga Chamber of Commerce	450,000	450,000	450,000
Chamber of Commerce Marketing-Enterprise South	75,000	75,000	75,000
Lease Payments	6,863,320	6,100,000	9,354,144
Less: Chattanoogan Lease Payment offset	(1,985,857)	(422,618)	(600,000)
Tourist Development Zone	-	2,359,548	-
Total	$8,478,151	$11,636,430	$10,011,275

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	FY09 Actual	FY10 Projected	FY11 Proposed
2030 HUMAN SERVICES DEPARTMENT			
ESTIMATED REVENUE			
Federal – State Grants	$12,296,621	$17,373,356	$17,373,356
City of Chattanooga	1,333,477	1,233,477	733,477
Interest Income	4,264	40,613	40,613
Donations & Other	84,744	70,100	70,100
Day Care Fees	46,483	46,641	46,641
Fund Balance	362,111	(1,433,288)	(1,433,288)
Total	$14,127,700	$17,330,899	$16,830,899
APPROPRIATIONS			
Administration	$954,984	$944,260	$444,260
Headstart	7,531,703	8,043,413	8,043,413
Day Care	858,801	690,641	690,641
Weatherization	474,682	218,154	218,154
Foster Grandparents	524,489	418,906	418,906
LIEAP	2,620,237	1,080,019	1,080,019
CSBG	757,506	784,334	784,334
Human Services Program	348,376	174,909	174,909
City General Relief	71,490	-	-
ARRA	-	4,959,690	4,959,690
Other	(14,568)	16,573	16,573
Total	$14,127,700	$17,330,899	$16,830,899

9250 NARCOTICS FUND			
ESTIMATED REVENUE			
Federal	$65,474	$18,725	$50,000
State	17,560	1,000	12,000
Confiscated Narcotics Funds	265,244	191,217	200,000
Other	98,997	99,969	50,000
Total	$447,275	$310,911	$312,000
APPROPRIATIONS			
Operations	$597,000	$219,409	$312,000
Total	$597,000	$219,409	$312,000

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	FY09 Actual	FY10 Projected	FY11 Proposed
2050 STATE STREET AID			
ESTIMATED REVENUE			
State of Tennessee	$4,089,271	$4,058,433	$4,029,360
Fund Balance	385,605	-	-
State Maintenance of Streets	25,312	2,560	35,000
Investment Income	23,715	1,850	15,000
Total	$4,523,903	$4,062,843	$4,079,360
APPROPRIATIONS			
Operations	$4,523,903	$3,846,833	$4,079,360
Total	$4,523,903	$3,846,833	$4,079,360
2060 COMMUNITY DEVELOPMENT FUND			
ESTIMATED REVENUE			
Federal	$3,490,890	$3,751,000	$5,500,000
Miscellaneous	643,355	800,000	600,000
Total	$4,134,245	$4,551,000	$6,100,000
APPROPRIATIONS			
Administration			
Chattanooga Neighborhood Enterprise	$451,119	$451,000	$394,000
Other Community Development Projects	580,501	1,400,000	1,000,000
Transfers	2,708,742	2,200,000	4,306,000
Total	398,165	500,000	400,000
	$4,138,526	$4,551,000	$6,100,000
2070 HOTEL/MOTEL TAX FUND			
ESTIMATED REVENUE			
Occupancy Tax	$3,893,990	$3,850,875	$3,889,384
SRC Parking Garage Revenue	240,244	277,083	277,000
Interest Revenue	27,220	16,647	-
Fund Balance	1,443,592	-	-
Total	$5,605,046	$4,144,605	$4,166,384
APPROPRIATIONS			
21st Century Waterfront Capital Fund	$2,000,000	$ -	$737,708
Other Waterfront Capital Fund	-	-	-
Appropriation from Fund Balance	-	-	-
Appropriation to Capital	-	-	-

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	FY09 Actual	FY10 Projected	FY11 Proposed
Hotel/Motel Collection Fee	69,489	77,018	79,680
Debt Service	3,265,313	2,688,500	3,318,996
Hamilton County	30,000	30,000	30,000
Total	$5,364,802	$2,795,518	$4,166,384

3100. DEBT SERVICE FUND

ESTIMATED REVENUE			
General Fund	$12,166,456	$10,906,307	$15,494,470
911 Emergency Communications	200,000	200,000	200,000
Homeland Security Grant (911)	608,759	608,759	-
Hamilton County	478,191	527,853	474,423
CDBG (Fannie Mae Loan)	654,284	501,232	469,740
Safety Capital (Fire Loan)	2,247	5,639	5,639
Hotel/Motel Tax	3,265,313	2,683,530	3,318,996
Other Sources	425,542	361,197	433,905
Use of Fund Balance	-1,876,068	3,196,977	-
Total	$15,924,724	$18,991,494	$20,397,173
APPROPRIATIONS			
Principal	$9,591,680	$12,430,007	$13,054,075
Interest	6,236,742	6,461,487	7,243,098
Bank Service Charges	96,302	100,000	100,000
Total	$15,924,724	$18,991,494	$20,397,173

6010 INTERCEPTOR SEWER SYSTEM

	FY 09 Actual	FY 10 Projected	FY11 Proposed
Estimated Revenues:			
Sewer Service Charges	$34,293,838	$34,950,000	$35,649,467
Industrial Surcharges	3,585,652	2,850,000	2,500,000
Septic Tank Charges	420,517	415,500	324,238
Wheelage and Treatment:			
Lookout Mountain, TN	176,294	207,500	214,303
Dade County	12,344	23,200	12,793
Walker County, GA	445,780	407,700	412,683
Collegedale, TN	300,380	310,300	306,225
Soddy-Daisy, TN	149,099	184,650	192,194

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	FY 09 Actual	FY 10 Projected	FY11 Proposed
East Ridge, TN	1,047,337	1,362,500	1,462,403
Windstone	35,955	33,800	31,674
Hamilton County, TN	729,768	731,950	715,198
Northwest Georgia	706,652	680,150	728,097
Lookout Mountain, GA	66,369	63,250	61,480
Rossville, GA	430,749	471,700	471,917
Ringgold, GA	305,335	338,150	349,255
Red Bank, TN	489,023	564,600	595,584
Debt Service Northwest Georgia	372,794	447,353	447,353
Industrial User Permits	39,000	39,000	41,000
Industrial User Fines	700	-	-
Miscellaneous	46,775	-	-
Garbage Grinder Fees	47,581	47,580	50,700
Operating Revenue:	$43,701,942	$44,128,883	$44,566,564
Fund Balance (P540)	7,500,000	10,804,000	-
Interest Earnings	971,072	314,146	300,000
	$52,173,014	$55,247,029	$44,866,564
Appropriations:			
Operations & Maintenance:			
Administration	2,828,438	2,140,829	3,007,083
Laboratory	590,630	612,175	659,130
Engineering	365,999	384,720	482,381
Plant Maintenance	1,333,338	1,442,074	1,546,923
Sewer Maintenance	3,050,364	1,666,923	3,572,007
Moccasin Bend - Liquid Handling	9,714,198	9,100,546	9,152,927
Inflow & Infiltration	1,028,589	1,658,349	1,213,637
Safety & Training	128,056	134,828	136,361
Pretreatment/Monitoring	462,245	446,810	504,979
Moccasin Bend - Solid Handling	3,080,591	3,527,515	3,637,243
Landfill Handling	1,506,615	1,482,000	1,600,000
Combined Sewer Overflow	177,840	296,387	436,600
Total Operations & Maintenance	$24,266,903	$22,893,156	$25,949,271

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Pumping Stations:			
Mountain Creek Pump Station	19,123	22,185	42,285
Citico Pump Station	348,933	278,235	314,135
Friar Branch Pump Station	205,082	170,340	203,490
Hixson 1, 2, 3, & 4 Pump Stations	116,678	111,573	176,861

	FY 09 Actual	FY 10 Projected	FY11 Proposed
19th Street Pump Station	36,459	59,637	63,925
Orchard Knob Pump Station	57,410	39,310	72,460
South Chickamauga Pump Station	311,501	314,800	367,450
Tiftonia 1 & 2 Pump Stations	60,344	96,725	173,675
23rd Street Pump Station	150,523	133,780	146,330
Latta Street Pumping Stations	9,085	16,110	16,360
Residential Pump Stations	23,408	25,000	39,500
Murray Hills Pump Station	13,705	15,310	22,310
Highland Park Pump Station	9,806	11,710	14,210
Big Ridge 1-5 Pump Stations	63,144	69,373	104,481
Dupont Parkway Pump Station	30,287	28,175	35,175
VAAP Pump Station	4,310	6,260	10,260
Northwest Georgia Pump Station	41,292	49,475	59,875
Brainerd Pump Station	16,731	17,100	70,850
East Brainerd Pump Station	42,630	49,002	69,515
North Chattanooga Pump Station	20,874	22,370	29,260
South Chattanooga Pump Station	3,506	9,355	7,905
Ooltewah-Collegedale Pump Station	92,815	78,000	92,645
Odor Control Pump Stations	800,074	775,000	815,000
Enterprise South Pump Station	1,161	1,120	9,345
River Park Pump Station	-	1,500	4,250
Ringgold Pump Station	77,818	80,050	56,850
West Chickamauga	-	8,000	49,000
Total Pumping Stations	$2,566,699	$2,2,489,495	$3,067,402
Total Operations & Maintenance	$26,823,602	$25,382,651	$29,016,673
Capital Improvement	197,456	1,242,285	1,149,782
Debt Service Reserve	935,697	1,059,825	1,575,012
Construction Trust Fund (P540)	7,500,000	10,804,000	0

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Debt Service			
Principal	10,988,409	9,492,618	9,137,500
Interest	4,015,808	3,755,185	3,987,597
	$15,988,409	$13,247,803	$13,125,097
Total Appropriations:	$50,460,972	$51,736,564	$44,866,564

6020 SOLID WASTE & SANITATION FUND

ESTIMATED REVENUE			
Landfill Tipping Fees	$558,019	$678,670	$415,024
Permits	2,658	2,200	-
State of Tennessee Household Hazardous Waste Grant	81,171	65,000	85,000
State of Tennessee Recycle Rebate	24,044	25,000	60,000
City Tipping Fees	6,275,560	5,740,775	5,907,775
Investment Income	286,642	36,520	320,930
Sale of Mulch	37,252	335,813	280,000
Miscellaneous	42,161	13,250	27650
Total	$7,307,507	$6,897,228	$7,096,379

	FY09 Actual	FY10 Projected	FY11 Proposed
APPROPRIATIONS			
Recycle	$684,207	$766,284	$923,918
Waste Disposal – Summit Monitoring	219,871	194,500	320,930
Waste Disposal – City Landfill	1,436,548	1,109,468	1,262,969
Wood Recycle	376,203	549,532	594,358
Montague Park Monitoring	5,827	35,150	-
Solid Waste Reserve	-	-	150,000
Debt Service			
Principal	2,534,945	2,653,045	2,782,577
Interest	1,228,184	1,120,652	961,627
Capital Improvement	300,000	-	-
Household Hazardous Waste	87,464	99,660	100,000
Total	$6,873,249	$6,528,291	$7,096,379

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	FY09 Actual	FY10 Projected	FY11 Proposed
6030 WATER QUALITY FUND			
ESTIMATED REVENUE			
Water Quality Fee	$ 5,727,780	$11,769,829	$13,694,524
Land Disturbing Fee	30,125	30,525	-
Other	97,717	86,500	-
General Fund Subsidy	683,952	683,952	-
Fund Balance	775,000	-	-
Total	$ 7,314,574	$12,570,806	$13,694,524
APPROPRIATIONS			
Water Quality Administration	$ 2,060,592	$ 2,100,556	$ 1,850,293
Water Quality Operations	1,384,397	1,616,910	5,254,480
Water Quality Site Development	-	-	348,649
Water Quality Engineering	-	-	699,110
Water Quality Public Education	-	-	65,158
Renewal & Replacement	36,621	29,828	779,690
Debt Service			
Principal	1,645,268	1,730,510	1,824,500
Interest	653,587	568,952	1,530,603
Debt Service Reserve	-	-	1,342,041
Appropriation to Capital Project Fund	775,000	-	-
Total	$6,555,465	$6,046,756	$13,694,524
9091 AUTOMATED TRAFFIC ENFORCEMENT			
ESTIMATED REVENUE			
Automated Traffic & Speeding Fines	$1,343,065	$1,436,406	$1,300,000
Use of Fund Balance	-	543,879	-
Total	$1,343,065	$1,980,285	$1,300,000
APPROPRIATIONS			
Traffic Enforcement Operations	$648,819	$1,565,485	$1,300,000
Transfer to General Fund	-	414,800	-
Total	$648,819	$1,980,285	$1,300,000

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2110
TENNESSEE VALLEY REGIONAL COMMUNICATIONS

ESTIMATED REVENUE			
Telecommunications Program Revenue	0	0	$856,954
Total	0	0	$856,954
APPROPRIATIONS			
Telecommunications Operations	0	0	$856,954
Total	0	0	$856,954

SECTION 6(b). That there be and is hereby authorized the appropriation of all collections and fund balances to the respective funds, other than the General Fund, to be expended for the general public purposes as indicated.

SECTION 6(c). That the Chattanooga City Council adopted Resolution 25862 on March 24, 2009, authorizing the City to enter into an Airport Operations Service Contract ("Contract") with the Chattanooga Metropolitan Airport Authority ("Airport Authority"). In accordance with Section 5.1 of the Contract, the City hereby appropriates the sum of $644,889.00 from the Debt Service Fund (which represents the total debt service requirements for the Airport Authority's fiscal year 2011), to be used only in the event that the Airport Authority is unable to meet its debt service requirement for fiscal year 2011.

SECTION 6(d). The City, or its designee, shall have the authority to impose and collect reasonable fees related to the administration of the Chattanooga Renewal Community Initiative including, but not limited to, a fee for applications for the Commercial Revitalization Deduction program as established under the Community Renewal Tax Relief Act of 2000 and the Tennessee Department of Economic and Community Development Qualified Allocation Plan.

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SECTION 7(a). That all persons under the "City of Chattanooga Classification and Pay System" and covered by the "Pay Plans" on the effective date of this Ordinance shall receive pay within the appropriate range as designed in the City's Pay Plan. The Mayor shall authorize pay for all persons not within the "City of Chattanooga Classification System" and not covered by the "Pay Plan".

SECTION 7(a)(1). In addition to the minimum rate of pay established in the Classification Plan, a rate of pay less than the minimum of the designated pay range may be assigned to the newly employed or promoted incumbent for a specified period of time. This pay shall be identified as "probation pay". Provided, however, that no full time City employee shall be paid less than the prevailing poverty rate, except for those employees whose pay is governed by federal formula.

SECTION 7(a)(2). Any person employed on a temporary basis in positions authorized within the Classification Plan shall be paid at a rate not more than the minimum of the position's pay range. As provided in the Chattanooga City Code, Part II, temporary employment shall not exceed a period of six (6) months on any occasion.

SECTION 7(a)(3). In addition to positions provided for hereinafter, known as positions within the "City of Chattanooga Classification System", which includes only permanent full time positions, the City recognizes and authorizes the following types of designation of positions as exempt from the Classification System: Permanent Part-Time, Temporary Part-Time, Permanent Daily, Permanent Full-Time Elected Officials, and Temporary Full-Time.

SECTION 7(b). That except as otherwise provided, the positions specified hereinafter are hereby authorized at the pay ranges or maximum amounts and upon the terms hereinafter specified.

Funded	Position Name	Range/Rate	Period

DEPARTMENT OF GENERAL GOVERNMENT

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OFFICE OF CITY ATTORNEY

C00150	1	City Attorney		34	B
C02963	1	Receptionist		$11.75H	B
C04037	4	Administrative Support Spec		10	B
C04127	1	Transportation Inspector			B
C04130	1	Claims Investigator		18	B
C04131	1	Deputy City Attorney		30	B
C04132	1	Administrative Sup Spec PT			B
C30020	4	Staff Attorney		25	B

CITY COURT (JUDICIAL) – First Division

C00152	2	City Court Officer	(each)	NP	B
C00153	1	Judicial Assistant		$23.30H	B
C20010	1	City Judge		*	B

CITY COURT (JUDICIAL) – Second Division

C00152	2	City Court Officer	(each)	NP	B
C00153	1	Judicial Assistant		$23.30H	B
C20010	1	City Judge		*	B

* The City Judges shall be paid the same salary as the General Sessions Judges of Hamilton County, Tennessee.

CITY COUNCIL

C00159	1	Clerk to Council		NP	B
C00160	1	Management Analyst		NP	B
C00161	1	Assistant Clerk to Council		NP	B
C00163	1	Council Secretary		NP	B
C20100	1	Council Chairperson		***	B
C20200	1	Council Vice Chairperson		**	B
C20300	7	Council Member	(each)	*	B

* Members of the Council shall be paid fifteen percent (15%) of the Mayor's Salary - $21,991.05 each.

** The Vice-Chairperson shall be paid fifteen percent (15%) of the Mayor's salary plus an additional $2,500.00 -$24,491.05

*** The Chairperson shall be paid fifteen percent (15%) of the Mayor's salary plus an additional $5,000.00 – $26,991.05

INTERNAL AUDIT/ PEFORMANCE REVIEW

C00084	3	Internal Auditor 1	(each)	19	B

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C02117	1	Internal Auditor 2		21	B
C02118	1	Director Internal Audit		29	B
C04037	1	Administrative Support Spec		10	B
		INFORMATION SERVICES			
C00107	1	Chief Information Officer		33	B
C00108	1	Manager Application Services		28	B
C00109	1	Dep Chief Information Officer		29	B
C00110	2	Network Analyst		22	B
C00113	1	Manager IT Support Services		28	B
C00114	1	Network Engineer		17	B
C00115	2	Systems & Database Spec 2	(each)	23	B
C00116	2	Systems & Database Spec 1	(each)	22	B
C00117	1	Manager Network		27	B
C00119	4	Programmer 2	(each)	20	B
C00120	1	IT Support Services Supervisor		21	B
C00127	4	Programmer 1	(each)	18	B
C04004	4	IT Business Project Analyst	(each)	25	B
C04008	1	Webmaster		20	B
C04009	3	IT Specialist	(each)	19	B
C04015	4	IT Technician	(each)	15	B
C0xxxx	1	Security Analyst			B
C0xxxx	1	Device Specialist			B
C04037	1	Administrative Support Spec		10	B
C04047	1	Adm Support Assistant 2		7	B
		TELECOMMUNICATIONS			
C00145	1	Telecommunications Manager		24	B
C00146	1	Telecommunications Coordinator		17	B
		311 CALL CENTER			
C02106	1	Customer Service Rep 2		8	B
C02107	8	Customer Service Rep 1	(each)	7	B
C02108	1	Customer Service Supervisor		15	B
C04008	1	Webmaster		20	B
		DEPARTMENT OF GENERAL GOVERNMENT			
		GENERAL SERVICES ADMINISTRATION			
C00020	1	Director General Services		30	B
C00021	1	Asst. Director Gen Svcs		NR (1 Frozen)	B
C00022	1	Special Project Coordinator		NR (1 Frozen)	B
Cxxxx	1	Contract Administrator		NR	B
C00187	1	General Svcs Technology Spec		22	B
C04011	1	Fiscal Analyst		17	B.

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C04047	1	Adm Support Assistant 2		7	B

PURCHASING

C00250	1	Manager Purchasing		23	B
C00252	7	Buyer	(each)	16	B
C00269	1	Deputy Purchasing Manager		21	B
C00283	1	Manager Real Property		22	B
C04057	1	Adm Support Assistant 1		4	B
C04047	1	Adm Support Assistant 2		7	B

CITY HALL / ANNEX MAINTENANCE

C00198	2	Security Guard	(each)	4	B
C04010	1	General Supervisor		18	B
C04045	1	Crew Supervisor 1		8	B
C04059	9	Crew Worker 1	(each)	2 (1 Frozen)	H
C04029	1	Bldg Maintenance Mechanic 2	(each)	12	H
C04040	1	Bldg Maintenance Mechanic 1	(each)	9	H

DEVELOPMENT RESOURCE CENTER

C04057	1	Adm Support Assistant 1		4	B
C04059	2	Crew Worker 1	(each)	2	H

CHATTANOOGA MOBILE COMMUNICATION SERVICES

C00199	1	Mgr Electronics Communications		25	B
C00213	4	Electronics Com Technician 2		16	B
C04019	2	Electronics Com Technician 1	(each)	14	B
C04116	1	Electronics Shop Supv		18	B
C04057	1	Administrative Support Asst 1		4	B

MUNICIPAL GARAGE – AMNICOLA

C00204	1	Fleet Maintenance Shift Supv		16	B
C00205	1	Manager Fleet		23	B
C00206	4	Equipment Mechanic 3*	(each)	13	H
C00208	3	Equipment Mechanic 1*	(each)	10	H
C00209	1	Data Analyst		12	B
C00218	2	Fleet Maintenance Shop Supv	(each)	18	B
C00224	11	Equipment Mechanic 2*	(each)	12	H
C01301	1	Inventory Clerk		5	H
C04028	1	Inventory Coordinator		13	H
C04051	2	Inventory Technician	(each)	7	H
C04059	2	Crew Worker 1	(each)	2	H

**denotes positions authorized to receive a tool allowance based on City of Chattanooga policy.*

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MUNICIPAL GARAGE – 12TH STREET

C00204	2	Fleet Maintenance Shift Supv	(each)	16	B
C00206	7	Equipment Mechanic 3*	(each)	13	H
C00208	5	Equipment Mechanic 1*	(each)	10	H
C00218	1	Fleet Maintenance Shop Supv		18	B
C00224	6	Equipment Mechanic 2*	(each)	12	H
C04028	1	Inventory Coordinator		13	B
C04037	1	Administrative Support Spec		10	B
C04051	2	Inventory Technician	(each)	8	B
C04053	1	Vehicle Servicer		7	H
C04057	1	Adm Support Assistant 1		4	H
C04058	1	Crew Worker 2		4	H
C04059	1	Crew Worker 1		2	H
C04100	1	Equipment Operator 4		10	H

**denotes positions authorized to receive a tool allowance based on City of Chattanooga policy.*

MUNICIPAL GAS STATION

C04051	1	Inventory Technician	7	H
C04100	1	Equipment Operator 4	10	H

DEPARTMENT OF FINANCE & ADMINISTRATION

FINANCE OFFICE

C00075	1	Administrator & City Finance Officer		35	B
C00076	1	Deputy Administrator Finance		29	B
C00077	1	Budget Officer		27	B
C00079	1	Manager Financial Operations		27	B
C00081	1	Accounts Payable Supervisor		17	B
C00082	1	Accounting Manager		24	B
C00083	1	Payroll Supervisor		19	B
C00085	5	Management & Budget Analyst 1	(each)	17	B
C00086	1	Management & Budget Analyst 2		21	B
C00087	3	Accountant 1	(each)	17	B
C00090	2	Accountant 2	(each)	21	B
C00099	1	Payroll Assistant		7	B
C00102	2	Payroll Technician	(each)	11	B
C00995	1	Grants Specialist		15	B
C01402	3	Accounting Technician 1	(each)	8	B
C01991	1	Development Planning Manager		NR	B
C04021	1	Executive Assistant		14	B
C04035	2	Accounting Technician 2	(each)	10	B
C04047	4	Adm Support Assistant 2	(each)	7	B

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Cxxxxx	1	Technology Support Specialist		NR	B.

CITY TREASURER

C00131	1	Assistant City Treasurer		22	B
C00132	2	Tax Supervisor	(each)	16	B
C00133	1	City Treasurer		25	B
C00136	1	Business Tax Inspector		9	B
C00904	1	Property Clerk I		$9.04	H
C00905	1	Property Clerk II		$9.31	H
C00906	1	Property Clerk III		$10.15	H
C01006	7	Tax Specialist	(each)	7	B

OFFICE OF CITY COURT CLERK

C00055	1	City Court Clerk		24	B
C00059	1	Deputy City Court Clerk		17	B
C01101	12	Court Operations Assistant	(each)	5	B
C04044	2	Court Operations Technician 2	(each)	8	B
C04054	3	Court Operations Technician 1	(each)	6	B

POLICE DEPARTMENT

SWORN

C00796	3	Assistant Police Chief	(each)	P9	B
C00805	1	Police Chief		34	B
C00806	1	Deputy Police Chief		30	B
C00809	8	Police Captain	(each)	P8	B
C00812	17	Police Lieutenant	(each)	P7	B
C00813	89	Police Sergeant	(each)	P6	B
C00818	349	Police Officer I	(each)	P2 (frozen 12)	B
C04122		Police Officer II	(each)	P3	B
C04123		Police Officer III	(each)	P4	B
C04060		Master Police Officer	(each)	P5	B

NON-SWORN

C00168	1	Public Relations Coordinator 2		18	B
C00825	9	Police Services Technician 1	(each)	4	B
C00828	1	Crime Scene Technician		9	B
C00829	1	Photographic Lab Technician		9	B
C00834	1	School Patrol Officer Supv		9	B
C00840	7	Police Property Technician	(each)	7	B
C00856	1	Police Records Operation Supv		13	B
C00970	18	Police Service Technician 2	(each)	6	B
C00975	3	School Patrol Lieutenant	(each)	$21.84	H

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C00976	30	School Patrol Officer	(each)	$15.08	H
C01005	1	Manager Accreditation		17	B
C01010	1	Police Information Center Mgr		16	B
C01011	5	Police Records Analyst	(each)	10	B
C01402	1	Accounting Technician 1		8	B
C02205	1	Terminal Agency Coordinator		8	B
C03003	1	Crime Statistical Analyst		15	B
C04010	1	General Supervisor		18	B
C04011	1	Fiscal Analyst		17	B
C04014	1	Occupational Safety Specialist		17	B
C04020	1	Electronics Surveillance Techn		14	B
C04021	2	Executive Assistant		14	B
C04040	2	Bldg Maintenance Mechanic 1	(each)	9	B
C04042	1	Fiscal Technician		9	B
C04047	14	Adm Support Assistant 2	(each)	7	B
C04050	2	Fingerprint Technician	(each)	7	B
C04052	2	Personnel Assistant	(each)	8	B
C04056	18	Police Records Technician	(each)	5	B
C04057	2	Adm Support Assistant 1	(each)	4	B

AUTOMATED TRAFFIC FUND

SWORN

C00813	1	Police Sergeant		P6	B
C00818	3	Police Officer I	(each)	P2	B
C04122	1	Police Officer II		P3	B
C04123	1	Police Officer III		P4	B
C04060	1	Master Police Officer		P5	B

NON-SWORN

C04037	1	Adm Support Specialist		10	B

FIRE DEPARTMENT

SWORN

C00865	1	Fire Chief		34	B
C00866	1	Deputy Fire Chief		F7C	B
C00867	1	Fire Marshall		F7C	B
C00869	6	Fire Battalion Chief	(each)	F5A	B
C00873	81	Fire Lieutenant	(each)	F3A	B
C00874	46	Firefighter	(each)	F1A	B
C00892	171	Firefighter Senior	(each)	F2A	B
C04001	4	Assistant Fire Chief	(each)	F6C	B
C04003	78	Fire Captain	(each)	F4A	B

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C04111	10	Staff Captain	(each)	F4 C	B
C04112	11	Staff Lieutenant	(each)	F3C	B
C04113	1	Staff Firefighter Senior	(each)	F2C	B
C04115	1	Executive Deputy Fire Chief		29	B

NON-SWORN

C00168	1	Public Relations Coordinator 2		18	B
C00891	3	Fire Equipment Specialist	(each)	11	B
C00999	1	Manager IT Fire		18	B
C01407	1	Budget Technician		12	B
C04010	1	General Supervisor		18	B
C04021	1	Executive Assistant		14	B
C04029	1	Bldg Maintenance Mechanic 2		12	B
C04040	3	Bldg Maintenance Mechanic 1	(each)	9	B
C04047	2	Adm Support Assistant 2	(each)	7	B
C04051	1	Inventory Technician		7	B
C04052	1	Personnel Assistant		8	B
C04057	1	Adm Support Assistant 1		4	B

DEPARTMENT OF PUBLIC WORKS

ADMINISTRATION

C00450	1	Administrator		34	B
C00451	1	Deputy Administrator		31	B
C04028	1	Inventory Coordinator		13	B
C04011	1	Fiscal Analyst		17	B
C04021	1	Executive Assistant		14	B
C04047	2	Administrative Support Assistant 2	(each)	7	B

CITY WIDE SERVICES

C00474	1	Director, City Wide Services		27	B
C00479	1	Accident Investigator		10	B
C01301	1	Inventory Clerk		5	B
C01530	1	Crew Scheduler		8	B
C04014	1	Occupation Safety Specialist		15	B
C04028	1	Inventory Coordinator		13	B
C04037	2	Administrative Support Specialist		10	B
C04047	2	Administrative Support Assistant 2	(each)	7	B/H
C04051	1	Inventory Technician		7	B
C04057	3	Administrative Support Specialist 1	(each)	4	B
C04059	1	Crew Worker 1		2	B
C04068	1	Asst. Director City Wide Services Adm		22	B

MUNICIPAL FORESTRY

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C00311	1	Municipal Forester		23	B
C00312	1	Forestry Supervisor		18	B
C00333	2	Tree Trimmer	(each)	9	H
C04038	2	Crew Supervisor 2	(each)	12	H
C04100	2	Equipment Operator 4	(each)	10	H
		EMERGENCY			
C04010	1	General Supervisor		18	B
C04059	5	Crew Worker 1	(each)	2 (1 frozen)	H
C04100	6	Equipment Operator 4	(each)	10	H
C04102	3	Equipment Operator 3	(each)	8	H
C04105	1	Equipment Operator 1		5	H
		SOLID WASTE REFUSE COLLECTION CENTER			
C04100	1	Equipment Operator 4	(each)	10	H
		ENGINEERING			
C00505	1	City Engineer		31	B
C00512	1	Assistant City Engineer		28	B
C00513	5	Civil Engineer	(each)	19	B
C00516	3	Engineering Coordinator	(each)	21	B
C00518	4	Survey Party Chief	(each)	14	B
C00522	2	Survey Instrument Technician	(each)	9	B
C00524	1	Manager IT Public Works		24	B
C00582	1	Engineering Technician	(each)	13	B
C00965	2	Engineering Co-op	(each)	$12.33 (1 frozen)	H
C04047	1	Administrative Support Assistant 2		7	B
C04057	1	Administrative Support Assistant 1		4 (1 frozen)	B
C04064	2	Engineering Manager	(each)	27	B
C04090	3	GIS Technician	(each)	13	B
C04117	1	Engineering Contracts Tech			B
C04135	2	Construction Inspector 2	(each)	15	B
		LAND DEVELOPMENT OFFICE			
C00334	1	Landscape Inspector		14	B
C00513	1	Civil Engineer		19	B
C00521	3	Construction Inspector 1	(each)	14 (1 frozen)	B
C00541	1	Building Official		25	B
C00544	1	Chief Building Inspector		19	B
C00545	1	Chief Electrical Inspector		19	B
C00546	1	Chief Plumbing Inspector		19	B
C00548	2	Electrical Inspector 1	(each)	14	B
C00550	2	Plumbing Inspector 1	(each)	14 (1 frozen)	B

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C00551	1	Plumbing Inspector 2		15	B
C00552	8	Combination Inspector	(each)	14 (1 frozen)	B
C00553	1	Building Inspector 1		14	B
C00554	1	Electrical Inspector 2		15	B
C00555	1	Building Inspector 2		15	B
C00559	1	Gas/Mechanical Inspector 2		15	B
C00567	1	Director Land Development		27	B
C00578	1	Chief Zoning and Sign Inspector		19	B
C01004	5	Permit Clerk	(each)	6	B
C01955	1	Development Ombudsman		18	B
C04032	1	Office Supervisor		12	B
C04047	1	Administrative Support Assistant 2		7	B
C04057	1	Administrative Support Assistant 1		4 (1 frozen)	B
C04080	1	Plans Review Specialist 3		15	B
C04085	1	Historic Preservation Planner		14	B
C04096	1	Plans Review Specialist 2		12	B
C04101	2	Plans Review Specialist 1	(each)	9	B
C004135	1	Construction Inspector 2		15	B

STREET CLEANING

C04010	1	General Supervisor		18	B
C04038	1	Crew Supervisor 2		12 (1 frozen)	B
C04045	3	Crew Supervisor 1	(each)	8	B
C04058	2	Crew Worker 2	(each)	4	H
C04059	11	Crew Worker 1	(each)	2 (1 frozen)	H
C04100	11	Equipment Operator 4		10 (1 frozen)	H
C04105	6	Equipment Operator 1	(each)	5	H

TRAFFIC CONTROL

C00206	1	Equipment Mechanic 3*		13 (1 frozen)	H
C00743	1	Manager Traffic Operations		24	B
C00744	1	Traffic Electrician Supervisor		19	B
C00753	1	Parking Meter Technician		7	B
C00756	2	Electronics Technician 1	(each)	14	B
C00757	1	Traffic Electronic Supervisor		19	B
C04010	1	General Supervisor		18	B
C04018	1	Electrician 2		14	B
C04027	4	Electrician 1	(each)	13	B
C04037	1	Administrative Support Specialist		10	B
C04038	1	Crew Supervisor 2		12	B
C04049	2	Crew Worker 3	(each)	7	H
C04057	1	Administrative Support Assistant 1		4	B
C04058	3	Crew Worker 2	(each)	4 (1 frozen)	H
C04059	7	Crew Worker 1	(each)	2	H
C04102	6	Equipment Operator 3	(each)	8	H

**denotes positions authorized to receive a tool allowance based on City of Chattanooga policy.*

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TRAFFIC ENGINEERING

C00768	1	City Traffic Engineer		27	B
C00769	1	Assistant City Traffic Engineer		25	B
C00770	1	Traffic Operations Analyst		16	B
C00771	1	Traffic Engineering Coordinator		13	B
C00774	4	Traffic Engineering Technician	(each)	10	B
C00776	1	Traffic Signal Designer		14	B
C04047	1	Administrative Support Assistant 2		7	B
C0XXX	1	Traffic Signal Systems Engineer		N/A	B

BRUSH & TRASH

C04010	1	General Supervisor		18	B
C04059	4	Crew Worker 1	(each)	2	H
C04100	11	Equipment Operator 4	(each)	10 (1 frozen)	H

TRASH FLASH

C04102	6	Equipment Operator 3	(each)	8	H

CURBSIDE RECYCLE

C04038	1	Crew Supervisor 2		12	B
C04059	4	Crew Worker 1	(each)	2 (1 frozen)	H
C04102	3	Equipment Operator 3	(each)	8	H
C04104	1	Equipment Operator 2	(each)	6	H

GARBAGE COLLECTION

C00532	1	Manager Sanitation		22	B
C04100	14	Equipment Operator 4		10	H
C04010	1	General Supervisor		18	B
C04038	1	Crew Supervisor 2		12	B
C04059	7	Crew Worker 1	(each)	2	H
C04102	3	Equipment Operator 3	(each)	8 (1 frozen)	H
C04105	2	Equipment Operator 1	(each)	5	H

REFUSE INSPECTION

C00531	6	Refuse Inspector	(each)	10 (1 frozen)	H

SOLID WASTE FUND POSITIONS
SANITARY FILLS

C00663	1	Manager Landfill		22	B
C04010	1	General Supervisor		18	B
C04058	1	Crew Worker 2		4	H
C04098	1	Landfill Technician		11	B

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C04100	5	Equipment Operator 4	(each)	10	H
C04105	1	Equipment Operator 1		5	H

WOOD RECYCLE

C04058	1	Crew Worker 2		4	B
C04059	1	Crew Worker 1		2	H
C04100	3	Equipment Operator 4	(each)	10	H

RECYCLE

C04102	1	Equipment Operator 4	(each)	10	H

WATER QUALITY MANAGEMENT FUND POSITIONS

WATER QUALITY MANAGEMENT

C00728	1	Manager PWD Water Quality Mgt		25	B
C00736	2	Water Quality Supervisor		19	B
C00738	2	Water Quality Technician	(each)	12	B
C00740	7	Water Quality Specialist 1		14	B
C00965	4	Engineering Co-op	(each)	$12.33	H
C01016	2	Water Quality Specialist 2		18	B
C04047	1	Administrative Support Assistant 2		7	B
C04069	1	GIS Systems Administrator		22	B
C04075	2	GIS Analyst 1	(each)	18	B
C04090	2	GIS Technician		13	B

WATER QUALITY OPERATIONS

C00410	2	General Supervisors	(each)	18	B
C00683	1	Manager Sewer Construction & Maintenance		25	B
C00521	1	Construction Inspector 1		14	B
C04045	4	Crew Supervisor 1	(each)	8	B
C04038	8	Crew Supervisor 2	(each)	12	B
C04030	6	Crew Supervisor 3	(each)	14	B
C04049	9	Crew Worker 3	(each)	7	H
C04058	14	Crew Worker 2	(each)	4	H
C04059	26	Crew Worker 1	(each)	2	H
C04100	4	Equipment Operator 4	(each)	10	H
C04102	4	Equipment Operator 3	(each)	8	H
C04104	8	Equipment Operator 2	(each)	6	H
C04124	10	Equipment Operator 5	(each)	12	H

WATER QUALITY SITE DEVELOPMENT

C00728	1	Manager Water Quality		25	B
C00742	3	Soil Engineering Specialist	(each)	19	B
C01004	1	Permit Clerk		6	B

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WATER QUALITY ENGINEERING & PROJECT MANAGEMENT

C00XXX	1	Engineering Manager		XX	B
C00733	1	Construction Program Supervisor		21	B
C00513	5	Civil Engineer	(each)	19	B
C00XXX	1	Flood Plain Supervisor		XX	B
C04071	2	Project Engineer	(each)	22	B

WATER QUALITY PUBLIC EDUCATION

C00600	1	Public Information Specialist		15	B

STATE STREET AID

STREET MAINTENANCE

C00516	1	Engineering Coordinator		21	B
C00521	1	Construction Inspector 1		14	B
C04010	2	General Supervisor	(each)	18	B
C04030	4	Crew Supervisor 3	(each)	14	B
C04038	1	Crew Supervisor 2	(each)	12	B
C04045	1	Crew Supervisor 1	(each)	8	B
C04058	13	Crew Worker 2	(each)	4	H
C04059	21	Crew Worker 1	(each)	2	H
C04065	1	Asst. Director City Wide Services Ops.		25	B
C04100	3	Equipment Operator 4	(each)	10	H
C04102	7	Equipment Operator 3	(each)	8	H
C04104	5	Equipment Operator 2	(each)	6	H
C04124	10	Equipment Operator 5	(each)	12	H

INTERCEPTOR SEWER SYSTEM

ADMINISTRATION

C00575	1	Director Waste Resources		29	B
C00590	1	Waste Resources Plant Engineer		22	B
C01301	2	Inventory Clerk	(each)	5	H
C04009	1	IT Specialist		19	B
C04011	1	Fiscal Analyst		17	B
C04028	1	Inventory Coordinator		13	B
C04037	1	Administrative Support Spec		10	B
C04047	1	Adm Support Assistant 2		7	B
C04051	1	Inventory Technician		7	B
C04052	1	Personnel Assistant		7	B
C04057	1	Adm Support Assistant 1		4	B
C04071	1	Project Engineer		22	B

LABORATORY

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C00591	1	Manager Laboratory Services		23	B
C00594	2	Chemist		17	B
C04091	1	Laboratory Technician 2		13	B
C04094	4	Laboratory Technician 1	(each)	12	B

ENGINEERING

C00596	1	Construction Inspector Supv		18	B
C00597	1	Waste Resources Sys Engineer		25	B
C00598	3	Sewer Project Coordinator	(each)	15	B
C01530	1	Crew Scheduler		8	B

PLANT MAINTENANCE

C00601	1	Plant Maintenance Supervisor		21	B *
C00603	1	Chief Electrical Instmnt Techn		19	H *
C00605	2	Chief Maintenance Mechanic	(each)	19	H *
C00610	11	Plant Maintenance Mechanic	(each)	11	H *
C00618	3	Plant Maintenance Lubricator	(each)	5	H *
C04018	7	Electrician 2	(each)	14	H *
C04038	1	Crew Supervisor 2		12	H *
C04040	1	Bldg Maintenance Mechanic 1		9	B *
C04058	1	Crew Worker 2		4	H

* *denotes positions authorized to receive a tool allowance based on City of Chattanooga, Department of Public Works, Interceptor Sewer System policy.*

SEWER MAINTENANCE

C04010	1	General Supervisor		18	B
C04030	5	Crew Supervisor 3	(each)	14	H
C04058	2	Crew Worker 2	(each)	4	H
C04100	5	Equipment Operator 4	(each)	10	H
C04102	4	Equipment Operator 3	(each)	8	H

MOCCASIN BEND TREATMENT PLANT – LIQUID HANDLING

C00630	1	Plant Superintendent		27	B
C00633	5	Chief Plant Operator	(each)	15	H
C00636	5	Plant Operator 3	(each)	13	H
C00638	7	Plant Operator 1	(each)	9	H
C04006	1	Plant Operations Supervisor		21	B
C04034	9	Plant Operator 2	(each)	11	H
C04057	1	Adm Support Assistant 1		4	B

INFLOW AND INFILTRATION

C04010	1	General Supervisor		18	H
C04030	3	Crew Supervisor 3	(each)	14	H
C04058	3	Crew Worker 2	(each)	4	H

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C04102	6	Equipment Operator 3	(each)	8	H

SAFETY & TRAINING

C04014	1	Occupational Safety Specialist		17	B
C04058	1	Crew Worker 2		4	H

PRETREATMENT/MONITORING

C00652	1	Pretreatment Supervisor		19	B
C00653	4	Monitor Technician	(each)	12	B
C00655	1	Pretreatment Inspector		14	B
C04047	1	Adm Support Assistant 2		7	B

MOCCASIN BEND TREATMENT PLANT – SOLID HANDLING

C00636	3	Plant Operator 3		13	H
C00638	3	Plant Operator 1	(each)	9	H
C04006	1	Plant Operations Supervisor		21	B
C04034	6	Plant Operator 2	(each)	11	H
C04100	1	Equipment Operator 4		10	H

DEPARTMENT OF PARKS AND RECREATION

ADMINISTRATION

C00300	1	Adm Parks & Recreation		32	B
C04011	2	Fiscal Analyst	(each)	17	B
C04021	1	Executive Assistant		14	B
C04052	1	Personnel Assistant		8	B

PUBLIC INFORMATION

C04017	1	Public Relations Coordinator 1		15	B

OUTDOOR CHATTANOOGA

C02133	1	Events and Marketing Spec		15	B
C04007	1	Recreation Division Manager		20	B
C00382	1	Recreation Specialist		9	B

SKATE PARK

C02940	2	Skatepark Assistant (P/T) 36hr	(each)	$10.30	H

RECREATION FACILITY MANAGEMENT

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C00378	4	Recreation Program Coordinator	(each)	16	B
C00382	27	Recreation Specialist	(each)	9	B
C02938	1	Director Recreation		25	B
C02943	1	Assistant Director of Recreation		21	B
C04007	2	Recreation Division Manager	(each)	20	B
C04025	14	Recreation Facility Manager	(each)	14	B
C04037	1	Administrative Support Spec		10	B
C04057	2	Adm Support Assistant 1	(each)	4	B
C04059	13	Crew Worker 1	(each)	2	B
C04082	2	Recreation Facility Manager 2	(each)	15	B
C04083	1	Recreation Program Specialist		13	B

SUMMIT OF SOFTBALL

C04038	1	Crew Supervisor 1		12	B
C04058	5	Crew Worker 2		4	B

FITNESS CENTER

C00954	1	Fitness Trainer (P/T)		$10.61	H
C00960	1	Front Desk Clerk (P/T) 18hr		$8.86	H
C04007	1	Recreation Division Manager		20	B
C04057	1	Adm Support Assistant 1		4	B

OUTVENTURE

C00378	1	Recreation Program Coordinator		16	B
C00378	1	Recreation Program Specialist		13	B
C00935	1	Recreation Specialist (P/T) 18hr		$11.38	H

CHAMPION'S CLUB

C00394	1	Tennis Professional		16	B
C00981	2	Tennis Assistant (P/T) 20hr	(each)	$8.02	H
C04059	1	Crew Worker 1		2	B
C04083	1	Recreation Program Specialist		13	B

AQUATICS

C00421	1	Aquatics Program Coordinator		16	B

THERAPEUTIC RECREATION

C00420	1	Therapeutic Program Coord		16	B
C04083	1	Recreation Program Specialist		13	B

PARKS & ATHLETIC FIELDS

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C00208	1	Equipment Mechanic 1		10	H
C04010	1	General Supervisor		18	B
C04038	2	Crew Supervisor 2	(each)	12	H
C04058	2	Crew Worker 2	(each)	4	H
C04059	1	Crew Worker 1	(each)	2	H
C04100	3	Equipment Operator 5	(each)	12	H
C04100	2	Equipment Operator 4	(each)	10	H
C04105	3	Equipment Operator 1		5	H

TENNESSEE RIVERPARK - DOWNTOWN

C04010	1	General Supervisor		18	B
C04038	3	Crew Supervisor 2	(each)	12	H
C04045	4	Crew Supervisor 1	(each)	8	H
C04058	1	Crew Worker 2	(each)	4	H
C04059	14	Crew Worker 1	(each)	2	H

BUILDINGS & STRUCTURES

C01301	1	Inventory Clerk		5	H
C04010	1	General Supervisor		18	B
C04029	1	Bldg Maintenance Mechanic 2		12	H
C04038	1	Crew Supervisor 2		12	H
C04040	8	Bldg Maintenance Mechanic 1	(each)	9	H
C04097	1	Pool Technician		12	H

CAROUSEL OPERATIONS

C00968	2	Carousel Assistant (P/T) 30hr	(each)	$7.78	H
C04047	1	Adm Support Assistant 2		7	B

PARKS & FACILITIES

C02934	1	Director Parks		25	B
C02943	1	Assistant Director Parks		21	B
C04037	1	Administrative Support Spec		10	B

LANDSCAPE

C00365	1	Gardener		7	H
C02932	1	Groundskeeper		7	H
C04010	1	General Supervisor		18	B
C04038	1	Crew Supervisor 2		12	H
C04058	4	Crew Worker 2	(each)	4	H
C04059	2	Crew Worker 1	(each)	2	H

TENNESSEE RIVERPARK SECURITY

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C00850	5	Park Ranger	(each)	4	B
C00863	1	Park Ranger Supervisor		9	B
		CITY-WIDE SECURITY			
C00850	3	Park Ranger	(each)	4	B
C00953	1	Ranger (P/T) 20hr	(each)	$11.70	H
		ATHLETIC FACILITIES			
C00362	1	Stadium Manager		17	B
C00942	1	Softball Coordinator		$321.00	W
C02932	1	Groundskeeper		7	H
C04038	1	Crew Supervisor 2		12	H
C04058	1	Crew Worker 2		4	H
C04059	3	Crew Worker 1	(each)	2	H
		CHATTANOOGA ZOO			
C00416	1	Director Zoo		23	B
C00417	1	Assistant Director Zoo		15	H
C00418	4	Zookeeper 1	(each)	5	H
C00419	1	Zookeeper 2		7	H
C00980	1	Zoo Education Curator		10	B
C02942	1	Zoo Cmty Partnership Coord		14	B
		DEPARTMENT OF PERSONNEL			
C00270	1	Administrator Personnel		32	B
C00271	1	Assistant Personnel Director		NR	B
C00272	1	Compensation Mgt Analyst		21	B
C00273	1	Deputy Administrator Personnel		29	B
C00275	1	Personnel Records Specialist		20	B
C00284	1	Fire & Police Recruitment Supv		18	B
C04012	4	Human Resources Generalist	(each)	17	B
C04021	1	Executive Assistant		14	B
C04033	2	Personnel Technician	(each)	11	B
C04047	2	Administrative Support Asst 2	(each)	7	B
		WELLNESS INITIATIVE			
C00011	1	Project Manager Wellness		NP	B
C00012	1	Wellness Coordinator		16	B
		EMPLOYEE BENEFITS OFFICE			
C00182	1	Dir Risk Mgt and Insurance		27	B
C00185	2	Benefits Technician	(each)	11	B

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C00266	1	Ocp Safety & Health Coordinator		21	B

DEPARTMENT OF NEIGHBORHOOD SERVICES & COMMUNITY DEVELOPMENT

ADMINISTRATION

C00050	1	Adm Neighborhood Services		32	B
C01912	1	Dep Adm Neighborhood Svcs		29	B
C01949	1	Graphics & Technology Spec		15	B
C01975	1	Clerical Assistant		$7.92	H
C04016	2	Neighborhood Program Spec	(each)	15	B
C04021	1	Executive Assistant		14	B

CODES, COMMUNITY SERVICES & NEIGHBORHOOD RELATIONS

C00155	3	Neighborhood Relations Spec	(each)	14	B
C00548	1	Mgr Codes & Neighborhood Relations		21	B
C00565	9	Code Enforcement Inspector 1	(each)	12	B
C041339	1	Code Enforcement Inspector 2	(each)	14	B
C00574	3	Code Enforcement Insp Supv	(each)	16	B
C04047	3	Adm Support Assistant 2	(each)	7	B

GRANTS ADMINISTRATION

C04086	1	Project Specialist		14	B

COMMUNITY DEVELOPMENT

C00188	1	Manager Community Development		23	B
C00189	1	Asst Mgr Community Development		21	B
C00192	3	Community Development Spec	(each)	16	B
C04011	1	Fiscal Analyst		17	B
C04047	1	Adm Support Assistant 2		7	B

EXECUTIVE DEPARTMENT OF THE MAYOR

ADMINISTRATION

C00164	1	Director of Media Relations		NP	B
C00171	1	Chief of Staff		NP	B
C00174	1	Special Project Assistant		NP	B
C00175	1	Special Assistant	(each)	NP	B
C01209	1	Deputy to the Mayor		NP	B
C20001	1	Mayor*			B
C02135	1	Assistant to Mayor		NP	B
C02136	1	Special Project Coordinator		NP	B
C04047	1	Administrative Support Assistant 2		7	B

*The salary of the Mayor shall be the same as the salary of

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the County Mayor of Hamilton.

OFFICE OF MULTICULTURAL AFFAIRS

C01204	1	Administrative Support Specialist		10	B
C02140	1	Director, Multicultural Affairs		NP	B
C02142	1	Compliance Officer		17	B
C01207	1	Executive Assistant		13	B
C01403	1	Administrative Coordinator		10	B

DEPARTMENT OF EDUCATION, ARTS, & CULTURE

ADMINISTRATION

C02960	1	Adm Education Arts Culture		32	B
C02961	1	Deputy Administrator EAC		30	B
C04017	1	Public Relations Coordinator 1		15	B
C04021	1	Executive Assistant		14	B
C04037	1	Administrative Support Spec		10	B

MEMORIAL AUDITORIUM

C00405	1	Technical Coordinator		12	B
C04059	2	Crew Worker 1	(each)	2 (1 Frozen)	H

TIVOLI THEATRE

C00405	1	Technical Coordinator		12	B
C04059	1	Crew Worker 1		2	H

CIVIC FACILITIES ADMINISTRATION

C00400	1	Director Civic Facilities		22	B
C00401	1	Business Mgr Civic Facilities		20	B
C00402	1	Supr Civic Facilities Operation		18	B
C00406	1	Facilities Marketing Coord		15	B
C00410	1	Box Office Supervisor		11	B
C00956	2	Box Office Cashiers (P/T) 36hr	(each)	$10.79	H
C00958	4	Phone Sales Clerks (P/T) 36hr	(each)	$10.54	H
C04045	1	Crew Supervisor 1		8	B
C04047	2	Adm Support Assistant 2		7	B

NORTH RIVER CIVIC CENTER

C04026	1	Community Facilities Supv		13	B

EASTGATE CENTER

C04026	1	Community Facilities Supv		13	B

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		HERITAGE HOUSE		
C04039	1	Community Facilities Supv	13	B
		DEPARTMENT OF HUMAN SERVICES		
C1A010	1	Administrator	32	B
C1A171	1	Dep Administrator Human Svcs	29	B

NR - Positions Not Rated in the Classification System

SECTION 7(b)(1). In order to achieve the efficiencies in personnel assignments, the Mayor is hereby authorized to realign, reclassify or otherwise change positions within the total number of funded positions provided for.

SECTION 7(c). This ordinance further provides longevity bonus pay for permanent, full time classified service employees who have five (5) or more years of continuous service as of October 31, 2010. The longevity pa y shall be fifty dollars ($50.00) for each full year of continuous service up to a maximum of thirty (30) years or one thousand five hundred dollars ($1,500). Employees terminated prior to October 31, 2010 shall not qualify for the longevity bonus pay.

SECTION 8. That all salaries and wages and other expenditures shall be paid only upon the authorization of the official who has the responsibility of expending the appropriation against which the salaries or wages or other expenditures are charged, pursuant to Private Acts of 1953, Chapter 105, Section 2 (4). That all funds appropriated in this Ordinance for payment of salaries and/or wages shall be spent for salaries and wages only unless proper authorization is given to do otherwise.

SECTION 9. That the City Finance Officer is authorized to pay the payroll and/or costs of personal services, whether on the payroll, voucher or otherwise, of the Air Pollution Control Bureau, Chattanooga-Hamilton County Bicentennial Library, Chattanooga-Hamilton County Regional Planning Agency, Human Services Department, Scenic Cities Beautiful, Golf Courses,

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and any other department, agency, board, commission, office, division, or branch of Municipal Government heretofore or hereafter established, notwithstanding that same is not specified hereinbefore, as certified to him by the respective administrative official.

SECTION 9(a). That the City Finance Officer is authorized to pay a uniform and equipment maintenance allowance of five hundred dollars ($500.00) for all sworn police officers and firefighters as of July 1, 2010, except for those new employees who have received from the city a new uniform since July 1, 2009. Further, the City Finance Officer is authorized to pay a supplemental tool allowance of two hundred dollars ($200.00) for certain employees as set forth in Resolution No. 18381, dated December 5, 1989, as amended; and is authorized to pay a supplemental uniform allowance of two hundred fifty dollars ($250.00) for City Court Officers. It shall be the duty of employees receiving these supplements to use the funds for the specified purpose and retain receipts to that effect.

SECTION 9(b). That the City Finance Officer is authorized to match the total salaries of all participants in the Fire and Police Pension Fund with a contribution from the General Fund not to exceed twenty four and ninety-one hundredth percent (24.91%).

SECTION 9(c). That the City Finance Officer is authorized to contribute to the General Pension Plan an amount equal to nine and eight one hundredth percent (9.08%) of all participants' salaries as specified in the most recent actuarial study.

SECTION 9(d). That the City Finance Officer is authorized to pay the following Union Pension Plan the specified amounts per participation agreements

Central Pension Fund	$1.38 per hour

SECTION 10. That the City Finance Officer is authorized to reimburse officials and employees for use of personal vehicles on official business at the current rate per mile recognized and established by the Internal Revenue Service.

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SECTION 11. That for employees currently receiving a monthly allowance of four hundred dollars ($400.00) per person in-lieu of a take-home government vehicle shall continue to receive same for as long as such employee holds his or her current position. Additional employees may receive this allowance only with approval of the Mayor and passage of an ordinance by the City Council.

SECTION 12. That employees called to active duty and deployed outside the continental United States ("OCONUS") to a combat zone or a qualified hazardous duty area, as those terms are defined by federal law, shall be paid the difference that their City pay exceeds their total military base pay, up to $850.00 per month, from the time called to active duty until relieved from active duty status or until June 30, 2011, whichever occurs first. Payments beyond the current fiscal year shall be subject to future appropriations by City Council. The City Finance Officer be and is authorized to appropriate the necessary money from other available funds. The difference in pay shall be calculated without regard to any payment of combat pay.

Further, with the concurrence of the General Pension Fund and the Fire and Police Pension Fund, or any union fund participation agreement, the City shall pay such contributions necessary, both the employee's and the employer's share, based on their pension-eligible salary at the time of call-up (not counting over-time pay) to ensure the continued enrollment and pension-eligibility of employees while called-up for deployment OCONUS for the same period as referenced above. In this manner, the affected employees shall not be penalized nor incur financial hardship as relates to their pension eligibility.

If the City's medical insurance provider will extend medical coverage to families affected by the call-up of reservists for deployment OCONUS beyond the customary six (6) month period, the City shall pay the employers share of the premium for any employee called-up to active duty. The employee's share of the coverage shall remain the responsibility of the employee and may be paid in the most convenient method by the employee. During the time of

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active duty, the employee may request the City to make such payments on his/her behalf and reconcile the amounts paid upon his/her return to City employment.

SECTION 13. That Chattanooga City Code, Part II, Chapter 2, Section 2-167(b), be and is hereby amended by deleting same in its entirety and substituting in lieu thereof the following:

> (b) Unless his/her military organization requires a specified time for the training period, the employee shall arrange with his/her department head for a mutually suitable time period. Employees shall be granted twenty (20) days of paid leave for each calendar year for active-duty training.

SECTION 14. Copying Fees. Whenever a request is made by a member of the public for copies of City records, the following fees are hereby levied and shall be paid by the requesting party in order to defray the City's costs:

(1) A fee of fifteen cents ($0.15) per page per each standard 8 ½ by 11 or 8 ½ x 14 black and white copy produced.

(2) A fee of fifty cents ($0.50) per page per each 8 ½ x 11 or 8 ½ x 14 color copy produced.

(3) If the time reasonably necessary to produce the requested records, including time spent locating, retrieving, reviewing, redacting, and reproducing the records, exceeds more than one (1) hour, the City is permitted to charge the hourly wage of the employee(s) producing such requested records. The hourly wage is based upon the base salary of the employee(s) and does not include benefits. If an employee is not paid on an hourly basis, the hourly wage shall be determined by dividing the employee's annual salary by the required hours to be worked per year.

(4) Any records request not subject to the provisions of the Tennessee Open Records Act may be provided at the discretion of the department head at a reasonable rate considering the employees' time and expenses to provide the records.

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SECTION 15. That, pursuant to the Charter, it shall be unlawful for any department, agency, or branch of the Government to expend any money other than the purpose for which it was appropriated, nor shall the expenditures for a purpose exceed the appropriation for said purpose.

SECTION 16. If at any time the actual receipt of revenues is projected to be less than the estimated revenues, it shall be the duty of the Mayor to forthwith initiate an ordinance amending this budget ordinance so as to appropriately reduce or otherwise change the various appropriations made herein which, in the judgment of the City Council, should be made.

SECTION 17. That the City Finance Officer be and is hereby authorized to transfer credits from one account to another account within or between the accounts of the various agencies and divisions of government and the various departments of the City as may be necessary to meet expenditures for the fiscal year 2010-2011, but this authorization shall not apply to Special Funds.

SECTION 18. In addition to FY11 appropriations for current year expenditures, funds shall be appropriated to meet obligations carried forward from prior year open purchase order balances in each fund. Such appropriation shall be from the fund balance of each respective fund.

SECTION 19. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36(a), be and the same is hereby deleted and the following substituted in lieu thereof:

> (a) Enumeration of charges; quantity of water used. Sewer service charges shall be based upon the quantity of water used as shown by water meter readings and shall be the dollar amount derived by applying the total charge in dollars per one thousand (1,000) gallons for the quantities of water shown in the following table:

Fiscal Year 2010/2011 - 1 10/1/2010 Total	Fiscal Year 2010/2011 - 2 4/1/2011 Total

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User Class (gallons)		Charges ($/1,000 gallons)	Charges ($/1,000 gallons)
First	100,000	$ 5.43	$ 5.58
Next	650,000	4.03	4.14
Next	1,250,000	3.27	3.68
Next	30,000,000	2.75	2.83
Over	32,000,000	2.68	2.75

In addition, the total charges derived from the above chart for residential users will be multiplied by ninety (90) percent to compensate for water use not going to the sewer such as lawn and garden watering. Any residential location where a separate water meter has been installed for the purpose of lawn and garden watering shall not be entitled to have the multiplier applied to any water consumed through the primary water meter. Each residence or apartment unit shall have a maximum monthly sewer service charge for a volume of no more than 12,000 gallons water used; unless the minimum charge due to water meter size exceeds the 12,000 gallon limit, then the monthly sewer service charge shall be at least the minimum for that particular size water meter.

SECTION 20. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36(c) as relates to sewer service charges and fees be and the same is hereby deleted and the following substituted in lieu thereof:

(c) Billable flow. The amount due from the regional user shall be the dollar amount derived by applying the total charge shown in the table below per one thousand (1,000) gallons of water sold.

	Regional Operation & Maintenance Charge ($/1,000 gallons)	Regional Debt Charge ($/1,000 gallons)	Total Regional Charge (Wheelage and Treatment) ($/1,000 gallons)
Wheelage and Treatment	$ 1.6768	$ 0.5248	$ 2.2016

If regional customers are billed directly through the water company, the rate to be charged shall be two dollars and twenty one cents ($2.21) per one thousand (1,000) gallons.

SECTION 21. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-36 (d), be and the same hereby deleted and the following substituted in lieu thereof:

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(d) Total flow. The amount due from the regional user shall be the dollar amount derived by applying the total charge shown in the table below applied to the quantity of water measured by a flow meter installed and maintained at or near the point of connection between the system of the regional user and the Chattanooga system. In the event of any malfunction of said meters, flow shall be estimated, interpolated and/or projected in the most equitable manner possible. Such estimates, along with available readings for periods where there was no malfunction, shall be the basis for billing.

	Regional Operation & Maintenance Charge ($/1,000 gallons)	Regional Debt Charge ($/1,000 gallons)	Total Regional Charge (Wheelage and Treatment) ($/1,000 gallons)
Wheelage and Treatment	$ 0.8584	$ 0.2577	$ 1.1161

SECTION 22. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-37, be and the same is hereby deleted and the following substituted in lieu thereof:

Minimum sewer service charges based upon water meter connection size shall be as follows:

Monthly Minimum Sewer Service Charges

Meter Size (inches)	Fiscal Year 2010/2011-1 Charge per Month	Fiscal Year 2010/2011 - 2 Charge per Month
5/8	$ 11.20	$ 11.50
3/4	39.96	41.03
1	69.83	71.70
1-1/2	156.28	160.46
2	276.71	284.12
3	648.63	666.00
4	1,198.67	1,230.78
6	2,855.04	2,931.51
8	5,050.05	5,185.32

The minimum sewer service change for residential users with various meter size shall be multiplied by ninety (90) percent to compensate for water use not going to the sewer such as lawn and garden watering. Any residential location where a separate water

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meter has been installed for the purpose of lawn and garden watering shall not be entitled to have the multiplier applied to any water consumed through the primary water meter.

SECTION 23. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-41(c), be and the same is hereby deleted and the following substituted in lieu thereof:

(c) Rates. Based upon the current cost of treating wastewater containing constituents with concentrations in excess of "normal wastewater," numerical rates are hereby established for Bc and Sc as follows:

Bc = $0.102 per pound of BOD for concentrations in excess of three hundred (300) milligrams per liter.

Sc = $0.0695 per pound of total suspended solids for concentrations in excess of four hundred (400) milligrams per liter.

SECTION 24. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-43 (b), (f) and (g) be and the same are hereby deleted and the following substituted in lieu thereof:

(b) *Fees for garbage grinders.* Any user of a garbage grinder, except users in a premise used exclusively for an individual residence, shall be charged at a rate of one hundred sixty nine dollars ($169.00) per month. The superintendent shall bill users on a bi-monthly basis and the bills shall be due and payable within fifteen (15) days following the last day of the billing period.

(f) *Fees for septic tank discharge.* All persons discharging concentrated, domestic septic tank sewage waste from a truck under the provisions of Article III of this Chapter shall be charged at the rate of sixty three dollars ($63.00) per one thousand (1,000) gallons of such waste. The minimum charge for septic tank discharges shall be one half (1/2) of the rate for one thousand (1,000) gallons of the rate in effect at the time of such discharge. All persons discharging grease trap or grease interceptor waste or loads where septic tank waste has been mixed or blended with grease trap or grease interceptor waste shall be charged at the rate two and one half (2 1/2) times the rate for septic tank wastes.

Fees holding tank wastes. All persons discharging any holding tank waste authorized pursuant to division 6 of this article shall be charged at the rate of five dollars and fifty-eight cents ($5.58) per one thousand (1,000) gallons of such discharge, plus any surcharge rate authorized by Article III of this chapter for

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concentrations of pollutants in excess of normal waste water without regard to the definition of the industrial user or other limitations set forth in such section. The superintendent may also require a chemical analysis of such waste and charge therefore.

SECTION 25. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-39 (a),(b), be and the same hereby deleted and the following substituted in lieu thereof:

(a) *Generally*. The owners or occupants of property obtaining water from a source or sources other than through a meter of the city water company which is discharged into the city's sewers shall install, without cost to the city, a meter to measure the quantity of water received from such source, and shall pay the same rates as provided in sections 31-36 and 31-37 of this Code. No meter shall be installed or used for such purpose without the approval of the Director of Waste Resources or his designee. If the owner of such property fails to install an approved meter or meters, the Director of Waste Resources his designee or shall make an estimate of the quantity of such water used by such property owner and discharged into the city's sewers from the property, and the owner or occupant of the property shall be liable to the city for the sewer service charges due, which may be collected by suit in any court of competent jurisdiction.

(b) *Multi-unit complexes*. To provide more equality between single-family and multi-unit dwellings (with just one (1) or less number of water meters than the total number dwelling units in complex), sewer service charges to multi-unit apartment complexes served by master meters or any combination of meters totaling less than the number of units served shall be charged as follows:
(1) By multiplying the total water consumption by the residential rate for either an account with a separate lawn and garden meter or an account without a separate meter for lawn and garden meter.
(2) The total sewer service charge shall not exceed the per unit usage of 12,000 (twelve thousand) gallons per unit per month multiplied by the appropriate residential rate unless the meter size volumetric allowance is larger then this allowance shall be multiplied by the appropriate residential rate.
(3) The minimum sewer service charge for different meter sizes shall be calculated by multiplying the particular meter size volumetric allowance by the applicable residential rate.

SECTION 26. That Chattanooga City Code, Part II, Chapter 31, Article II, Section 31-40 (b) (3), (4) be and the same hereby deleted and the following substituted in lieu thereof:

(3) Where secondary meters are installed for lawn or garden watering, sprinkling systems, and other processes where water is used but not returned to the sewer;

SECTION 27. That this Ordinance shall be operative, as distinguished from its effective date, on and after July 1, 2010.

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SECTION 28. Notwithstanding any other provision of this Ordinance to the contrary, water providers within the City of Chattanooga shall bill according to the new Chattanooga sewer service charges effective on the following dates:

> For the Fiscal Year 2010/2011 -1 for service rendered beginning on the 1st day of October 2010 and ;
> For the Fiscal Year 2010/2011 -2 for service rendered beginning on the 1st day of April 2011 and until further notice

SECTION 29. That this Ordinance shall be operative, as distinguished from its effective date, on and after July 1, 2010.

SECTION 30. That if any section, sentence, word or figures contained in this Ordinance should be declared invalid by a final decree of a Court of competent jurisdiction, such holding shall not affect the remaining sentences, sections, words or figures contained in this Ordinance, but the same shall remain in full force and effect.

SECTION 31. That this Ordinance shall take effect two (2) weeks from and after its passage.

PASSED on Second and Final Reading

July 6, 2010.

/s/ CHAIRPERSON

APPROVED: x DISAPPROVED: ______

DATE: 7/7, 2010

/s/ MAYOR

VLM/DWM/add

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INCLUSIVE PAY PLAN: GENERAL, FIRE, POLICE

RANGE	MINIMUM	MIDPOINT	MAXIMUM	RANGE
P9	73,246	87,757	102,268	P9
P8	56,135	67,227	78,317	P8
P7	49,913	59,764	69,615	P7
P6	43,692	52,296	60,906	P6
P5	46,483	47,364	55,000	P5
P4	42,961	43,843	44,725	P4
P3	39,436	40,318	41,199	P3
P2	35,913	36,794	37,674	P2
P1	34,118	34,118	34,118	P1
F7C	68,579	85,552	102,532	F7C
F6C	65,350	81,479	97,607	F6C
F5A	60,756	75,751	90,746	F5A
F4C	49,132	61,229	73,325	F4C
F3C	46,358	57,007	67,656	F3C
F3A	43,358	54,007	64,656	F3A
F2C	39,004	47,000	53,405	F2C
F2A	36,004	44,000	50,405	F2A
F1C	35,077	42,313	50,049	F1C
F1A	32,077	39,313	47,049	F1A
F0C	31,577	31,577	31,577	F0C
35	95,283	120,612	147,749	35
34	90,746	114,868	140,714	34
33	86,425	109,398	134,013	33
32	82,309	104,189	127,631	32
31	78,390	99,227	121,554	31
30	74,657	94,502	115,765	30
29	71,102	90,002	110,253	29
28	67,716	85,716	105,003	28
27	64,491	81,635	100,002	27
26	61,420	77,747	95,240	26
25	58,496	74,045	90,705	25
24	55,710	70,519	86,386	24
23	53,057	67,161	82,272	23
22	50,531	63,963	78,355	22
21	48,124	60,917	74,623	21
20	45,833	58,016	71,070	20
19	43,650	55,254	67,686	19
18	41,572	52,622	64,462	18
17	39,592	50,117	61,393	17
16	37,707	47,730	58,469	16

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15	35,911	45,457	55,685	15
14	34,201	43,293	53,033	14
13	32,573	41,231	50,508	13
12	31,021	39,268	48,103	12
11	29,544	37,398	45,812	11
10	28,137	35,617	43,631	10
9	26,798	33,921	41,553	9
8	25,521	32,306	39,574	8
7	24,306	30,767	37,690	7
6	23,149	29,302	35,895	6
5	22,046	27,907	34,186	5
4	20,997	26,578	32,558	4
3	19,996	25,312	31,008	3
2	19,044	24,107	29,531	2

1ST READING 9-29-09
2ND READING 10-6-09
INDEX NO. ______

ORDINANCE NO. 12294

AN ORDINANCE TO AMEND CHATTANOOGA CITY CODE, PART II, CHAPTER 31, ARTICLE VIII, SECTIONS 31-302, 31-352, 31-354, 31-356, AND 31-357, TO ADD DEFINITIONS, REVISE THE WATER QUALITY FEE (FORMERLY KNOWN AS STORM WATER USER'S FEE) RATE STRUCTURE, AND PROVIDE A SCHEDULE OF CHARGES FOR THE FUNDING OF THE OPERATION, MAINTENANCE, AND IMPROVEMENT OF THE STORM WATER SYSTEM WITHIN THE CITY LIMITS.

WHEREAS, the 1972 U.S. Federal Water Pollution Control Act, amended by the Water Quality Act of 1987 and the Tennessee Department of Environment and Conservation, regulates the City's operation of its storm water system, by which the City is required to obtain an NPDES Phase I permit for this system and will be required to implement programs to improve the quality of storm water; and

WHEREAS, the City currently owns and operates a storm water system for the collection and disposal of storm and other surface waters and for flood control; and,

WHEREAS, T.C.A. § 68-221-1107 authorizes municipalities to establish a graduated storm water user's fee; and,

WHEREAS, the City is conducting a water quality utility program level of service analysis, cost of service analysis, rate study analysis and cash flow analysis, identifying and analyzing water quality and water quantity problems and needs, and financing and management options, which is hereby incorporated by reference; and,

WHEREAS, the City Council finds that the repair, replacement, improvement and regulation of the storm water system is necessary to prevent further deterioration of the existing system, prevent or reduce water pollution and to prevent or reduce drainage and flood; and

WHEREAS, it is the intent of the City that the costs of the operation, maintenance, and improvements of the storm water system be borne by the users of the system in relation to their individual contributions of water quality to the system; and

WHEREAS, the "water quality fee" (formerly referred to as the "storm water user's fee") should be fair, equitable, revenue sufficient, and reflect the relative contribution of surface water runoff from a property, benefits enjoyed, and services received by each property as a result of the collection of surface water, and should consider the impervious area of the various properties within the City, because the extent of surface water runoff from a particular lot or parcel is largely a function of its impervious area;

WHEREAS, the City is responsible for the protection and preservation of the public health, safety, and welfare of the community, and the environment and finds that it is in the best interest of the health, safety, and welfare of the citizens of the city and the community at large and the environment to proceed with the revision of a water quality utility program; and,

WHEREAS, it is necessary and desirable and in the best interests of the City, its citizens, and the users of the City storm water system to revise the mechanism for the financing of storm water and water quality facilities, systems, and services provided by the City through the water quality fee, which shall be imposed and collected as provided in this ordinance; and,

NOW, THEREFORE,

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHATTANOOGA, TENNESSEE:

SECTION 1. That Chattanooga City Code, Part II, Chapter 31, Article VIII, be and is hereby amended by deleting the terms "storm water user's fee," "storm water fee," "storm water fees," "storm water charge," and "storm water charges" throughout the article and replacing same with the term "water quality fee."

SECTION 2. That Chattanooga City Code, Part II, Chapter 31, Article VIII, Section 31-302, be and is hereby amended by adding the following definitions in alphabetical order:

"Abatement" means any action taken to remedy, correct, or eliminate a condition within, associated with, or impacting a drainage system.

"Adjustment" means a modification in a non-residential customer's water quality service fee for certain activities that impact water quality runoff or impacts the City's costs of providing water quality management.

"Apartment Property" is defined as a lot or parcel of real estate on which is situated a building containing 3 or greater single-family dwelling units.

"Approved plans" shall mean plans approved according to a permits and plan review which will govern all improvements made within the City that require storm water/water quality facilities or changes or alterations to existing storm water/water quality facilities.

"Code" means the Chattanooga Municipal Code.

"Condominium Property" is defined as a lot or a parcel of real estate in which individuals own their units and share joint ownership in common elements with other unit owners. Water Quality fees are assessed according to the following:

- Condominium dwelling units with separate/individual parcels are treated as "Residential" properties;
- Condominium dwelling units without separate/individual parcels, which are part of another parcel or share the same parcel with other units, are treated as "Non-Residential" properties.

"Detention" is described as the temporary storage of storm water runoff in a basin, pond, or other structure to control the peak discharge rate by holding the storm water for a lengthened period of time.

"Detention facility" means an area designed to store excess storm water.

"Equivalent Residential Unit (ERU)" is a value, equal to 3,200 square feet of measured impervious area and is equal to the average amount of impervious area of residential properties within the City of Chattanooga.

"Facilities" means various storm water and drainage works that may include inlets, pipes, pumping stations, conduits, manholes, energy dissipation structures, channels, outlets, retention/detention basins, and other structural components.

"Infiltration" is defined as a complex process of allowing runoff to penetrate the ground surface and flow through the upper soil surface.

"Mobile Home Property" is defined as a lot or a parcel of real estate in which individuals own their units and share joint ownership in common elements with other unit owners. Water Quality fees are assessed according to the following:

- Mobile Home dwelling units with separate/individual parcels are treated as "Residential" properties;
- Mobile Home dwelling units without separate/individual parcels, which are part of another parcel or share the same parcel with other units, are treated as "Non-Residential" properties.

"Non-residential properties" means all properties not encompassed by the definition of "Residential Property." Non-residential properties include:

- apartment properties;
- condominium dwelling units without separate/individual parcels;
- mobile home parks with rented spaces (parcel not owned);
- commercial property;
- industrial property;
- institutional property;
- governmental property;
- churches;
- schools;
- federal, state, and local properties; and
- any other property not mentioned in this or the list of residential properties below.

"Residential Property" means all single-family, condominium dwelling units with separate/individual parcels, mobile home units with separate/individual parcels and separate City tax billing accounts, two-family duplex properties and all agricultural parcels within the City of Chattanooga.

"Retention" is defined as the holding of storm water runoff in a constructed basin or pond or in a natural body of water without release except by means of evaporation, infiltration, or emergency bypass.

"Retention facility" means a facility, which provides storage of storm water runoff and is, designed to eliminate subsequent surface discharges.

"Square footage of impervious area" means, for the purpose of assigning an appropriate number of ERUs to a parcel of real property, the square footage of all impervious area using the outside boundary dimensions of the impervious area to include the total enclosed square footage, without regard for topographic features of the enclosed surface.

"Storm sewer" means a sewer, piping or natural structure, which carries storm water, surface runoff, street wash waters, and drainage, but which excludes sanitary sewage and industrial wastes, other than unpolluted cooling water.

"Storm water system" means all man-made facilities, structures, and natural watercourses owned by the City of Chattanooga, used for collecting and conveying storm water to, through, and from drainage areas to the points of final outlet including, but not limited to, any and all of the following: conduits and appurtenant features, canals, creeks, catch basins, ditches, streams, gulches, gullies, flumes, culverts, siphons, streets, curbs, gutters, dams, floodwalls, levees, and pumping stations.

"Water quality fee" is defined as a fee assessed to users and contributors of flow to the City's storm water collection, impounding and transportation system.

SECTION 3. That Chattanooga City Code, Part II, Chapter 31, Article VIII, Division 7, Sections 31-352, 31-354, 31-356, and 31-357, be and are hereby amended by deleting same in their entirety and substituting in lieu thereof the following:

Sec. 31-352. Rate Structure.

(a) A water quality fee shall be assessed to the owner of each and every lot and parcel of land within the corporate City limits which directly or indirectly uses the storm water system of the City and that contains impervious area. This fee is not related to the drinking water and/or sewer service and does not rely on occupancy of the premises to be in effect and is hereinbefore provided, and in the amount determinable as follows:

(b) For any such property, lot, parcel of land, building or premises that directly or indirectly uses the storm water system of the City, such fee shall be based upon the size of impervious area situated thereon.

(c) All properties having impervious area within the City of Chattanooga will be assigned an Equivalent Residential Unit (ERU) or a multiple thereof, with all properties of having impervious area receiving at least one (1) ERU.

(d) **Residential properties.** All residential properties will be assigned one (1) ERU. A flat rate fee will apply to all residential properties.

(e) **Non-residential properties.** Non-residential properties will be assigned an ERU multiple based upon the properties' individually measured impervious area (in square feet) divided by 3,200 square feet (1 ERU). This division will be calculated to the first decimal place and rounded according to mathematical convention.

Sec. 31-354. Schedule of Fees.

The annual water quality fee shall be $115.20 per ERU as of the adoption of this ordinance.

Sec. 31-356. Adjustments to Water Quality Fee

Increase adjustments (debit) can be made to non-residential service charges by property owners adding additional impervious area such as rooftops, parking lots, driveways and walkways. Decrease (credit) adjustments can be made to non-residential service charges by property owners performing activities that reduce the impact of storm water runoff to the water quality system.

Upon application by any user adequately supported by documentation, the user shall be entitled to an adjustment of their water quality fee as provided in this section. The water quality credits (applied in 5% increments) are offered to property owners that perform an activity or activities that reduce the burden on the City storm water system and provide water quality benefit.

(a) Permanent Basins Credits. The water quality fee shall be reduced up to 10% for the proper maintenance of storm water facilities that retain and control the quantity of storm water runoff. An additional 20% credit is available for permanent basins exceeding minimum design standards for water quantity control.

(b) Water Quality Devices Credits.

(i) Floatable Skimmers. The water quality fee shall be reduced up to 10% for the proper maintenance of floatable skimmers that are used to retain oil and floatable materials from entering the City storm water system.

(ii) Proprietary Devices Credits. The water quality fee shall be reduced up to 10% for the proper maintenance of water quality propriety devices. An additional 20% credit is available for the installation of propriety devices exceeding minimum standards for water quality control.

(c) Low Impact Developments (LIDs) or Open Space Developments Credits. The water quality fee shall be reduced up to 50% for the installation and proper maintenance of green storm water control structures such as green roofs, bio-retention areas (rain gardens), bio-swales, filter strips, wetlands, porous pavement, level spreader, conservation easement, and proper steep slope management or other proven LIDs.

(d) LEED® certified developments. The water quality fee shall be reduced up to 50% for developments that earn at least 5 credits from the "Sustainable Sites" category including Credit-6.1 (Storm Water Design Quantity Control) and Credit-6.2 (Storm Water Design Quality Control).

(e) Education credits. The water quality fee shall be reduced up to 25% for public and private schools (K through 12) for the purpose of providing water quality and watershed management education programs to students. To obtain this credit public and private schools would teach a water curriculum in each grade level.

(f) The reductions authorized under sections a, b, c, d, and e above shall be cumulative, provided, however, that the total reduction in water quality fee shall not exceed 50%.

(g) The user shall make application to the Manager of the Storm Water Management Section requesting reductions in the water quality fee pursuant to this section. Each application shall be accompanied by proper documentation to demonstrate the accuracy of the claims. To the extent that the Manager is satisfied that the reductions applied for are warranted by the circumstances, he or she shall reduce the bill as provided herein. If the fee shall have been paid, a refund or credit on future billing shall be authorized to the extent warranted by the reductions.

(h) The Manager shall act upon any application for a reduction in fees within ninety (90) days of the receipt thereof. In the event he shall not have acted upon same within this time, then the application shall be deemed to have been denied.

(i) The user may appeal the denial by the Manager of any claimed Water Quality Fee reduction to the Storm Water Regulations Board by filing a written notice of appeal in care of the Administrator of Public Works within thirty (30) days following the action of the Manager. No particular form for a notice of appeal shall be required and any written notice setting forth with reasonable particularity the grounds for the appeal shall be acceptable, but the Manager shall develop and maintain a form for such purposes. A copy of the notice of appeal shall be filed with the Manager. Unless the Storm Water Regulations Board shall consent to an enlargement of the administrative record, the appeal shall be decided upon the plans and data submitted by the applicant in support of the claimed reduction and any information relating thereto generated by the Administrator in review of the application. The board shall schedule a meeting to consider the appeal and both the applicant and the Manager shall be allowed to make a written and oral argument before the board in support of their respective positions.

Sec. 31-357. Water Quality Only Accounts.

Water Quality accounts are parcels that may not have other services (drinking water and/or sanitary sewer) but do contain impervious area or hard surface so a water quality charge would apply. New and additional water quality accounts will be determined by the Water Quality Manager or his designee of the Department of Public Works office.

Sec. 31-358. Elderly low-income or disabled homeowner exemption from fees.

Those persons who have qualified as an elderly low-income homeowner pursuant to T.C.A. § 67-5-702 or who have qualified as a disabled homeowner pursuant to T.C.A. § 67-5-704 shall be exempt from payment of fees on that property which they use as their residence.

Secs. 31-359 – Reserved.

SECTION 4. BE IT FURTHER ORDAINED, That this Ordinance shall take effect immediately upon passage.

PASSED on Second and Final Reading

October 6, 2009.

W. Carl Benn[illegible]
CHAIRPERSON

APPROVED: x DISAPPROVED: ______

~~DATE: ______, 2009~~

MAYOR

VLM/add/mms/ccw/add

1ST READING 2-2-10
2ND READING 2-9-10
INDEX NO. ________

ORDINANCE NO. 12347

AN ORDINANCE TO AMEND CHATTANOOGA CITY CODE, PART II, CHAPTER 31, SECTION 31-355(a), TO EXTEND THE TIME IN WHICH TO FILE A NOTICE OF PROTEST CONCERNING THE ACCURACY OF WATER QUALITY FEES IMPOSED IN 2009 ONLY FROM MARCH 1, 2010 TO JUNE 1, 2010.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHATTANOOGA, TENNESSEE:

SECTION 1. That Chattanooga City Code, Part II, Chapter 31, Section 31-355(a), be and the same is hereby amended by deleting the date of "March 1, 2010" wherever it appears and substituting in lieu thereof the date of "June 1, 2010."

SECTION 2. BE IT FURTHER ORDAINED, That this Ordinance shall become effective immediately from and after its passage.

PASSED on Second and Final Reading

February 9, 2010.

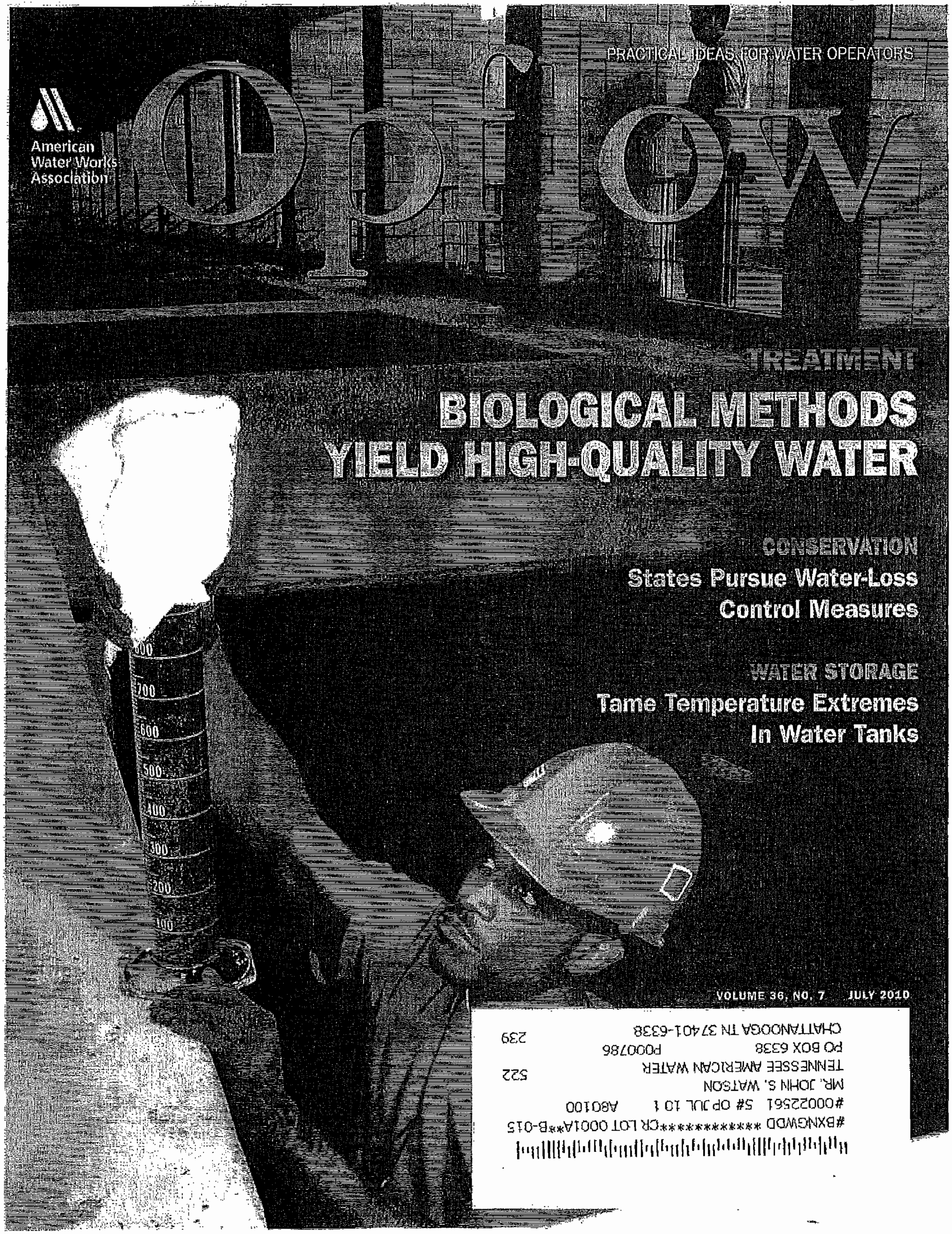
CHAIRPERSON

APPROVED: X DISAPPROVED: ______

DATE: ________________, 2010

MAYOR

VLM/add


PRACTICAL IDEAS FOR WATER OPERATORS
Opflow
American Water Works Association
TREATMENT
BIOLOGICAL METHODS YIELD HIGH-QUALITY WATER
CONSERVATION
States Pursue Water-Loss Control Measures
WATER STORAGE
Tame Temperature Extremes In Water Tanks
VOLUME 36, NO. 7 JULY 2010
#BXNGWDD ************CR LOT 0001A**B-015
#00022561 5# OP JUL 10 1 A80100
MR. JOHN S. WATSON
TENNESSEE AMERICAN WATER 522
PO BOX 6338 P000786
CHATTANOOGA TN 37401-6338 239

Conservation

Water Audits

Coming to a Neighborhood Near You?

Water efficiency is taking on greater importance in areas stressed by limited water resources, as well as areas historically perceived as water rich. Several states are proactively pursuing effective water-loss control measures to enhance operations. BY THE AWWA WATER LOSS CONTROL COMMITTEE

AWWA's WATER LOSS Control Committee (WLCC) is actively updating tools to help water utilities compile annual water audits and to control water and revenue losses. WLCC advocates using the best practice water audit methodology published in 2000 by the International Water Association (IWA) with assistance from AWWA. The water balance of this methodology is shown in the figure on page 19, with definitions of the terms. With development of version 4.0 of the AWWA Free Water Audit Software© and publication of the third edition AWWA Manual of Water Supply Practices M36: *Water Audits and Loss Control Programs* in 2009, water utilities have effective tools to improve their accountability and efficiency.

PROACTIVE AGENCIES

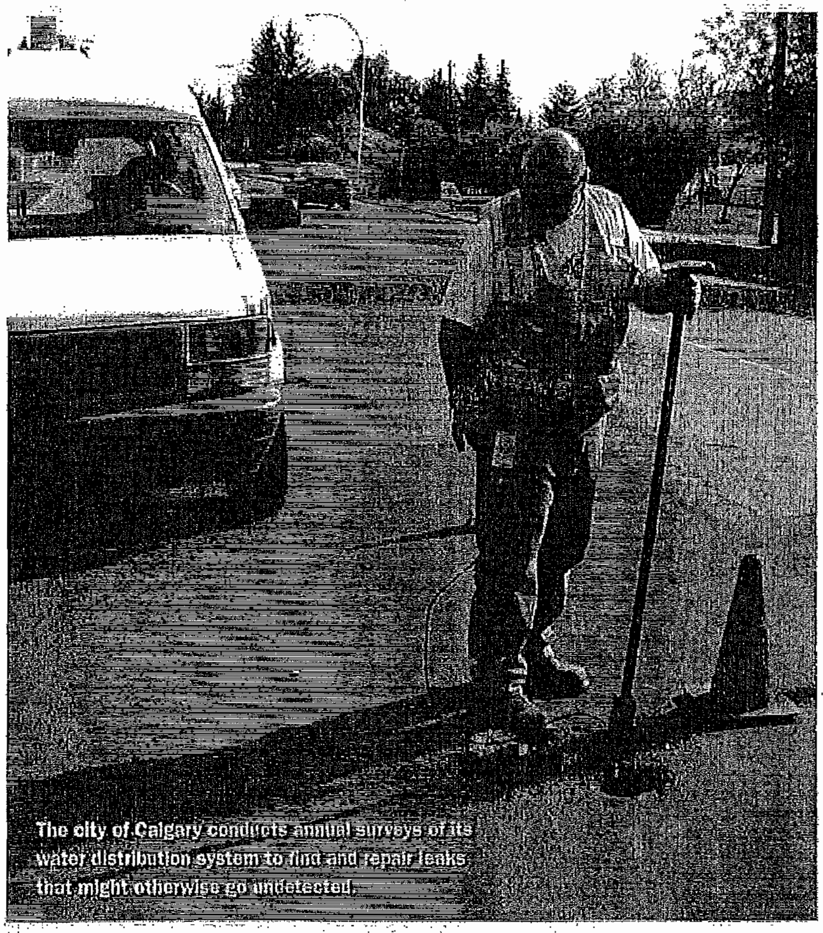
WLCC has worked with many water oversight agencies interested in establishing consistent national auditing practices. The following highlights some of the agencies that have either created new regulations or are closely evaluating the IWA/AWWA water audit method.

Texas. Texas became the first state to pass legislation requiring water utilities to submit water audits. Texas utilities must submit their audits to the Texas Water Development Board every five years. More than 2,100 completed water audits were submitted to the board for calendar year 2005. Data from these water audits were assessed and the findings compiled in An Analysis of Water Loss as Reported by Public Water Suppliers in Texas (2007), which is available for free download at www.twdb.state.tx.us/RWPG/rpgm_rpts/0600010612_WaterLossinTexas.pdf. Although the 2005 data were determined to be of low validation, a second round of data collection in 2011 should be more accurate.

The Texas Water Development Board is conducting workshops and individual consultations to improve knowledge about the water audit process. The board also provides free leak-detection equipment and ultrasonic flowmeters to participating Texas utilities to help them assess their water losses. The board also maintains its water audit guidelines in a manual that includes the capability to assess utilities' data validity. The 2008 manual can be downloaded at www.twdb.state.tx.us/assistance/conservation/Municipal/Water_Audit/Leak_Detection/WaterLossManual_2008.pdf.

Pennsylvania. The Pennsylvania Public Utility Commission (PUC)/Delaware River Basin Commission (DRBC) enacted requirements for water utilities to submit annual water audits—initially voluntarily, but moving to a mandatory basis. Both agencies use the AWWA Free Water Audit Software to collect and assess data in a standardized way. In 2009, PUC launched a two-year audit pilot program with five participating water companies: Aqua PA, Pennsylvania American Water, United Utilities, York Water, and Superior Water, some of which operate multiple systems. The initial data collection represented 17 systems, ranging in size from 63 to 237,000 service connections.

In March 2010, a workshop was held in Harrisburg, Pa., to review the initial data. WLCC members George Kunkel, Philadelphia Water Department, and David Sayers, DRBC, helped facilitate the workshop, and the group assessed the data by comparing the utilities and



PHOTOGRAPH: CITY OF CALGARY

The AWWA Water Loss Control Committee works to increase awareness of the nature and extent of water loss and improve water supplier accountability.

highlighting validation issues. PUC will continue the pilot by compiling water audit data for these companies for 2010 and, at the end of the pilot phase, consider the best way to pursue permanent water auditing.

DRBC revised its Water Code in 2009 to require utilities to use the AWWA Free Water Audit Software. Audit submittal is currently voluntary, but audit submittal becomes mandatory in 2012. DRBC is beginning to conduct outreach for water utilities in the Delaware River Basin, which includes Delaware, New Jersey, New York, and Pennsylvania. Eventually, data will be gathered for more than 600 water utilities, including several large and many small systems. Outreach and training programs are being designed, particularly with small systems in mind.

New Mexico. The New Mexico Office of the State Engineer (OSE) has been progressive in water auditing and loss reduction, using an individualized method for water audit data collection and assessment. Initial funding for water audits was provided to specific utilities in 2006 for consultants to compile more detailed and well-validated audits than those compiled by voluntary programs. Funding was extended in 2009, with a grant to provide leak-detection equipment to three utilities identified during the first round of water audits as having leakage problems. Followup audits and leak-detection training was provided in 2009 and 2010.

This program will be expanded to include the New Mexico Rural Water Association. Leak-detection equipment will be loaned in exchange for the association providing OSE with water audit data following IWA/AWWA guidelines. With limited water resources and a growing population, New Mexico is setting the pace in the southwestern United States for efficiently managing water resources. For more information, visit www.ose.state.nm.us/wucp_accounting.html.

Virginia. The Washington County Service Authority (WCSA) supplies water to 20,500 service connections in Southwestern Virginia. In addition to embracing water auditing and loss-control programs at its utility, WCSA is promoting the programs throughout the state. Since the late 1990s, WCSA has taken water loss control seriously from a financial and public health perspective and has reduced its nonrevenue water by nearly 1 mgd and increased its revenue by nearly $1 million/year while eliminating potential sources of contamination.

WCSA General Manager Robbie Cornett has shared WCSA's tools with the Virginia Department of Health, the state's drinking water regulatory agency. Cornett also addressed the annual meeting of the Virginia Water and Waste Authorities Association in April 2010 on water loss and water auditing. That association's members are water and wastewater utilities from throughout the commonwealth. The Virginia Department of Health accepts the AWWA-advocated methods and is contemplating conducting training workshops for utilities to promote the same as it continues to evaluate new approaches advocated by AWWA.

Georgia. On May 3, 2010, Georgia enacted the landmark Georgia Water Stewardship Act of 2010, a significant piece of legislation in a state caught in the crosshairs of controversial water debate in recent years. The act includes several provisions regarding water-loss control, requiring that Georgia regulatory agencies "identify and provide for rules, regulations, incentives, or opportunities that will encourage water systems to develop and improve water loss abatement programs, and to implement the industry's best management practices for controlling water loss to achieve the recommended standards" by Aug. 1, 2010. Measures for monitoring and improving the efficiency and effectiveness of water use, to be adopted by the Board of Natural Resources by Jan. 1, 2011, and applicable to public water systems serving at least 3,300 persons, include

- Establishing an infrastructure leakage index.
- Establishing categories of public water systems based on geographical size and service population.

Conservation

- Implementing a phased-in approach requiring public water systems to conduct standardized annual water loss audits according to the IWA water audit method/standard and to submit those audits to the Environmental Protection Division of the Department of Natural Resources.
- Initiating a phased-in approach requiring public water systems to implement water-loss detection programs.
- Developing a technical assistance program to provide guidance to public water systems for water-loss detection programs, including without limitation metering techniques, use of portable and permanent water-loss detection devices, and funding when available.

By Jan. 1, 2012, public water systems serving at least 10,000 individuals will have conducted a water-loss audit pursuant to minimum standards and best practices adopted by the Board of Natural Resources. By Jan. 1, 2013, all other public water systems will have conducted a water-loss audit pursuant to minimum standards and best practices adopted by the Board of Natural Resources.

Calgary, Alberta, Canada. The city of Calgary recently compiled an IWA/AWWA water audit and is working to implement recommendations stemming from the findings. The city is now investigating pressure management and expansion of active leakage-control efforts and working with the Alberta Urban Municipality Association (AUMA). In addition, the city made a presentation on water loss and water audits at a 2008 AUMA conference. AUMA's Web site states that water conservation is one of AUMA's most significant priorities, with villages and summer villages rating water conservation as their top advocacy priority. The association's Water Conservation Efficiency and Productivity plan was adopted by a resounding majority at the 2009 AUMA annual convention. The plan outlines targets for implementing efficiency and conservation measures and details how these targets will be supported, tracked, and achieved. One of the targets is to compile water audits and calculate the Infrastructure Leakage Index.

AUMA continues to support municipalities through informative webinars. Most recently, Chris Huston, city of Calgary Water Services, gave a presentation on the AWWA Free Water Audit Software. Additional information can be found at http://water.auma.ca/AUMA+CEP+Plan/The+Initiative.

North Carolina. Numerous North Carolina water utilities recently compiled IWA/AWWA water audits and have begun to systematically examine ways to enhance utility revenues. The North Carolina State Water Infrastructure Commission recently established a Water Loss Initiative, and several state funding agencies now require a Water Loss Control Program to be established before grant funds are provided. In addition, several systems have formed the North Carolina Water Loss Control Committee, which meets bimonthly via conference call to share lessons learned and engage in activities similar to those conducted nationally by WLCC. The calls provide a forum for information exchange for systems such as Fayetteville Public Works Commission, the cities of Asheville and Burlington, and others, including some small systems (< 5,000 connections).

The committee has also discussed strategies for reducing apparent loss and real loss. Specific attention has been placed on improving confidence in the data. Although North Carolina systems compiled about 30 water audits between 2008 and 2010, the goal is for these "nodal" systems to continue to promote the value of comprehensive operational and financial practices to reduce nonrevenue water.

Tennessee. Drought raised concerns in Tennessee about water accountability and loss control. Legislation imposed in 2007 requires the following actions.

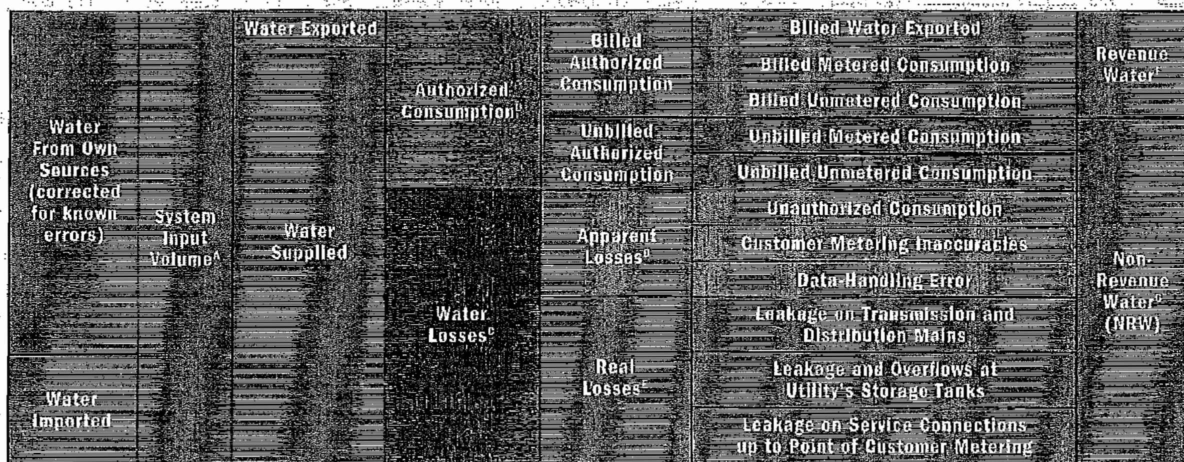
- Public water systems shall include in their annual audit their annual average unaccounted-for water (UFW) loss percentage in the manner prescribed by the comptroller of the treasury.
- The utility management review board and the water and wastewater financing board must define excessive UFW.
- The comptroller will file with the appropriate board the audit report of any water system whose UFW is excessive.
- If a system doesn't take action as required by the board to reduce water loss to an acceptable level, the board may petition a chancery court to require the system to take such action.
- The comptroller shall provide a report to the legislature listing the average annual UFW for utility districts.
- The utility management review board may initiate a contested case hearing on the question of whether a member or members of the board of commissioners of the utility district should be removed from office and a new member or members appointed or elected on the grounds that the utility district failed to comply with an order concerning excessive UFW or failed to take appropriate action to reduce UFW to an acceptable level.

The WLCC recommends against using the term "unaccounted-for water" and UFW percentage as a measure of water-loss standing. With publication of AWWA M36, water utilities and regulatory agencies have a reliable tool to conduct annual water audits and assess water loss through an array of informative performance indicators. WLCC has provided information about the AWWA water audit methodology to Tennessee's utility management review board, and the review board has been asked to consider transitioning from using "UFW" to "nonrevenue water" terminology and performance indicators. WLCC members believe accountability in Tennessee can be better assessed with

As water resource shortages continue to become more prevalent and severe, it's likely that many more agencies will set forth requirements to compile an annual water audit.

IWA/AWWA Water Balance Components and Definitions*

The IWA/AWWA Water Audit Method is effective because it features sound, consistent definitions for the major forms of water consumption and water loss encountered in drinking water utilities.



*All data in volume for the period of reference—typically one year

[A]The annual volume input to the water supply system

[B]The annual volume of metered and/or unmetered water taken by registered customers, the water supplier, and others authorized to do so

[C]The difference between System Input Volume and Authorized Consumption, consisting of Apparent Losses plus Real Losses

[D]Unauthorized Consumption, all types of metering inaccuracies, and systematic data-handling errors

[E]The annual volumes lost through all types of leaks, breaks, and overflows on mains, service reservoirs, and service connections, up to the point of customer metering

[F]Those components of System Input Volume that are billed and produce revenue

[G]The difference between System Input Volume and Billed Authorized Consumption

the IWA/AWWA methodology and that the state has an opportunity to align with other states that are moving toward this standardized method.

California. In 2009, the California Urban Water Conservation Council (CUWCC) adopted perhaps the most ambitious water auditing and loss control effort to date by revising its best management practice provision for water utility operations. Starting in 2010, CUWCC initiated a 10-year program during which water utilities will use the AWWA Free Water Audit Software to compile an annual water audit. The first four years will focus on refining data collection to improve validity. In years four through 10, specific water-loss performance indicators and acceptable ranges will be identified, and utilities will be assigned leakage-management levels. Going beyond auditing requirements and including a loss-reduction component make the CUWCC program the most comprehensive to date. CUWCC provides best practice requirements for about 300 signatory water utilities in the state. For more information, see Best Management Practices 1.2 provisions at www.cuwcc.org/mou/bmp1-utility-operations-programs.aspx.

PLANNING FOR THE FUTURE

In the United States, no national regulations exist to require drinking water utilities to report annual water audit data or contain their losses to economic levels. The progressive agencies profiled here have begun to require that water utilities submit water audit data. As water resource shortages continue to become more prevalent and severe, it's likely that many more agencies will set forth requirements to compile an annual water audit. AWWA will continue to provide guidance on the best management practices of water loss control. For more information, visit AWWA's WaterWiser Web site (www.awwa.org/waterwiser), a comprehensive clearinghouse of resources on water conservation, efficiency, and demand management for conservation professionals and the larger water supply community. You can also access the AWWA M36 publication for purchase or download the AWWA Free Water Audit Software at the WaterWiser Web site.

***Editor's Note:** The following individuals contributed to this article: Andrew Chastain-Howley, Miya Water, Fort Worth, Texas; Steve Cavanaugh, Cavanaugh & Associates, Winston-Salem, N.C.; Robbie Cornett, Washington County Service Authority, Va.; Chris Huston, city of Calgary Water Services, Calgary, Alberta, Canada; George Kunkel, Philadelphia Water Department, Philadelphia; Chris Leauber, Water & Wastewater Authority of Wilson County, Tenn.; and Gary Trachtman, Malcolm Pirnie, Birmingham, Ala.*

Tennessee American Water Company -Year 2006
Daily Water Balance Year to Date (1,000's Gallons)

System Input Volume (corrected for known errors) [illegible]	Authorized Consumption 30,598	Billed Authorized Consumption [illegible]	Billed Metered Consumption (inc. water exported) 30,181	Revenue Water 30,181
			Billed Unmetered Consumption 0	
		Unbilled Authorized Consumption 417	Unbilled Metered Consumption 5	Non-Revenue Water (NRW) 9,100
			Unbilled Unmetered Consumption 412	
	Water Losses 8,683	Apparent Losses 160	Unauthorized Consumption 160	
			Customer Metering Inaccuracies 0	
			Data Handling Errors 0	
		Real Losses 8,522	Leakage and Overflows at Utility's Storage Tanks [illegible]	
			Identified Leakage on Distribution Mains and Services 1,137	
			Unidentified Leakage in Distribution System [illegible]	
			Leakage on Service Connections to Meter 27	

Tennessee American Water Company, Chattanooga 2007

Daily Water Balance Year to Date

(1,000's Gallons)

System Input Volume (corrected for known errors) 40,30[illegible]	Authorized Consumption [illegible]	Billed Authorized Consumption	Billed Metered Consumption (inc. water exported) 31,332	Revenue Water 31,332
			Billed Unmetered Consumption 0	
		Unbilled Authorized Consumption [illegible]	Unbilled Metered Consumption 102	Non-Revenue Water (NRW) 8,971
			Unbilled Unmetered Consumption 479	
	Water Losses 8,390	Apparent Losses [illegible]	Unauthorized Consumption 103	
			Customer Metering Inaccuracies 0	
			Data Handling Errors 0	
		Real Losses 8,285	Leakage and Overflows at Utility's Storage Tanks [illegible]	
			Identified Leakage on Distribution Mains and Services 1,392	
			Unidentified Leakage in Distribution System 6,859	
			Leakage on Private Services Before Meter 0.00	

Daily NRW Volume Per Customer (in gallons)	121.04
NRW Volume in GPM (in gallons)	6,230
NRW Volume Per Mile of Main in GPM (in Gallons)	4.90

Daily Unavoidable Leakage UARL (in thousands of gallons)	2,140.000
Daily Unaccounted For Volume (in thousands of gallons)	6,859.351
Unaccounted For Percentage	17.0%

Tennessee American Water Company, Chattanooga, TN-2008

Daily Water Balance Year to Date

(1,000's Gallons)

System Input Volume (corrected for known errors)				
[illegible]	Authorized Consumption [illegible]	Billed Authorized Consumption 30,490	Billed Metered Consumption (inc. water exported) 30,490	Revenue Water 30,490
			Billed Unmetered Consumption 0	
		Unbilled Authorized Consumption [illegible]	Unbilled Metered Consumption 98	Non-Revenue Water (NRW) 7,969
			Unbilled Unmetered Consumption 375	
	Water Losses 7,495	Apparent Losses 93	Unauthorized Consumption [illegible]	
			Customer Metering Inaccuracies 0	
			Data Handling Errors 0	
		Real Losses 7,402	Leakage and Overflows at Utility's Storage Tanks 20	
			Identified Leakage on Distribution Mains and Services 966	
			Unidentified Leakage in Distribution System [illegible]	
			Leakage on Private Services Before Meter 0.00	

Daily NRW Volume Per Customer (in gallons)	106.81
NRW Volume in GPM (in gallons)	5,534
NRW Volume Per Mile of Main in GPM (in Gallons)	4.33

Daily Unavoidable Leakage UARL (in thousands of gallons)	2,170.000
Daily Unaccounted For Volume (in thousands of gallons)	6,407.402
Unaccounted For Percentage	16.7%

Tennessee American Water Company, Chattanooga -2009

Daily Water Balance Year to Date

(1,000's Gallons)

System Input Volume (corrected for known errors) 36,301	Authorized Consumption 27,277	Billed Authorized Consumption [illegible]	Billed Metered Consumption (inc. water exported) 27,277	Revenue Water 27,277
			Billed Unmetered Consumption 0	
		Unbilled Authorized Consumption 0	Unbilled Metered Consumption 105	Non-Revenue Water (NRW) 9,025
			Unbilled Unmetered Consumption 382	
	Water Losses [illegible]	Apparent Losses 110	Unauthorized Consumption [illegible]	
			Customer Metering Inaccuracies 0	
			Data Handling Errors 0	
		Real Losses [illegible]	Leakage and Overflows at Utility's Storage Tanks [illegible]	
			Identified Leakage on Distribution Mains and Services [illegible]	
			Unidentified Leakage in Distribution System 7,415	
			Leakage on Private Services Before Meter 0.00	

Daily NRW Volume Per Customer (in gallons)	120.76
NRW Volume in GPM (in gallons)	6,267
NRW Volume Per Mile of Main in GPM (in Gallons)	4.89

Daily Unavoidable Leakage UARL (in thousands of gallons)	2,170.000
Daily Unaccounted For Volume (in thousands of gallons)	7,414.523
Unaccounted For Percentage	20.4%

AWWA Water Audit Software: Reporting Worksheet

Back to Instructions

? Click to access definition

Water Audit Report for: Tennessee American Water
Reporting Year: 2005

Please enter data in the white cells below. Where possible, metered values should be used; if metered values are unavailable please estimate a value. Indicate this by selecting a choice from the gray box to the left, where M = measured (or accurately known value) and E = estimated.

ALL VOLUMES TO BE ENTERED AS ANNUAL QUANTITIES

WATER SUPPLIED			
Volume from own sources:	M	14,050.224	million gallons per year
Master meter error adjustment:		0.000	← enter adjustment type
Water Imported:		0.000	million gallons per year
Water Exported:	M	967.145	million gallons per year
WATER SUPPLIED:		13,083.079	million gallons per year

AUTHORIZED CONSUMPTION			
Billed metered:	M	10,607.885	million gallons per year
Billed unmetered:		0.000	million gallons per year
Unbilled metered:	M	7.600	million gallons per year
Unbilled unmetered:	E	161.071	million gallons per year
AUTHORIZED CONSUMPTION:		10,776.556	million gallons per year

WATER LOSSES (Water Supplied - Authorized Consumption)		2,306.523	million gallons per year
Apparent Losses			
Unauthorized consumption:	E	128.910	million gallons per year
Customer metering inaccuracies:		0.000	million gallons per year
Data handling errors:	M	124.354	million gallons per year
Apparent Losses:		253.264	million gallons per year
Real Losses			
Real Losses (Water Losses - Apparent Losses):		2,053.259	million gallons per year
Non-Revenue Water:			
Non-revenue water:		2,475.194	million gallons per year
WATER LOSSES:		2,306.523	million gallons per year

SYSTEM DATA			
Length of mains:	M	1,283	miles
Number of service connections:	M	72,361	
Connection density:		56	conn./mile main
Average length of private pipe:		0	ft (pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	E	120.00	psi

COST DATA			
Total annual cost of operating water system:	M	$14,716,262	$/Year
Customer retail unit cost (applied to apparent losses):	M	$2.81	$/1000 gallons
Variable production cost (applied to real losses):	M	$283.70	$/million gallons

DATA REVIEW - Please review the following information and make changes above if necessary:

- Input values should be indicated as either measured or estimated. You have entered:
- 10 as measured values
- 3 as estimated values
- 5 without specifying measured or estimated
- It is important to accurately measure the master meter - you have entered the measurement type as: measured
- Cost Data: No problems identified

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume:	18.91	
Non-revenue water as percent by cost:	9.11	
Annual cost of Apparent losses:	$212,685	
Annual cost of Real Losses:	$582,510	

Operational Efficiency Indicators

Apparent losses per service connection per day:	9.59	gallons/connection/day
Real losses per service connection per day:	77.74	gallons/connection/day
Real losses per length of main per day:	4,384.54	gallons/mile/day
Real losses per service connection per day per psi pressure:	0.65	gallons/connection/day/psi
? Unavoidable Annual Real Losses (UARL):	2.14	million gallons/day
Infrastructure Leakage Index (ILI) [Real Losses/UARL]:	2.63	

AWWA Water Audit Software: Water Balance

Water Audit Report For:	Report Yr:
Tennessee American Water	2005

Own Sources (Adjusted for known errors) [illegible]	Water Supplied [illegible]	Authorized Consumption 10776.56	Billed Authorized Consumption 10607.89	Billed Metered Consumption (inc. water exported) 10607.89	Revenue Water 10607.89
				Billed Unmetered Consumption 0.00	
			Unbilled Authorized Consumption [illegible]	Unbilled Metered Consumption 7.60	Non-Revenue Water (NRW) 2475.19
				Unbilled Unmetered Consumption [illegible]	
		Water Losses [illegible]	Apparent Losses 253.26	Unauthorized Consumption 128.91	
				Customer Metering Inaccuracies 0.00	
				Data Handling Errors 124.35	
Net Water Imported -967.15			Real Losses 2053.26	Leakage on Transmission and/or Distribution Mains Not broken down	
				Leakage and Overflows at Utility's Storage Tanks Not broken down	
				Leakage on Service Connections Not broken down	

AWWA Water Audit Software: Definitions

Back to Instructions

Item Name		Description
Volume from Own Sources	Find	The volume of treated water input to system from own production facilities
Master meter error adjustment	Find	An estimate or measure of the degree of any inaccuracy that exists in the master meters measuring the Volume from Own Sources. Please also indicate if this adjustment is because the master meters under-registered (did not capture all the flow) or over-registered (overstated the actual flow)
Water Imported	Find	Bulk water purchased to become part of the water supplied. Typically this is water purchased from a neighboring water utility or regional water authority. Be sure to account for any import meter inaccuracy in reporting this volume
Water Exported	Find	Bulk water sold and conveyed out of the water distribution system. Typically this is water sold to a neighboring water utility. Be sure to account for any export meter inaccuracy in reporting this volume
Authorized Consumption		The volume of metered and/or unmetered water taken by registered customers, the water supplier and others who are implicitly or explicitly authorized to do so by the water supplier, for residential, commercial and industrial purposes. It also includes water exported across operational boundaries. Authorized consumption may include items such as fire fighting and training, flushing of mains and sewers, street cleaning, watering of municipal gardens, public fountains, frost protection, building water, etc. These may be billed or unbilled, metered or unmetered.
Billed Authorized Consumption		All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Unbilled Authorized Consumption		All consumption that is unbilled, but still authorized by the utility. See "Authorized Consumption" for more information.
Billed Metered Consumption	Find	All metered consumption which is billed. This includes all groups of customers such as domestic, commercial, industrial or institutional and also includes water transferred across operational boundaries (water exported) which is metered and billed.
Billed unmetered Consumption	Find	All billed consumption which is calculated based on estimates or norms but is not metered. This might be a very small component in fully metered systems (for example billing based on estimates for the period a customer meter is out of order) but can be the key consumption component in systems without universal metering. This component might also include water transferred across operational boundaries (water exported) which is unmetered but billed.
Unbilled Metered Consumption	Find	Metered Consumption which is for any reason unbilled. This might for example include metered consumption of the utility itself or water provided to institutions free of charge, including water transferred across operational boundaries (water exported) which is metered but unbilled.
Unbilled Unmetered Consumption	Find	Any kind of Authorized Consumption which is neither billed nor metered. This component typically includes items such as fire fighting, flushing of mains and sewers, street cleaning, frost protection, etc. In a well run utility it is a small component which is very often substantially overestimated. Theoretically this might also include water transferred across operational boundaries (water exported) which is unmetered and unbilled - an unlikely case.
Authorized Consumption		billed metered + biled unmetered + unbilled metered + unbilled unmetered
Water Losses		The difference between System Input and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission or distribution systems, or individual zones. Water Losses consist of Real Losses and Apparent Losses.
Apparent Losses		Includes all types of inaccuracies associated with customer metering as well as data handling errors (meter reading and billing), plus unauthorized consumption (theft or illegal use). NOTE: Over-registration of customer meters, leads to under-estimation of Real Losses. Under-registration of customer meters, leads to over-estimation of Real Losses.
Unauthorized Consumption	Find	Includes water illegally withdrawal from hydrants, illegal connections, bypasses to consumption meter or meter/meter reading equipment tampering.
Customer Metering Inaccuracies	Find	Apparent water losses caused by customer meter inaccuracies.
Data Handling Errors	Find	Apparent water losses caused by data handling errors in the meter reading and billing system.
Apparent Losses		This is the combination of: unauthorized consumption + meter under-registration + data handling errors.

Real Losses		Physical water losses from the pressurized system and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Non-Revenue Water		Water which does not provide any revenue to the utility = Apparent Losses + Real Losses + Unbilled Metered + Unbilled Unmetered
Revenue Water		Water which is charged to customers to provide revenue to the utility.
Water Losses		= apparent losses + real losses
Length of mains	Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant).
Number of service connections	Find	Number of service connections. Please note that this includes the actual number of distinct piping connections whether active or inactive. This may differ substantially from the number of Customers (or number of accounts)
Connection density		=number of connections / length of mains
Average length of private pipe	Find	This is the distance between the curbstop and the customer meter, or from the curbstop to the building line (first point of customer consumption) if customers are unmetered.
Average Pressure	Find	The average pressure may be approximated when compiling the preliminary water audit. Once routine water auditing has been established, a more accurate assessment of average pressure should be pursued. If the water utility infrastructure is recorded in a Geographical Information System (GIS) the average pressure at many locations in the distribution system can be readily obtained. If a GIS does not exist, a weighted average of various pressure zones can be obtained using pressure data and the length of pipeline in each zone.
Unavoidable Annual Real Losses (UARL)	Find	UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lp) xP or UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lp) xP with Lm = length of mains, (miles or kilometers) Nc = number of service connections Lp = total length of private pipe, (miles/kilometers) (= Nc x average distance of private pipe) The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). It is not necessary that water utilities set this level as the target level of leakage, unless water is unusually expensive, scarce or both.
Variable Production Costs (applied to Real Losses)	Find	The cost to produce and supply the next unit of water. (E.g., $/million gallons) This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It should also include the unit cost of bulk water purchased as an import if applicable.
Infrastructure Leakage Index (ILI)	Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The is a highly effective performance indicator for comparing (benchmarking) performance among water utilities.

AWWA Water Audit Software: Determining Water Loss Standing?

Back to Instructions

Once data has been entered into the Reporting Worksheet, the performance indcators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and intregrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		

AWWA Water Audit Software Version 1.5 Developed by the Water Loss Control Committee of the American Water Works Association September 2005

ACKNOWLEDGMENT

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REFERENCES:
- Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272
- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65

AWWA WLCC Water Audit Software: Reporting Worksheet

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Click to access definition

Water Audit Report for: Tennessee American Water
Reporting Year: 2006

Please enter data in the white cells below. Where possible, metered values should be used; if metered values are unavailable please estimate a value. Indicate this by selecting a choice from the gray box to the left, where M = measured (or accurately known value) and E = estimated.

ALL VOLUMES TO BE ENTERED AS ANNUAL QUANTITIES

WATER SUPPLIED

Volume from own sources:	M	15,121.8	million gallons (US) per year
Master meter error adjustment:	M	0.0	million gallons (US) per year
Water Imported:	M	0.0	million gallons (US) per year
Water Exported:	M	1,327.5	million gallons (US) per year
WATER SUPPLIED:		13,794.4	million gallons (US) per year

AUTHORIZED CONSUMPTION

Billed metered:	M	11,619.5	million gallons (US) per year
Billed unmetered:	M	0.0	million gallons (US) per year
Unbilled metered:	M	15.3	million gallons (US) per year
Unbilled unmetered:	E	158.7	million gallons (US) per year
AUTHORIZED CONSUMPTION:		11,793.5	million gallons (US) per year

WATER LOSSES (Water Supplied - Authorized Consumption)		2,000.9	million gallons (US) per year

Apparent Losses

Unauthorized consumption:	E	61.7	million gallons (US) per year
Customer metering inaccuracies:	M	0.0	million gallons (US) per year
Data handling errors:	M	47.0	million gallons (US) per year
Apparent Losses:		108.7	million gallons (US) per year

Real Losses

Real Losses (Water Losses - Apparent Losses):		1,892.2	million gallons (US) per year
WATER LOSSES:		2,000.9	million gallons (US) per year

NON-REVENUE WATER

NON-REVENUE WATER:		2,174.8	million gallons (US) per year

SYSTEM DATA

Length of mains:	M	1,262.0	miles
Number of active AND inactive service connections:	M	73,389	
Connection density:		58	conn./mile main
Average length of private pipe:	M	0.0	ft (pipe length between curbstop and customer meter or property
Average operating pressure:	E	120.0	psi

COST DATA

Total annual cost of operating water system:	M	$17,916,556	$/Year
Customer retail unit cost (applied to apparent losses):	M	$2.78	$/1000 gallons (US)
Variable production cost (applied to real losses):	M	$192.00	$/million gallons (US)

DATA REVIEW - Please review the following information and make changes above if necessary:

- Input values should be indicated as either measured or estimated. You have entered:
15 as measured values
3 as estimated values
0 without specifying measured or estimated
- It is important to accurately measure the master meter - you have entered the measurement type as: measured
- Cost Data: No problems identified

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume:	15.8%	
Non-revenue water as percent by cost:	3.7%	
Annual cost of Apparent Losses:	$302,258	
Annual cost of Real Losses:	$363,295	

Operational Efficiency Indicators

Apparent losses per service connection per day:	4.06	gallons/connection/day
Real losses per service connection per day*:	70.64	gallons/connection/day
Real losses per length of main per day*:	N/A	
Real losses per service connection per day per psi pressure:	0.59	gallons/connection/day/psi
Unavoidable Annual Real Losses (UARL):	2.14	million gallons/day
Infrastructure Leakage Index (ILI) [Real Losses/UARL]:	2.42	

* only the most applicable of these two indicators will be calculated

AWWA WLCC Water Audit Software: Water Balance

Water Audit Report For:	Report Yr:
Tennessee American Water	2006

Own Sources (Adjusted for known errors) 15,121.8	Water Exported 1,327.[illegible]			Billed Water Exported	
	Water Supplied 13,794.4	Authorized Consumption 11,793.5	Billed Authorized Consumption 11,619.5	Billed Metered Consumption (inc. water exported) 11,619.5	Revenue Water 11,619.5
				Billed Unmetered Consumption 0.0	
			Unbilled Authorized Consumption 173.9	Unbilled Metered Consumption 15.3	Non-Revenue Water (NRW) 2,174.8
				Unbilled Unmetered Consumption 158.7	
		Water Losses 2,000.9	Apparent Losses 108.7	Unauthorized Consumption 61.7	
				Customer Metering Inaccuracies 0.0	
				Data Handling Errors 47.0	
Water Imported 0.0			Real Losses 1,892.2	Leakage on Transmission and/or Distribution Mains Not broken down	
				Leakage and Overflows at Utility's Storage Tanks Not broken down	
				Leakage on Service Connections Not broken down	

AWWA WLCC Water Audit Software: Definitions

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Item Name		Description
Volume from Own Sources	Find	The volume of treated water input to system from own production facilities
Master meter error adjustment	Find	An estimate or measure of the degree of any inaccuracy that exists in the master meters measuring the Volume from Own Sources. Please also indicate if this adjustment is because the master meters under-registered (did not capture all the flow) or over-registered (overstated the actual flow)
Water Imported	Find	Bulk water purchased to become part of the water supplied. Typically this is water purchased from a neighboring water utility or regional water authority. Be sure to account for any import meter inaccuracy in reporting this volume
Water Exported	Find	Bulk water sold and conveyed out of the water distribution system. Typically this is water sold to a neighboring water utility. Be sure to account for any export meter inaccuracy in reporting this volume
Authorized Consumption		= billed metered + billed unmetered + unbilled metered + unbilled unmetered The volume of metered and/or unmetered water taken by registered customers, the water supplier and others who are implicitly or explicitly authorized to do so by the water supplier, for residential, commercial and industrial purposes. This does NOT include water sold to neighboring utilities (water exported). Authorized consumption may include items such as fire fighting and training, flushing of mains and sewers, street cleaning, watering of municipal gardens, public fountains, frost protection, building water, etc. These may be billed or unbilled, metered or unmetered.
Billed Authorized Consumption		All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Unbilled Authorized Consumption		All consumption that is unbilled, but still authorized by the utility. See "Authorized Consumption" for more information.
Billed Metered Consumption	Find	All metered consumption which is billed. This includes all groups of customers such as domestic, commercial, industrial or institutional. It does NOT include water sold to neighboring utilities (water exported) which is metered and billed.
Billed Unmetered Consumption	Find	All billed consumption which is calculated based on estimates or norms but is not metered. This might be a very small component in fully metered systems (for example billing based on estimates for the period a customer meter is out of order) but can be the key consumption component in systems without universal metering. It does NOT include water sold to neighboring utilities (water exported) which is unmetered but billed.
Unbilled Metered Consumption	Find	Metered Consumption which is for any reason unbilled. This might for example include metered consumption of the utility itself or water provided to institutions free of charge. It does NOT include water sold to neighboring utilities (water exported) which is metered but unbilled.
Unbilled Unmetered Consumption	Find	Any kind of Authorized Consumption which is neither billed nor metered. This component typically includes items such as fire fighting, flushing of mains and sewers, street cleaning, frost protection, etc. In a well run utility it is a small component which is very often substantially overestimated. It does NOT include water sold to neighboring utilities (water exported) which is unmetered and unbilled - an unlikely case.
Water Losses		= apparent losses + real losses The difference between System Input and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission or distribution systems, or individual zones. Water Losses consist of Real Losses and Apparent Losses.
Apparent Losses		= unauthorized consumption + meter under-registration + data handling errors Includes all types of inaccuracies associated with customer metering as well as data handling errors (meter reading and billing), plus unauthorized consumption (theft or illegal use). NOTE: Over-registration of customer meters, leads to under-estimation of Real Losses. Under-registration of customer meters, leads to over-estimation of Real Losses.
Unauthorized Consumption	Find	Includes water illegally withdrawn from hydrants, illegal connections, bypasses to consumption meter or meter/meter reading equipment tampering.
Customer Metering Inaccuracies	Find	Apparent water losses caused by customer meter inaccuracies.
Data Handling Errors	Find	Apparent water losses caused by data handling errors in the meter reading and billing system.

Real Losses		Physical water losses from the pressurized system and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Non-Revenue Water		= Apparent Losses + Real Losses + Unbilled Metered + Unbilled Unmetered Water which does not provide any revenue to the utility
Revenue Water		Water which is charged to customers to provide revenue to the utility.
Length of mains	Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant).
Number of active AND inactive service connections	Find	Number of service connections, main to curb stop. Please note that this includes the actual number of distinct piping connections whether active or inactive. This may differ substantially from the number of Customers (or number of accounts)
Connection density		= number of connections / length of mains
Average length of private pipe	Find	This is the distance between the curbstop and the customer meter, or from the curbstop to the building line (first point of customer consumption) if customers are unmetered.
Average Operating Pressure	Find	The average pressure may be approximated when compiling the preliminary water audit. Once routine water auditing has been established, a more accurate assessment of average pressure should be pursued. If the water utility infrastructure is recorded in a Geographical Information System (GIS) the average pressure at many locations in the distribution system can be readily obtained. If a GIS does not exist, a weighted average of pressure data can be calculated from water pressure measured at various fire hydrants scattered across the water distribution system.
Total Annual Cost of Operating the Water System	Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the system, such as repayment of captial bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. These costs should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Customer Retail Unit Cost	Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied to the components of apparent loss, since these losses represent water reaching customers but not (fully) paid for. It is important to compile these costs per the same unit cost basis as the volume measure included in the water audit. For example, if all water volumes are measured in million gallons, then the unit cost should be dollars per million gallon ($/mil gal). The software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet or $/1,000 liters) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell.
Variable Production Cost (applied to Real Losses)	Find	The cost to produce and supply the next unit of water. (E.g., $/million gallons) This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It should also include the unit cost of bulk water purchased as an import if applicable.
Unavoidable Annual Real Losses (UARL)	Find	UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lp) xP, or UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lp) xP Where: Lm = length of mains, (miles or kilometers) Nc = number of service connections Lp = total length of private pipe, (miles or km) = Nc x average distance of private pipe The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). It is not necessary that water utilities set this level as the target level of leakage, unless water is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been fully proven as effective for very small water distribution systems. If, (Lm x 32) + Nc < 3000 (gallons per day) or (Lm x 20) + Nc < 3000 (liters per day) then the the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.
Infrastructure Leakage Index (ILI)	Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utilites in operational management of real losses.

AWWA WLCC Water Audit Software: Determining Water Loss Standing?

Back to Instructions

Once data has been entered into the Reporting Worksheet, the performance indcators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and intregrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

AWWA Water Audit Software Version 2.0 Developed by the Water Loss Control Committee of the American Water Works Association October 2005

ACKNOWLEDGMENTS

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REFERENCES: - Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272

- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65

AWWA WLCC Water Audit Software: Reporting Worksheet

Back to Instructions

Click to access definition

Water Audit Report for: Tennessee American Water
Reporting Year: 2007

Please enter data in the white cells below. Where possible, metered values should be used; if metered values are unavailable please estimate a value. Indicate this by selecting a choice from the gray box to the left, where M = measured (or accurately known value) and E = estimated.

ALL VOLUMES TO BE ENTERED AS ANNUAL QUANTITIES

WATER SUPPLIED

Volume from own sources:	M	14,777.6	million gallons (US) per year
Master meter error adjustment:	M	0.0	million gallons (US) per year
Water Imported:	M	0.0	million gallons (US) per year
Water Exported:	M	1,508.6	million gallons (US) per year
WATER SUPPLIED:		13,269.0	million gallons (US) per year

AUTHORIZED CONSUMPTION

Billed metered:	M	11,523.6	million gallons (US) per year
Billed unmetered:	M	0.0	million gallons (US) per year
Unbilled metered:	M	15.8	million gallons (US) per year
Unbilled unmetered:	E	166.5	million gallons (US) per year
AUTHORIZED CONSUMPTION:		11,705.9	million gallons (US) per year

WATER LOSSES (Water Supplied - Authorized Consumption)		1,563.1	million gallons (US) per year
Apparent Losses			
Unauthorized consumption:	M	37.4	million gallons (US) per year
Customer metering inaccuracies:	M	0.0	million gallons (US) per year
Data handling errors:	M	0.0	million gallons (US) per year
Apparent Losses:		37.4	million gallons (US) per year
Real Losses			
Real Losses (Water Losses - Apparent Losses):		1,525.7	million gallons (US) per year
WATER LOSSES:		1,563.1	million gallons (US) per year

NON-REVENUE WATER

NON-REVENUE WATER:		1,745.4	million gallons (US) per year

SYSTEM DATA

Length of mains:	M	1,272.0	miles
Number of active AND inactive service connections:	M	74,541	
Connection density:		59	conn./mile main
Average length of private pipe:	M	0.0	ft (pipe length between curbstop and customer meter or property)
Average operating pressure:	M	120.0	psi

COST DATA

Total annual cost of operating water system:	M	$17,856,300	$/Year
Customer retail unit cost (applied to apparent losses):	M	$3.02	$/1000 gallons (US)
Variable production cost (applied to real losses):	M	$211.00	$/million gallons (US)

DATA REVIEW - Please review the following information and make changes above if necessary:

- Input values should be indicated as either measured or estimated. You have entered:
  15 as measured values
  1 as estimated values
  0 without specifying measured or estimated
- It is important to accurately measure the master meter - you have entered the measurement type as: measured
- Cost Data: No problems identified

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume:	13.2%
Non-revenue water as percent by cost:	2.7%
Annual cost of Apparent Losses:	$112,948
Annual cost of Real Losses:	$321,923

Operational Efficiency Indicators

Apparent losses per service connection per day:	1.37	gallons/connection/day
Real losses per service connection per day*:	56.08	gallons/connection/day
Real losses per length of main per day*:	N/A	
Real losses per service connection per day per psi pressure:	0.47	gallons/connection/day/psi
Unavoidable Annual Real Losses (UARL):	2.17	million gallons/day
Infrastructure Leakage Index (ILI) [Real Losses/UARL]:	1.93	

* only the most applicable of these two indicators will be calculated

AWWA WLCC Water Audit Software: Water Balance				Water Audit Report For: Tennessee American Water	Report Yr: 2007
	Water Exported 1,503.6			Billed Water Exported	
Own Sources (Adjusted for known errors) 14,772.6	Water Supplied 13,269.0	Authorized Consumption 11,705.9	Billed Authorized Consumption 11,523.6	Billed Metered Consumption (inc. water exported) 11,523.6	Revenue Water 11,523.6
				Billed Unmetered Consumption 0.0	
			Unbilled Authorized Consumption 182.3	Unbilled Metered Consumption 15.8	Non-Revenue Water (NRW) 1,745.4
				Unbilled Unmetered Consumption 166.5	
		Water Losses 1,563.1	Apparent Losses 37.4	Unauthorized Consumption 37.4	
				Customer Metering Inaccuracies 0.0	
				Data Handling Errors 0.0	
Water Imported 0.0			Real Losses 1,525.7	Leakage on Transmission and/or Distribution Mains Not broken down	
				Leakage and Overflows at Utility's Storage Tanks Not broken down	
				Leakage on Service Connections Not broken down	

AWWA WLCC Water Audit Software: Definitions

Back to Instructions

Item Name		Description
Volume from Own Sources	Find	The volume of treated water input to system from own production facilities
Master meter error adjustment	Find	An estimate or measure of the degree of any inaccuracy that exists in the master meters measuring the Volume from Own Sources. Please also indicate if this adjustment is because the master meters under-registered (did not capture all the flow) or over-registered (overstated the actual flow)
Water Imported	Find	Bulk water purchased to become part of the water supplied. Typically this is water purchased from a neighboring water utility or regional water authority. Be sure to account for any import meter inaccuracy in reporting this volume
Water Exported	Find	Bulk water sold and conveyed out of the water distribution system. Typically this is water sold to a neighboring water utility. Be sure to account for any export meter inaccuracy in reporting this volume
Authorized Consumption		= billed metered + billed unmetered + unbilled metered + unbilled unmetered The volume of metered and/or unmetered water taken by registered customers, the water supplier and others who are implicitly or explicitly authorized to do so by the water supplier, for residential, commercial and industrial purposes. This does NOT include water sold to neighboring utilities (water exported). Authorized consumption may include items such as fire fighting and training, flushing of mains and sewers, street cleaning, watering of municipal gardens, public fountains, frost protection, building water, etc. These may be billed or unbilled, metered or unmetered.
Billed Authorized Consumption		All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Unbilled Authorized Consumption		All consumption that is unbilled, but still authorized by the utility. See "Authorized Consumption" for more information.
Billed Metered Consumption	Find	All metered consumption which is billed. This includes all groups of customers such as domestic, commercial, industrial or institutional. It does NOT include water sold to neighboring utilities (water exported) which is metered and billed.
Billed Unmetered Consumption	Find	All billed consumption which is calculated based on estimates or norms but is not metered. This might be a very small component in fully metered systems (for example billing based on estimates for the period a customer meter is out of order) but can be the key consumption component in systems without universal metering. It does NOT include water sold to neighboring utilities (water exported) which is unmetered but billed.
Unbilled Metered Consumption	Find	Metered Consumption which is for any reason unbilled. This might for example include metered consumption of the utility itself or water provided to institutions free of charge. It does NOT include water sold to neighboring utilities (water exported) which is metered but unbilled.
Unbilled Unmetered Consumption	Find	Any kind of Authorized Consumption which is neither billed nor metered. This component typically includes items such as fire fighting, flushing of mains and sewers, street cleaning, frost protection, etc. In a well run utility it is a small component which is very often substantially overestimated. It does NOT include water sold to neighboring utilities (water exported) which is unmetered and unbilled - an unlikely case.
Water Losses		= apparent losses + real losses The difference between System Input and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission or distribution systems, or individual zones. Water Losses consist of Real Losses and Apparent Losses.
Apparent Losses		= unauthorized consumption + meter under-registration + data handling errors Includes all types of inaccuracies associated with customer metering as well as data handling errors (meter reading and billing), plus unauthorized consumption (theft or illegal use). NOTE: Over-registration of customer meters, leads to under-estimation of Real Losses. Under-registration of customer meters, leads to over-estimation of Real Losses.
Unauthorized Consumption	Find	Includes water illegally withdrawn from hydrants, illegal connections, bypasses to consumption meter or meter/meter reading equipment tampering.
Customer Metering Inaccuracies	Find	Apparent water losses caused by customer meter inaccuracies.
Data Handling Errors	Find	Apparent water losses caused by data handling errors in the meter reading and billing system.

Real Losses		Physical water losses from the pressurized system and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Non-Revenue Water		= Apparent Losses + Real Losses + Unbilled Metered + Unbilled Unmetered Water which does not provide any revenue to the utility
Revenue Water		Water which is charged to customers to provide revenue to the utility.
Length of mains	Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant).
Number of active AND inactive service connections	Find	Number of service connections, main to curb stop. Please note that this includes the actual number of distinct piping connections whether active or inactive. This may differ substantially from the number of Customers (or number of accounts)
Connection density		=number of connections / length of mains
Average length of private pipe	Find	This is the distance between the curbstop and the customer meter, or from the curbstop to the building line (first point of customer consumption) if customers are unmetered.
Average Operating Pressure	Find	The average pressure may be approximated when compiling the preliminary water audit. Once routine water auditing has been established, a more accurate assessment of average pressure should be pursued. If the water utility infrastructure is recorded in a Geographical Information System (GIS) the average pressure at many locations in the distribution system can be readily obtained. If a GIS does not exist, a weighted average of pressure data can be calculated from water pressure measured at various fire hydrants scattered across the water distribution system.
Total Annual Cost of Operating the Water System	Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the system, such as repayment of captial bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. These costs should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Customer Retail Unit Cost	Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied to the components of apparent loss, since these losses represent water reaching customers but not (fully) paid for. It is important to compile these costs per the same unit cost basis as the volume measure included in the water audit. For example, if all water volumes are measured in million gallons, then the unit cost should be dollars per million gallon ($/mil gal). The software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet or $/1,000 liters) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell.
Variable Production Cost (applied to Real Losses)	Find	The cost to produce and supply the next unit of water, (E.g., $/million gallons) This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It should also include the unit cost of bulk water purchased as an import if applicable.
Unavoidable Annual Real Losses (UARL)	Find	UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lp) xP, or UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lp) xP where: Lm = length of mains, (miles or kilometers) Nc = number of service connections Lp = total length of private pipe, (miles or km) = Nc x average distance of private pipe The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key varible in the calculation of the Infrastructure Leakage Index (ILI). It is not necessary that water utilities set this level as the target level of leakage, unless water is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been fully proven as effective for very small water distribution systems. If, (Lm x 32) + Nc < 3000 (gallons per day) or (Lm x 20) + Nc < 3000 (liters per day) then the the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.
Infrastructure Leakage Index (ILI)	Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utiliites in operational management of real losses.

AWWA WLCC Water Audit Software: Determining Water Loss Standing?

Back to Instructions

Once data has been entered into the Reporting Worksheet, the performance indcators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and intregrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

AWWA Water Audit Software Version 2.0 Developed by the Water Loss Control Committee of the American Water Works Association October 2005

ACKNOWLEDGMENTS

DEVELOPED BY: *ANDREW CHASTAIN-HOWLEY, Water Prospecting and Resource Consulting*
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REFERENCES:
- Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272
- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65

AWWA WLCC Water Audit Software: Reporting Worksheet

Back to Instructions

? Click to access definition

Water Audit Report for: Tennessee American Water
Reporting Year: 2008

Please enter data in the white cells below. Where possible, metered values should be used; if metered values are unavailable please estimate a value. Indicate this by selecting a choice from the gray box to the left, where M = measured (or accurately known value) and E = estimated

ALL VOLUMES TO BE ENTERED AS ANNUAL QUANTITIES

WATER SUPPLIED

Volume from own sources:	M	14,097.0	million gallons (US) per year
Master meter error adjustment:	M	0.0	million gallons (US) per year
Water Imported:	M	0.0	million gallons (US) per year
Water Exported:	M	1,422.9	million gallons (US) per year
WATER SUPPLIED:		12,674.1	million gallons (US) per year

AUTHORIZED CONSUMPTION

Billed metered:	M	11,047.5	million gallons (US) per year
Billed unmetered:	M	0.0	million gallons (US) per year
Unbilled metered:	M	21.2	million gallons (US) per year
Unbilled unmetered:	E	170.0	million gallons (US) per year
AUTHORIZED CONSUMPTION:		11,238.7	million gallons (US) per year

WATER LOSSES (Water Supplied - Authorized Consumption)		1,435.4	million gallons (US) per year
Apparent Losses			
Unauthorized consumption:	E	34.4	million gallons (US) per year
Customer metering inaccuracies:	M	0.0	million gallons (US) per year
Data handling errors:	M	0.0	million gallons (US) per year
Apparent Losses:		34.4	million gallons (US) per year
Real Losses			
Real Losses (Water Losses - Apparent Losses):		1,401.0	million gallons (US) per year
WATER LOSSES:		1,435.4	million gallons (US) per year

NON-REVENUE WATER

NON-REVENUE WATER:		1,626.6	million gallons (US) per year

SYSTEM DATA

Length of mains:	M	1,277.0	miles
Number of active AND inactive service connections:	M	74,774	
Connection density:		59	conn./mile main
Average length of private pipe:	M	0.0	ft (pipe length between curbstop and customer meter or property)
Average operating pressure:	E	120.0	psi

COST DATA

Total annual cost of operating water system:	M	$24,495,869	$/Year
Customer retail unit cost (applied to apparent losses):	M	$3.20	$/1000 gallons (US)
Variable production cost (applied to real losses):	M	$280.00	$/million gallons (US)

DATA REVIEW - Please review the following information and make changes above if necessary:

- Input values should be indicated as either measured or estimated. You have entered:
  - 15 as measured values
  - 3 as estimated values
  - 0 without specifying measured or estimated
- It is important to accurately measure the master meter - you have entered the measurement type as: measured
- Cost Data: No problems identified

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume:	12.8%	
Non-revenue water as percent by cost:	2.3%	
Annual cost of Apparent Losses:	$110,080	
Annual cost of Real Losses:	$392,280	

Operational Efficiency Indicators

Apparent losses per service connection per day:	1.26	gallons/connection/day
Real losses per service connection per day*:	51.33	gallons/connection/day
Real losses per length of main per day*:	N/A	
Real losses per service connection per day per psi pressure:	0.43	gallons/connection/day/psi
? Unavoidable Annual Real Losses (UARL):	2.17	million gallons/day
? Infrastructure Leakage Index (ILI) [Real Losses/UARL]:	1.76	

* only the most applicable of these two indicators will be calculated

AWWA WLCC Water Audit Software: Water Balance

Water Audit Report For:	Report Yr:
Tennessee American Water	2008

Own Sources (Adjusted for known errors)	Water Exported [illegible]22.9			Billed Water Exported	
	Water Supplied [illegible]	Authorized Consumption 11,238.7	Billed Authorized Consumption 11,047.5	Billed Metered Consumption (inc. water exported) 11,047.5	Revenue Water 11,047.5
				Billed Unmetered Consumption 0.0	
			Unbilled Authorized Consumption 191.2	Unbilled Metered Consumption [illegible]	Non-Revenue Water (NRW) 1,626.6
				Unbilled Unmetered Consumption 170.0	
		Water Losses 435.4	Apparent Losses 34.4	Unauthorized Consumption 34.4	
				Customer Metering Inaccuracies 0.0	
				Data Handling Errors 0.0	
Water Imported 0.0			Real Losses 1,401.0	Leakage on Transmission and/or Distribution Mains Not broken down	
				Leakage and Overflows at Utility's Storage Tanks Not broken down	
				Leakage on Service Connections Not broken down	

AWWA WLCC Water Audit Software: Definitions

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Item Name		Description
Volume from Own Sources	Find	The volume of treated water input to system from own production facilities
Master meter error adjustment	Find	An estimate or measure of the degree of any inaccuracy that exists in the master meters measuring the Volume from Own Sources. Please also indicate if this adjustment is because the master meters under-registered (did not capture all the flow) or over-registered (overstated the actual flow)
Water Imported	Find	Bulk water purchased to become part of the water supplied. Typically this is water purchased from a neighboring water utility or regional water authority. Be sure to account for any import meter inaccuracy in reporting this volume
Water Exported	Find	Bulk water sold and conveyed out of the water distribution system. Typically this is water sold to a neighboring water utility. Be sure to account for any export meter inaccuracy in reporting this volume
Authorized Consumption		= billed metered + billed unmetered + unbilled metered + unbilled unmetered The volume of metered and/or unmetered water taken by registered customers, the water supplier and others who are implicitly or explicitly authorized to do so by the water supplier, for residential, commercial and industrial purposes. This does NOT include water sold to neighboring utilities (water exported). Authorized consumption may include items such as fire fighting and training, flushing of mains and sewers, street cleaning, watering of municipal gardens, public fountains, frost protection, building water, etc. These may be billed or unbilled, metered or unmetered.
Billed Authorized Consumption		All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Unbilled Authorized Consumption		All consumption that is unbilled, but still authorized by the utility. See "Authorized Consumption" for more information.
Billed Metered Consumption	Find	All metered consumption which is billed. This includes all groups of customers such as domestic, commercial, industrial or institutional. It does NOT include water sold to neighboring utilities (water exported) which is metered and billed.
Billed Unmetered Consumption	Find	All billed consumption which is calculated based on estimates or norms but is not metered. This might be a very small component in fully metered systems (for example billing based on estimates for the period a customer meter is out of order) but can be the key consumption component in systems without universal metering. It does NOT include water sold to neighboring utilities (water exported) which is unmetered but billed.
Unbilled Metered Consumption	Find	Metered Consumption which is for any reason unbilled. This might for example include metered consumption of the utility itself or water provided to institutions free of charge. It does NOT include water sold to neighboring utilities (water exported) which is metered but unbilled.
Unbilled Unmetered Consumption	Find	Any kind of Authorized Consumption which is neither billed nor metered. This component typically includes items such as fire fighting, flushing of mains and sewers, street cleaning, frost protection, etc. In a well run utility it is a small component which is very often substantially overestimated. It does NOT include water sold to neighboring utilities (water exported) which is unmetered and unbilled - an unlikely case.
Water Losses		= apparent losses + real losses The difference between System Input and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission or distribution systems, or individual zones. Water Losses consist of Real Losses and Apparent Losses.
Apparent Losses		= unauthorized consumption + meter under-registration + data handling errors Includes all types of inaccuracies associated with customer metering as well as data handling errors (meter reading and billing), plus unauthorized consumption (theft or illegal use). NOTE: Over-registration of customer meters, leads to under-estimation of Real Losses. Under-registration of customer meters, leads to over-estimation of Real Losses.
Unauthorized Consumption	Find	Includes water illegally withdrawn from hydrants, illegal connections, bypasses to consumption meter or meter/meter reading equipment tampering.
Customer Metering Inaccuracies	Find	Apparent water losses caused by customer meter inaccuracies.
Data Handling Errors	Find	Apparent water losses caused by data handling errors in the meter reading and billing system.

Real Losses		Physical water losses from the pressurized system and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Non-Revenue Water		= Apparent Losses + Real Losses + Unbilled Metered + Unbilled Unmetered Water which does not provide any revenue to the utility
Revenue Water		Water which is charged to customers to provide revenue to the utility.
Length of mains	Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant).
Number of active AND inactive service connections	Find	Number of service connections, main to curb stop. Please note that this includes the actual number of distinct piping connections whether active or inactive. This may differ substantially from the number of Customers (or number of accounts)
Connection density		=number of connections / length of mains
Average length of private pipe	Find	This is the distance between the curbstop and the customer meter, or from the curbstop to the building line (first point of customer consumption) if customers are unmetered.
Average Operating Pressure	Find	The average pressure may be approximated when compiling the preliminary water audit. Once routine water auditing has been established, a more accurate assessment of average pressure should be pursued. If the water utility infrastructure is recorded in a Geographical Information System (GIS) the average pressure at many locations in the distribution system can be readily obtained. If a GIS does not exist, a weighted average of pressure data can be calculated from water pressure measured at various fire hydrants scattered across the water distribution system.
Total Annual Cost of Operating the Water System	Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the system, such as repayment of captial bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. These costs should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Customer Retail Unit Cost	Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied to the components of apparent loss, since these losses represent water reaching customers but not (fully) paid for. It is important to compile these costs per the same unit cost basis as the volume measure included in the water audit. For example, if all water volumes are measured in million gallons, then the unit cost should be dollars per million gallon ($/mil gal). The software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet or $/1,000 liters) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell.
Variable Production Cost (applied to Real Losses)	Find	The cost to produce and supply the next unit of water. (E.g., $/million gallons) This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It should also include the unit cost of bulk water purchased as an import if applicable.
Unavoidable Annual Real Losses (UARL)	Find	UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lp) xP, or UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lp) xP where: Lm = length of mains, (miles or kilometers) Nc = number of service connections Lp = total length of private pipe, (miles or km) = Nc x average distance of private pipe The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). It is not necessary that water utilities set this level as the target level of leakage, unless water is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been fully proven as effective for very small water distribution systems. If, (Lm x 32) + Nc < 3000 (gallons per day) or (Lm x 20) + Nc < 3000 (liters per day) then the the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.
Infrastructure Leakage Index (ILI)	Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utiliites in operational management of real losses.

AWWA WLCC Water Audit Software: Determining Water Loss Standing?

Back to Instructions

Once data has been entered into the Reporting Worksheet, the performance indcators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and intregrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

AWWA Water Audit Software Version 2.0 Developed by the Water Loss Control Committee of the American Water Works Association October 2005

ACKNOWLEDGMENTS

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REFERENCES:

- Alegre, H., Hirner, W., Baptista, J. and Parena, R. Performance Indicators for Water Supply Services. IWA Publishing 'Manual of Best Practice' Series, 2000. ISBN 1 900222 272

- Kunkel, G. et al, 2003. Water Loss Control Committee Report: Applying Worldwide Best Management Practices in Water Loss Control. Journal AWWA, 95:8:65

AWWA WLCC Water Audit Software: Reporting Worksheet

Back to Instructions

? Click to access definition

Water Audit Report for: Tennessee American Water
Reporting Year: 2009

Please enter data in the white cells below. Where possible, metered values should be used; if metered values are unavailable please estimate a value. Indicate this by selecting a choice from the gray box to the left, where M = measured (or accurately known value) and E = estimated.

ALL VOLUMES TO BE ENTERED AS ANNUAL QUANTITIES

WATER SUPPLIED

Volume from own sources:	M	13,250.0	million gallons (US) per year
Master meter error adjustment:	M	70.0	over-registered million gallons (US) per year
Water imported:	M	0.0	million gallons (US) per year
Water exported:	M	1,046.7	million gallons (US) per year
WATER SUPPLIED:		12,133.3	million gallons (US) per year

AUTHORIZED CONSUMPTION

Billed metered:	M	9,953.0	million gallons (US) per year
Billed unmetered:	M	0.0	million gallons (US) per year
Unbilled metered:	M	49.5	million gallons (US) per year
Unbilled unmetered:	E	138.0	million gallons (US) per year
AUTHORIZED CONSUMPTION:		10,140.5	million gallons (US) per year

WATER LOSSES (Water Supplied - Authorized Consumption) 1,992.8 million gallons (US) per year

Apparent Losses

Unauthorized consumption:	E	40.0	million gallons (US) per year
Customer metering inaccuracies:	M	0.0	million gallons (US) per year
Data handling errors:	M	0.0	million gallons (US) per year
Apparent Losses:		40.0	million gallons (US) per year

Real Losses

Real Losses (Water Losses - Apparent Losses):	1,952.8	million gallons (US) per year
WATER LOSSES:	1,992.8	million gallons (US) per year

NON-REVENUE WATER

NON-REVENUE WATER: 2,180.3 million gallons (US) per year

SYSTEM DATA

Length of mains:	M	1,281.0	miles
Number of active AND inactive service connections:	M	74,475	
Connection density:		58	conn./mile main
Average length of private pipe:	M	0.0	ft (pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	E	120.0	psi

COST DATA

Total annual cost of operating water system:	M	$23,380,803	$/Year
Customer retail unit cost (applied to apparent losses):	M	$3.44	$/1000 gallons (US)
Variable production cost (applied to real losses):	M	$270.58	$/million gallons (US)

DATA REVIEW - Please review the following information and make changes above if necessary:

Input values should be indicated as either measured or estimated. You have entered:
15 as measured values
3 as estimated values
0 without specifying measured or estimated

It is important to accurately measure the master meter - you have entered the measurement type as: measured

Cost Data: No problems identified

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume:	18.0%
Non-revenue water as percent by cost:	3.1%
Annual cost of Apparent Losses:	$137,600
Annual cost of Real Losses:	$528,389

Operational Efficiency Indicators

Apparent losses per service connection per day:	1.47	gallons/connection/day
Real losses per service connection per day*:	71.84	gallons/connection/day
Real losses per length of main per day*:	N/A	
Real losses per service connection per day per psi pressure:	0.60	gallons/connection/day/psi
Unavoidable Annual Real Losses (UARL):	2.17	million gallons/day
Infrastructure Leakage Index (ILI) [Real Losses/UARL]:	2.46	

* only the most applicable of these two indicators will be calculated

AWWA WLCC Water Audit Software: Water Balance

Water Audit Report For:	Report Yr:
Tennessee American Water	2009

Own Sources (Adjusted for known errors) 13,180.0	Water Exported 046.7			Billed Water Exported	
	Water Supplied 12,13[illegible]	Authorized Consumption 10,140.5	Billed Authorized Consumption 9,953.0	Billed Metered Consumption (inc. water exported) 9,953.0	Revenue Water 9,953.0
				Billed Unmetered Consumption 0.0	
			Unbilled Authorized Consumption 187.5	Unbilled Metered Consumption 49.5	Non-Revenue Water (NRW) 2,180.3
				Unbilled Unmetered Consumption 138.0	
		Water Losses 1,992.[illegible]	Apparent Losses 40.0	Unauthorized Consumption 40.0	
				Customer Metering Inaccuracies 0.0	
				Data Handling Errors 0.0	
Water Imported 0.0			Real Losses 1,952.8	Leakage on Transmission and/or Distribution Mains Not broken down	
				Leakage and Overflows at Utility's Storage Tanks Not broken down	
				Leakage on Service Connections Not broken down	

AWWA WLCC Water Audit Software: Definitions

Back to Instructions

Item Name		Description
Volume from Own Sources	Find	The volume of treated water input to system from own production facilities
Master meter error adjustment	Find	An estimate or measure of the degree of any inaccuracy that exists in the master meters measuring the Volume from Own Sources. Please also indicate if this adjustment is because the master meters under-registered (did not capture all the flow) or over-registered (overstated the actual flow)
Water Imported	Find	Bulk water purchased to become part of the water supplied. Typically this is water purchased from a neighboring water utility or regional water authority. Be sure to account for any import meter inaccuracy in reporting this volume
Water Exported	Find	Bulk water sold and conveyed out of the water distribution system. Typically this is water sold to a neighboring water utility. Be sure to account for any export meter inaccuracy in reporting this volume
Authorized Consumption		= billed metered + billed unmetered + unbilled metered + unbilled unmetered The volume of metered and/or unmetered water taken by registered customers, the water supplier and others who are implicitly or explicitly authorized to do so by the water supplier, for residential, commercial and industrial purposes. This does NOT include water sold to neighboring utilities (water exported). Authorized consumption may include items such as fire fighting and training, flushing of mains and sewers, street cleaning, watering of municipal gardens, public fountains, frost protection, building water, etc. These may be billed or unbilled, metered or unmetered.
Billed Authorized Consumption		All consumption that is billed and authorized by the utility. This may include both metered and unmetered consumption. See "Authorized Consumption" for more information.
Unbilled Authorized Consumption		All consumption that is unbilled, but still authorized by the utility. See "Authorized Consumption" for more information.
Billed Metered Consumption	Find	All metered consumption which is billed. This includes all groups of customers such as domestic, commercial, industrial or institutional. It does NOT include water sold to neighboring utilities (water exported) which is metered and billed.
Billed unmetered Consumption	Find	All billed consumption which is calculated based on estimates or norms but is not metered. This might be a very small component in fully metered systems (for example billing based on estimates for the period a customer meter is out of order) but can be the key consumption component in systems without universal metering. It does NOT include water sold to neighboring utilities (water exported) which is unmetered but billed.
Unbilled Metered Consumption	Find	Metered Consumption which is for any reason unbilled. This might for example include metered consumption of the utility itself or water provided to institutions free of charge. It does NOT include water sold to neighboring utilities (water exported) which is metered but unbilled.
Unbilled Unmetered Consumption	Find	Any kind of Authorized Consumption which is neither billed nor metered. This component typically includes items such as fire fighting, flushing of mains and sewers, street cleaning, frost protection, etc. In a well run utility it is a small component which is very often substantially overestimated. It does NOT include water sold to neighboring utilities (water exported) which is unmetered and unbilled - an unlikely case.
Water Losses		= apparent losses + real losses The difference between System Input and Authorized Consumption. Water losses can be considered as a total volume for the whole system, or for partial systems such as transmission or distribution systems, or individual zones. Water Losses consist of Real Losses and Apparent Losses.
Apparent Losses		= unauthorized consumption + meter under-registration + data handling errors Includes all types of inaccuracies associated with customer metering as well as data handling errors (meter reading and billing), plus unauthorized consumption (theft or illegal use). NOTE: Over-registration of customer meters, leads to under-estimation of Real Losses. Under-registration of customer meters, leads to over-estimation of Real Losses.
Unauthorized Consumption	Find	Includes water illegally withdrawn from hydrants, illegal connections, bypasses to consumption meter or meter/meter reading equipment tampering.
Customer Metering Inaccuracies	Find	Apparent water losses caused by customer meter inaccuracies.
Data Handling Errors	Find	Apparent water losses caused by data handling errors in the meter reading and billing system.

Real Losses		Physical water losses from the pressurized system and the utility's storage tanks, up to the point of customer consumption. In metered systems this is the customer meter, in unmetered situations this is the first point of consumption (stop tap/tap) within the property. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows.
Non-Revenue Water		= Apparent Losses + Real Losses + Unbilled Metered + Unbilled Unmetered Water which does not provide any revenue to the utility
Revenue Water		Water which is charged to customers to provide revenue to the utility.
Length of mains	Find	Length of all pipelines (except service connections) in the system starting from the point of system input metering (for example at the outlet of the treatment plant).
Number of active AND inactive service connections	Find	Number of service connections, main to curb stop. Please note that this includes the actual number of distinct piping connections whether active or inactive. This may differ substantially from the number of Customers (or number of accounts)
Connection density		number of connections / length of mains
Average length of private pipe	Find	This is the distance between the curbstop and the customer meter, or from the curbstop to the building line (first point of customer consumption) if customers are unmetered.
Average Operating Pressure	Find	The average pressure may be approximated when compiling the preliminary water audit. Once routine water auditing has been established, a more accurate assessment of average pressure should be pursued. If the water utility infrastructure is recorded in a Geographical Information System (GIS) the average pressure at many locations in the distribution system can be readily obtained. If a GIS does not exist, a weighted average of pressure data can be calculated from water pressure measured at various fire hydrants scattered across the water distribution system.
Total Annual Cost of Operating the Water System	Find	These costs include those for operations, maintenance and any annually incurred costs for long-term upkeep of the system, such as repayment of captial bonds for infrastructure expansion or improvement. Typical costs include employee salaries and benefits, materials, equipment, insurance, fees, administrative costs and all other costs that exist to sustain the drinking water supply. These costs should not include any costs to operate wastewater, biosolids or other systems outside of drinking water.
Customer Retail Unit Cost	Find	The Customer Retail Unit Cost represents the charge that customers pay for water service. This unit cost is applied to the components of apparent loss, since these losses represent water reaching customers but not (fully) paid for. It is important to compile these costs per the same unit cost basis as the volume measure included in the water audit. For example, if all water volumes are measured in million gallons, then the unit cost should be dollars per million gallon ($/mil gal). The software allows the user to select the units that are charged to customers (either $/1,000 gallons, $/hundred cubic feet or $/1,000 liters) and automatically converts these units to the units that appear in the "WATER SUPPLIED" box. Since most water utilities have a rate structure that includes a variety of different costs based upon class of customer, a weighted average of individual costs and number of customer accounts in each class can be calculated to determine a single composite cost that should be entered into this cell.
Variable Production Cost (applied to Real Losses)	Find	The cost to produce and supply the next unit of water. (E.g., $/million gallons) This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. It should also include the unit cost of bulk water purchased as an import if applicable.
Unavoidable Annual Real Losses (UARL)	Find	UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lp) xP, or UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lp) xP where: Lm = length of mains, (miles or kilometers) Nc = number of service connections Lp = total length of private pipe, (miles or km) = Nc x average distance of private pipe The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). It is not necessary that water utilities set this level as the target level of leakage, unless water is unusually expensive, scarce or both. NOTE: The UARL calculation has not yet been fully proven as effective for very small water distribution systems. If, (Lm x 32) + Nc < 3000 (gallons per day) or (Lm x 20) + Nc < 3000 (liters per day) then the the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.
Infrastructure Leakage Index (ILI)	Find	The ratio of the Current Annual Real Losses (Real Losses) to the Unavoidable Annual Real Losses (UARL). The ILI is a highly effective performance indicator for comparing (benchmarking) the performance of utiliites in operational management of real losses.

AWWA WLCC Water Audit Software: Determining Water Loss Standing?

Back to Instructions

Once data has been entered into the Reporting Worksheet, the performance indcators are automatically calculated. How does a water utility operator know how well his or her system is performing? The AWWA Water Loss Control Committee provided the following table to assist water utilities is gauging an approximate Infrastructure Leakage Index (ILI) that is appropriate for their water system and local conditions. The lower the amount of leakage and real losses that exist in the system, then the lower the ILI value will be.

Note: this table offers an approximate guideline for leakage reduction target-setting. The best means of setting such targets include performing an economic assessment of various loss control methods. However, this table is useful if such an assessment is not possible.

General Guidelines for Setting a Target ILI
(without doing a full economic analysis of leakage control options)

Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and intregrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

AWWA Water Audit Software Version 2.0 Developed by the Water Loss Control Committee of the American Water Works Association October 2005

ACKNOWLEDGMENTS

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BUILDING A WORLD OF DIFFERENCE®

BLACK & VEATCH

Chattanooga, TN Signal Mountain Area Water Distribution System

Transient Analysis

Prepared for

Tennessee American Water Company

Chattanooga, TN Signal Mountain Area Water Distribution System

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Black & Veatch Project No. 145895.0100

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Introduction

The purpose of this analysis was to evaluate options and develop recommendations for reducing transient pressures in the Tennessee American Water distribution system along Mountain Creek Road, Glendale Road, Runyan Drive, and in the immediate vicinity of the Signal Mountain receiving tanks. The WaterGEMs version 8 computer model constructed and calibrated by CTI was used as a starting point in the analysis.

This area of analysis has a history of regular pressure spikes dating back at least 5 years. The cause of the transient pressures is believed to be partially due to the length of the larger water mains in the area and the high static head. According to TAWC engineering and operations personnel, the water hammer pressures occur when the two Signal Mountain receiving tank inlets flow control valves are operated from an open to a closed position. As a result surge pressures have been observed immediately upstream of the 8-inch Cla-Val valve on the inlet piping to the Signal Mountain receiving tanks. Customer complaints of high transient pressures have also been documented at Alpine Apartments on Mountain Creek Road and The Arbors on Runyan Drive. The pressures at these locations have been recorded at 150 psi and 155 psi, respectively.

A section of the water transmission/distribution system that includes the suction side of the Walden pump station, Mountain Creek ground storage tank, Signal Mountain receiving tanks, and connecting water mains was analyzed using an H20SURGE transient model. The transient analysis was conducted to model system pressure changes when one of the inlets flow control valves on the Signal Mountain receiving tanks is operated to a closed position. The model was also used to then develop options for reducing the transient pressures.

H20 SURGE Model Development

The H20SURGE model was created by converting the relevant portion of the WaterGEMs V8 model into an EPANET format. The EPANET model was then converted to an H20NET format. Finally, the H20NET model was converted to an H20SURGE model by including pipe wave speed, known existing air release and air vacuum valves, and valve(s) used for stopping or controlling flow.

The resulting H2OSURGE model consisted of 465 pipes ranging in diameter from 2-inch to 16-inch. The principal transmission mains in the model consist of 12-inch and 16-inch diameter pipes connected in series that run generally along Mountain Creek Road from Walden Pump station to the Signal Mountain receiving tanks. Steady state hydraulic conditions in the model were based on the 24-hour WaterGEMS model set up by CTI.

The elevation range of the water mains in the model is from 640 ft. to approximately 1029 ft. MSL. The predominant material of the existing larger water mains in the model is ductile or cast iron.

SCADA data provided by Tennessee American Water Company (TAWC) included Signal Mountain pump station discharge and pressure records recorded at Mountain Creek Rd/Morrison Springs Rd, Alpine Apartments, and The Arbors. As-built plans of the Signal Mountain receiving tanks and Cla-Val valve information were also provided. Tank level records were not available. All data was reviewed to assist in the construction of the H2OSURGE model.

Construction of the H2OSURGE model required certain assumptions and unique system characteristics. These assumptions and characteristics were developed and defined based on communications with TAWC and CTI. The final assumptions applied to the model were as follows:

- The maximum usage rate in the Signal Mountain water system is approximately 2,400 gallons per minute.
- One 6-inch diameter Cla-Val flow control valve (fcv) is installed on the inlet to each of the Signal Mountain receiving tanks, at elevation 750.3 MSL.
- One 8-inch diameter Cla-Val type valve is on the tank inlet piping a short distance upstream of the flow control valves. It is strongly suspected by TAWC personnel and Cla-Val engineers that this is a pressure reducing/pressure sustaining valve.
- Two parallel 6-inch diameter Neptune turbine meters are located in a vault just upstream of the 8-inch Claval valve.
- Cv curves for the Cla-Val valves on the inlet piping of the Signal Mountain receiving tanks were provided by the manufacturer and were added to the model.
- Estimated Cla-Val fitting losses are included at the inlet piping.
- Signal Mountain receiving tanks have a water elevation of 748.3 ft MSL.
- Mountain Creek tank has a water elevation of 1018 ft MSL.
- Two small surge tanks with a combined volume of approximately 6.3 cubic feet are located 245 feet upstream of the turbine meter vault, connected to the existing 12-inch main. They are combined in one tank in the surge model.
- There is one combination air release valve in the H2OSURGE model, on Runyan Drive at approximately elevation 940 MSL. It has a 2-inch diameter vacuum orifice.

TAWC reported that the existing Cla-Val valves are hydraulically actuated, and the closing time on these valves was unknown. According to Cla-Val engineers, the valves likely have excessively worn seats due to pressure drop across the flow control valves (fcvs). The discharge pressure on the flow control valves is approximately 0 psig, which Cla-Val engineers defined as being too low.

According to TAWC personnel, the fcvs appear to close faster as they close more. In addition, the 8-inch Cla-Val has likely lost all throttling functionality.

An overall H2OSURGE node diagram is included on Page 1 of the Appendix. A node diagram of the inflow piping and Signal Mountain receiving tanks is included on Page 2 of the Appendix. The 6-inch flow control valves and the 8-inch Cla-Val (pressure reducing/pressure sustaining valve) are indicated on the Appendix Page 2 node diagram.

In the steady state analysis, prior to the transient occuring, one 6-inch Cla-Val fcv is open and passing approximately 900 gpm to the 250,000 gallon Signal Mountain receiving tank. The other 6-inch Cla-Val fcv is closed. The pressure at the inlet to the turbine meter pit is 120 psi.

Water demand in the H2OSURGE model totals 2.3 mgd, of which 1.6 mgd is conveyed to the Walden Pump station. The remaining 0.7 mgd demand is distributed through out the H20SURGE model. In addition there is flow to the receiving tank, as mentioned above. Hydraulic grade lines used in the model are shown on the node diagram on Page 1 in the Appendix.

The Hazen-Williams equation was used to estimate pipe head loss. Hazen-Williams coefficients used in the H20SURGE model were the same as those used in the WaterGEMs model constructed by CTI. The coefficients range from 93 to 150.

The scenarios modeled with H20SURGE started with the estimated existing condition of one 6-inch fcv fast closure with the 8-inch prs/prv out of operation. Several additional runs were conducted with and without the 8-inch prs/prv in service. Two of the scenarios included a 2,000 gallon closed surge tank. All graphed transient pressures were measured at the inlet to the turbine meter pit on the site of the Signal Mountain receiving tanks.

Design guidelines followed for the transient analysis were:

- Keep estimated minimum transient pressures above zero psig at all times throughout all water mains.
- Keep estimated maximum transient pressures as low as possible in order to limit water main breaks.

Surge Concepts

Rapid changes in flow velocity in closed conduits results in pressure waves that travel upstream and downstream from the point of origin. These waves travel at the sonic wave speed of the pipe. The sonic wave speed in water transmission pipes is primarily dependent on pipe material, pipe diameter, and amount of dissolved air in the water. The calculation of wave speed is shown on Page 3 in the Appendix. The wave speed used in the H20SURGE model is that of the modeled existing 12-inch and 16 inch cast iron and ductile iron pipeline since these two diameters make up the principal transmission main that connects the Mountain Creek tank to the Signal Mountain receiving tanks.

The critical period of a pipeline in seconds, (Tc) is calculated by the formula $Tc = 2L/a$, where:

L = length of the pipeline in ft

a = sonic wave speed of the pipe

The length of the transmission main from the Signal Mountain receiving tanks to the Mountain Creek tank is approximately 16,640 ft., therefore, the calculated critical period is 8.2 seconds and is shown on Page 3 in the Appendix. In order to minimize transient pressures resulting from a valve closure on this transmission main, the valve closure needs to occur in a time not less than 4 to 10 times Tc. Therefore, a minimum valve closure time in this situation would be between 33-82 seconds.

Analysis and Discussion of Results

Transient Analysis

The Appendix shows the analysis results on Pages 4 thru 8. All graphs mention a linear closure of 35 or 120 seconds. This means that the fcv is actuated from fully open to fully closed at an unchanging rate of either 35 or 120 seconds.

Page 4 of the Appendix shows the results of a 35 second linear closure of one 6-inch fcv (starting at time = 13 seconds) on the inlet of the 250,000 gallon Signal Mountain receiving tank. The valve is actuated from 20% open to fully closed in 7 seconds. The 8-inch prs/prv was left wide open throughout the analysis. The transient pressure is measured at the turbine meter pit on the upstream side. In this scenario the pressure rises from 120 psi to approximately 184 psi.

Page 5 of the Appendix shows the same analysis with the 6-inch fcv closing all the way from 20 percent open, over a 24 second period. The resulting maximum pressure is reduced to approximately 138 psi.

Page 6 of the Appendix shows the same scenario again, but with the addition of a 50% full, 2,000 gallon closed surge tank with 4-inch connecting pipes, located approximately at the point of the existing surge suppressor tanks. The resulting maximum pressure is modeled at 143 psi and pressure fluctuations are dampened.

Page 7 of the Appendix shows the results of an analysis in which the 6-inch fcv and 8-inch prs/prv are closed at the same time and speed. The 8-inch prs/prv actuates to maintain approximately 55 psi downstream, in concert with the fcv. In addition, there is an orifice present just downstream of the 6-inch fcv which creates headloss and thus pressure (21 psi at 900 gpm) on the discharge of the fcv. The resulting maximum pressure is 134 psi.

Page 8 of the Appendix shows the same scenario as Page 7, with the addition of a 50% full, 2,000 gallon closed surge tank with 4-inch connecting pipes, located approximately at the point of the existing surge suppressor tanks. The resulting maximum pressure is 130 psi. Again, with the inclusion of the surge tank the pressure fluctuations are dampened. The maximum pressure is only slightly less than that shown on Page 7 of the Appendix.

Finally, one additional analysis was run in which a 6-inch fcv equipped with anti-cavitation internals and the 8-inch prs/prv are closed at the same time and speed. The fcv was closed linearly in 76 seconds from 64 percent open to zero percent open with an initial steady state flow of 900 gpm. The 8-inch prs/prv actuates to maintain approximately 55 psi downstream, in concert with the fcv. The resulting maximum pressure is 130 psi. For the sake of brevity, no graph is included in the appendix for this run.

Steady State Analysis

The H2OSURGE model can be used to run steady state analyses. The results are outlined below.

The estimated maximum flow capacity in the existing system with the two 6-inch fcvs and the 8-inch prs/prv all wide open is approximately 3380 gpm or 1690 gpm through each fcv. The 8-inch prs/prv reduces pressure from 65 psi to 46 psi at 3380 gpm flow.

The estimated maximum flow capacity in the system including two 6-inch fcvs (each with an orifice downstream as outlined on the previous page) and the 8-inch prs/prv all wide open is approximately 2640 gpm or 1320 gpm through each fcv. The 8-inch prs/prv reduces pressure from 87 psi to 75 psi at 2640 gpm flow.

The estimated maximum flow capacity in the system including two 6-inch fcvs (each with anti-cavitation internals, wide open fcv "K" = 25.5) and the 8-inch prs/prv all wide open is approximately 2840 gpm or 1420 gpm through each fcv. The 8-inch prs/prv reduces pressure from 82 psi to 68 psi at 2840 gpm flow.

Recommendations

Recommendations for reducing system transients are as follows:

- Set the flow control valves (FCVs) linear valve actuation time for a minimum of 120 seconds.
- Install electrically actuated flow control valves for better predictability of actuation. Locate these valves in a vault down stream from the pressure reducing/pressure sustaining valve so the lower elevation will increase discharge pressures on the flow control valves.
- Design electrically actuated valves to "fail as-is" in the event of power loss with an alarm to the system operator.
- Design considerations for FCVs should include differential pressures and maximum future flow rates. To achieve this it is recommended a globe type pressure reducing/pressure sustaining valve or be installed upstream of the FCVs. The FCVs should include anti-cavitation internals and should be of a globe type design. Confirm valve installation design before construction.
- Implement operational safe guards to prevent the simultaneous closure of both flow control valves.

Estimated transient pressures in all existing piping were acceptable when the recommendations above were followed. Estimated maximum pressures were significantly lower, and minimum estimated transient pressures were in accordance with the design guidelines.

BUILDING A WORLD OF DIFFERENCE® BLACK & VEATCH

Technical Memorandum #1 – Main Break Analysis

Prepared for

Tennessee American Water Company

Non-Revenue Water Loss Reduction Strategy Analysis

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Black & Veatch Project No. 145895.0100

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TAWC Water Distribution System Main Break Correlation Analysis

All water distribution systems leak, and if left in place long enough all pipes will fail. A reactive approach to main breaks is the continuous surveying of the system to detect leaks and conduct repairs. This reactionary approach to main repair and replacement can, however, be costly. A proactive approach to managing distribution systems is replacing distribution pipes prior to them becoming a repeat maintenance cost sink or outright failure. The TAWC system encompasses 1,342 miles of water distribution system mains of varying ages, sizes, and materials. Some of these assets are beyond their design life or inadequately sized for modern water system operation. Attempting to draw correlations between pipe breaks and water main characteristics is the first step in proactively managing those assets.

An asset management approach, however, is one that water utilities are only beginning to apply. An asset management approach is largely based on condition assessment, something that is at best difficult, or at worst, not possible for a buried asset. This issue is further complicated by the fact that not all pipes perform equally and they fail for a variety of reasons. The TAWC has been constructed with pipe materials and installation practices over the last 140 years. During that time pipe failures have no doubt not occurred chronologically.

Ideally, a proactive pipe replacement program requires a substantial database of pipe information from which to draw failure correlations. However, since utilities are only recently beginning to apply asset management approaches, databases often have not evolved with the level of detail typically desired. With the findings of this project TAWC is beginning the development of such a database for moving forward. In the meantime, the evaluation of available past data can be maximized to establish potential failure correlations to enable managers and field teams to proactively prioritize and address system failures in locations where the data suggest failures are most likely to occur.

A review of TAWC's main break database shows that a continuous main break history has been maintained since 1984. Eleven sporadic records exist in the database for the period 1900-1979. The database includes a total of 11,859 break records. Of these records 9,522 are complete with limited data on date of repair, location, and pipe size. As part of this project the data has been converted to an electronic database in a MS Access and MS Excel formats.

The scope of this technical memorandum was an evaluation of the existing data with the objective of drawing correlations between breaks and available pipe data. Using the available data Black & Veatch was able to develop correlations between breaks and pipe material, pipe size, service pressures, areas of surge, and location. While the data include the date of repair, the data do not include information on the age of the pipe. Potentially, the age of pipes may be estimated by considering the age, the type and the size of the pipe in areas of the system. However, a direct correlation between pipe age and breakage was not possible.

According to the pipe database, the system includes nine different pipe materials as shown in Table 1. The majority of the system, 81%, is made up of cement lined mains and ductile iron. All other materials constitute 16% of the system. Three-percent of the system is of unknown material.

Table 1. Pipe Materials and Occurrence in the Distribution System By Linear Feet and Percentage

Pipe Material	Linear Feet	Percentage of Total
Cement Lined	3,026,262	43%
Ductile Iron	2,714,652	39%
Cast Iron	461,848	7%
Galvanized	260,124	4%
Concrete	106,083	2%
PVC	174,725	2%
Asbestos Cement	17,461	<1%
Copper	9,736	<1%
Polyethlene	126	<1%
Steel	21,553	<1%
No material listed	242,837	3%
Total	7,035,405	100%

The distribution system contains a wide variety of pipe sizes. As Table 2 shows, pipe diameters range from ¾-inch up to 54-inches. Six- and eight- inch mains make up 64% of the system, followed by 2-inch mains at 15% of the system, and 12-inch mains making up 11%. The remaining 10% of the system is made up of the other pipes sizes ranging in frequency from 3% to less than 1%. Between the database of pipe material and pipe diameter there is a discrepancy in total length of 15,648 feet, or less than 1%.

Table 2. Summary of Total Pipe Length by Diameter and Percentage Occurrence in Distribution System

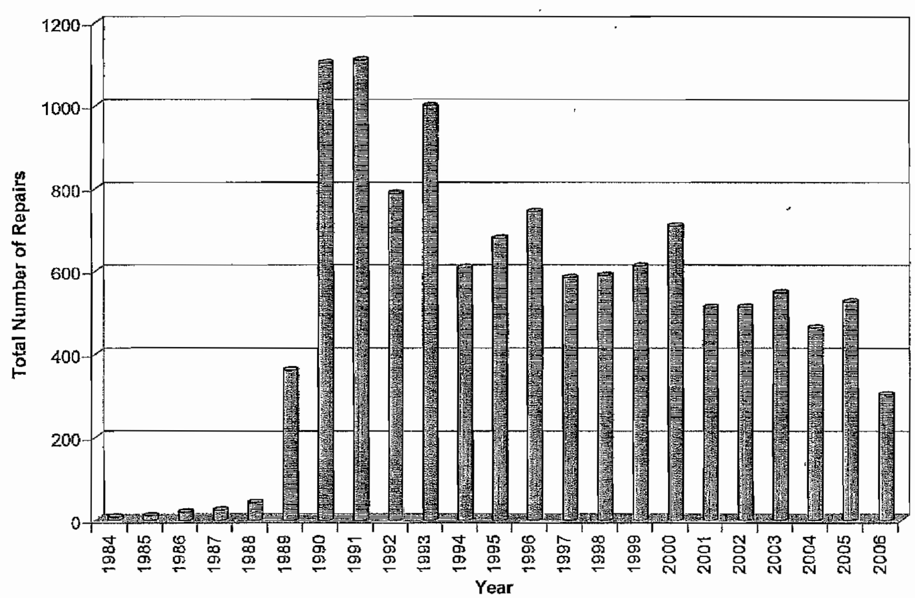
Pipe Diameter	Length in Distribution System (ft)	Percentage of Total Pipe
0.75	943	<1%
1	18,005	<1%
1.25	24,060	<1%
1.5	15,649	<1%
2	1,031,282	15%
2.25	109,770	2%
2.5	6,099	<1%
3	28,404	<1%
4	108,444	2%
6	1,826,100	26%
8	2,642,855	38%
10	42,663	1%
12	767,841	11%
14	1,706	<1%
16	230,017	3%

Table 2. Summary of Total Pipe Length by Diameter and Percentage Occurrence in Distribution System

Pipe Diameter	Length in Distribution System (ft)	Percentage of Total Pipe
18	173	<1%
20	71,904	1%
24	90,438	1%
30	28,930	<1%
36	3,857	<1%
42	750	<1%
54	1,163	<1%
Total	7,051,053	100%

Figure 1 shows that the overall trend in the number of breaks per year has been decreasing since 1991.

Figure 1. Number of Recorded Repairs 1984 Through 2006



Black & Veatch first examined in what size pipe breaking was most frequently. Figure 2 shows the correlation between break frequency and pipe size. Figure 2 shows that over the last twenty-two year period 50% of breaks have occurred in 2-inch pipe and another 22% in 2 ½ -inch pipe. These two, of the nineteen size categories alone represent approximately 72% of all main breaks in the system. Comparatively, these two size categories represent only 15% and 0.09% of total distribution system length respectively. Most notable is that the 2 ½ inch mains account for approximately 22% of the breaks, but are only 0.09% (6,099 ft) of the total distribution system. Figure 3 shows the comparison of relative system length and percentage of reported breaks. GIS records show that the materials of construction vary for the 2- and 2 ½-inch pipes. These materials and the identified length in the system are identified in Table 3.

Figure 2. Percentage of Total Reported Main Breaks By Pipe Diameter

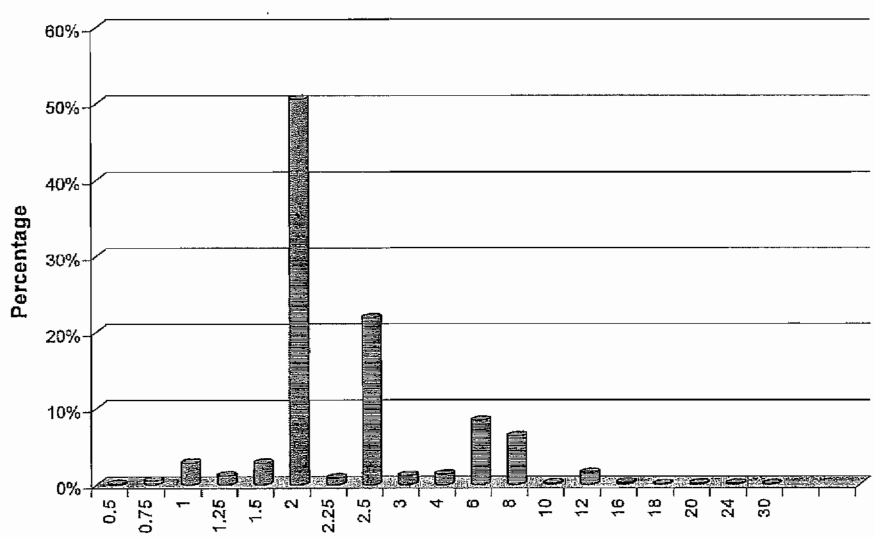


Figure 3. Comparison of Percentage of Main Breaks and Percentage of System Length By Pipe Size

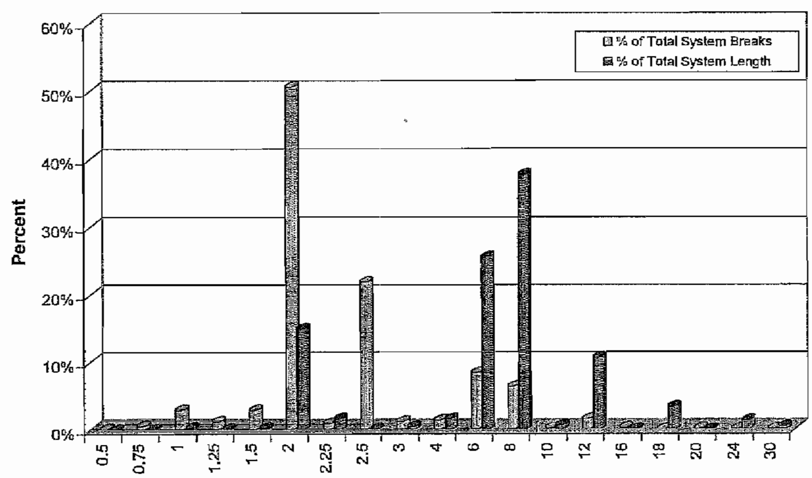
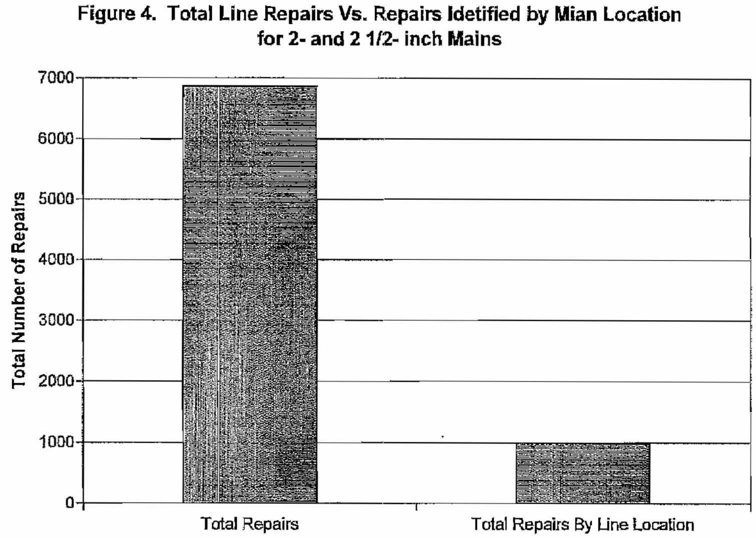


Table 3. 2- and 2 ½- inch Main Occurrence and Materials in the Distribution System

Pipe Material	Length of 2-inch mains in system (ft)	Length of 2 ½-inch mains in system (ft)	Total 2- and 2 ½-inch main length (ft)	Percent of 2- and 2 ½-inch mains to total system
Cast Iron	15,798	788	16,586	2 %
Cement Lined Cast Iron	733,089	457	733,546	71%
Copper	6,437	0	6,437	<1%
Ductile Iron	111	0	111	<1%
Galvanized Steel	196,563	345	196,908	19%
PVC	15,095	3,026	18,121	2%
Unidentified	63,756	0	63,756	6%
Total Length	1,030,849	6,099	1,036,948	
% of System Total	15%	0.09%	15.09%	100%

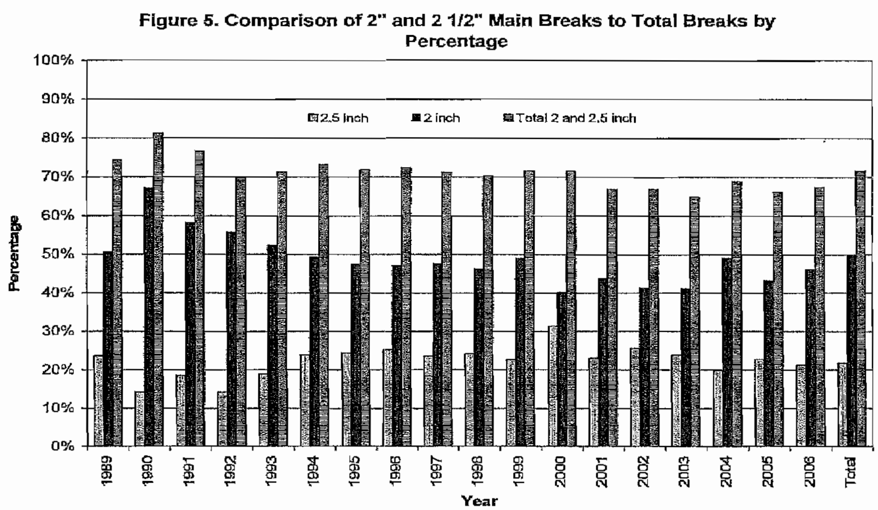
Given the high percentage of breaks in 2- and 2 ½-inch mains relative to the occurrence of the pipe size in the system, the main break database was investigated to uncover the extent of repeat breaks and repairs made to these two classes of pipe. The objective was not to identify multiple leaks at the same location, but multiple leaks along a continuous stretch of pipe. Using the available database, a continuous stretch of pipe was defined as a set of breaks reported at locations with a common street name. For example, the database listed four breaks at addresses on Worthington Street in 1991, 1993, 2005, and 2006. For the purposes of this evaluation these four breaks were assigned to "Worthington" as four repeat breaks. The assumption in sorting the data base in this manner was that the similar size pipe on a common name street was installed at generally the same time. It was also assumed that locations with a common street name were on a continuous stretch of pipe. It was understood that these assumptions may not be valid in all cases, but were reasonable for evaluating the data for correlations.

Using this approach, the database was modified by eliminating all repeat street name locations so that no street location was listed more than once. For example, in the "total break" data set the four Worthington Street locations constituted four breaks. In the "repeat break" data set those Worthington Street breaks were represented as a single entry. Figure 4 shows the results of this evaluation.



As shown in Figure 4, since 1984 the 2- and 2 ½-inch mains have accounted for nearly 7,000 repairs. If we apply the common water main assumption based on street name, had the 2-and 2 ½-inch mains been replaced with at least a 4-inch main after the first break, has many as 6,000 repeat breaks may have been eliminated. Considering the rate of breaks in 4-inch mains in the database it would not be unrealistic to assume at least 5,000 breaks could have been eliminated had the mains been replaced.

Because of the strong correlation between the pipe breaks and pipe size, the rate of 2- and 2 ½-inch breaks were compared to total system breaks of all sizes. Figure 5 shows that 2- and 2 ½-inch pipe classes consistently account for 50-65% of all pipe breaks on an annual basis.



Black & Veatch conducted a correlation analysis using break location and break frequency. Because of the disproportionate number of breaks in 2- and 2 ½- inch pipes in the database, the location and break frequency focused only on these size pipes.

Figure 6 represents the density of total main breaks across the system, the darker colors indicating the highest number of reported breaks. The figure represents total breaks whether they were first time breaks or repeat breaks. The main break database showed that 2- and 2 ½-inch breaks have been reported in all pressure zones with the exception of the Panorama, Hill Point, and Windy Hill zones. Of additional interest is that Figure 6 shows that the highest density of breaks has occurred in the western half of the East Ridge Zone, the Missionary Ridge Zone and the eastern edge of the Citico Zone. This finding is of value when the typical service pressures for these zones are reviewed.

Table 4 lists the available field recorded service pressures in the distribution system from highest to lowest pressure. As the table shows, the Missionary Ridge and Hill City service areas where concentrations of breaks, repeat breaks and small main breaks have occurred correspond with service pressures of 150 psi or greater and system age. Service areas such as Citico do not correspond to service pressures, but do correlate a concentration of breaks with system age.

Table 4. Listing of Available Field Recorded Service Pressures

Pressure Zone	Maximum Service Pressure (psi)	Pressure Zone	Maximum Service Pressure (psi)
Lookout Mountain	300	Suck Creek	146
Missionary Ridge	220	Hill Pointe	144
Elder Mountain	215	Crestwood	106
St Elmo	210	Panorama	100
Hill City	172	Lone Oak	96
Rossville	155	Stuart Heights	90
East Ridge	140	Citico	125
Ryall Spring	150	Minnekahda	62

Based on this comparative analysis of the available data the following recommendations have been developed to address main breaks and non-revenue water loss in the distribution system:

- Continue full system leak detection survey program. Link results of leak detection with replacement 2 and 2 ½ inch replacement prioritization process. Augment leak detection data base with information on size, type, and cause of leak.
- Roll in findings of leak detection survey and develop a prioritized plan to replace all 2- and 2 ½ -inch service mains through a combination of main break response and pro-active replacement.

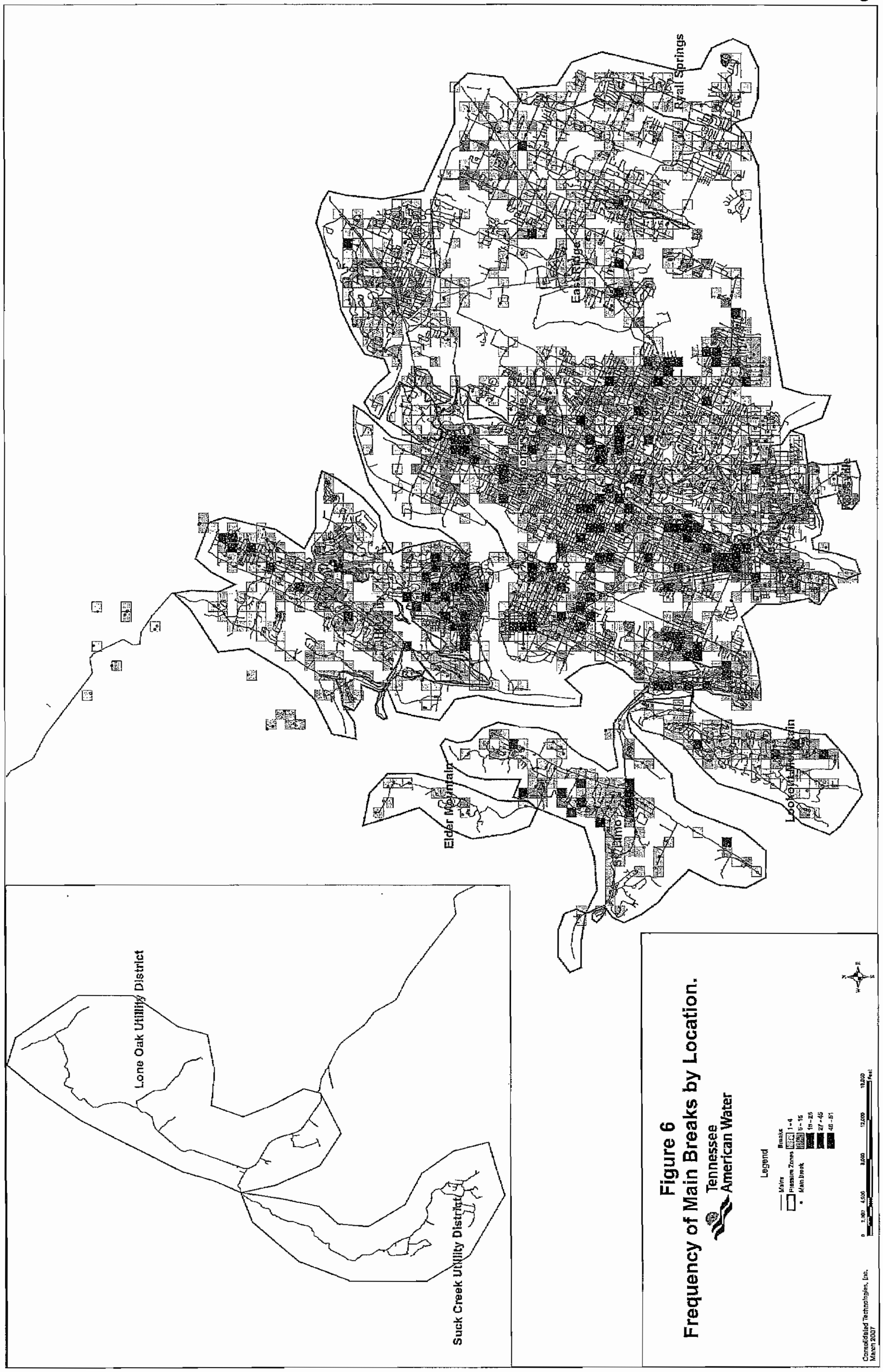


Figure 6
Frequency of Main Breaks by Location.

- It is recommended that TAWC develop a simple prioritization scoring matrix using available data and the criteria or criticality, consequence, zone pressure, and previous breaks. This can be accomplished by creating a composite score for each 2 and 2 ½ pipe in the system. The following scoring system is recommended:

Criteria	Description	Points
Criticality	Health care customer w/o redundant supply	10 points
	Non-health care w/o redundant supply	5 points
	Health care with redundant supply	3 points
	Non-health care with redundant supply	1 point
Consequence	High consequence resulting from loss of service	3 points
	Medium consequence resulting from loss of service	2 points
	Low consequence resulting from loss of service	1 point
Zone Pressure	Greater than 230 psi	4 points
	180-229 psi	3 points
	130-179 psi	2 points
	80-129 psi	1 point
Previous breaks	Greater than 3 breaks	3 points
	Two breaks	2 points
	One break	1 point

All scores are summed and the highest score represents the highest priority, lowest score the lowest priority. This will provide a beginning point and should only be used as a guide. Since all of the 2 and 2 ½ pipe should be replaced, if an opportunity to replace a lower priority location along with other activities it is recommended that pipe be replaced at that time.

- Develop a comprehensive main break database that includes the following information:
  - Installation date
  - Size
  - Manufacturer
  - Installation bedding material
  - Pipe material
  - Installation depth
  - Location
  - Adjacent pipe materials and ages
  - Operating pressure
  - Ground temperature
  - Soil conditions
  - Internal/external pipe condition

- Link the pipe break database with GIS so when a main break is reported, main break history is available for input into deciding whether to repair or replace.

- Make appropriate operational and infrastructure changes to reduce service pressures. This step may reduce the frequency of breaks and well as reduce non-revenue water loss through yet to be detected leaks.

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Technical Memorandum #2 – Strategy Analysis

Non-Revenue Water Loss Reduction – Sub-Meter Zones

Prepared for

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Black & Veatch Project No.:	145895 / CTI Project No. C06070-2

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SUB-METER ZONES

Summary

This technical memorandum provides the following:

- Objectives for creating sub-metering zones
- Description of specific locations for sub-metering stations and isolation valves along with maps and criteria for site selection (Special attention was given to areas exhibiting a history of main breaks. Trend results from the Main Break Analysis [Tech Memo #1] and Surge Analysis [Tech Memo #4] were used to identify areas having high potential for non-revenue water [NRW].)
- List of maximum and minimum flows for each new sub-metering station calculated by network hydraulic model
- Description of potential negative effects on TAW network due to sub-meter zones, including pressure, fire flows, and water quality, based on network hydraulic model results
- Estimates of capital and operational costs associated with new sub-metering stations
- Drawings outlining boundaries of new and/or expanded sub-metering zones

Sub-Meter Zone Objective

The most important goal in dividing the distribution system into sub-metering zones is to facilitate the detailed monitoring and control of NRW. With detailed monitoring of flow in and out of sub-meter zones, nighttime demand patterns can be determined, any significant changes in these patterns (due to main breaks, etc.) can be detected, and breaks can be repaired quickly. The duration of the leakage is the most significant factor in the quantity of water lost due to line breaks; therefore early detection and repair are critical. With sub-meter zones, network personnel can determine not only when a new break occurs, but also approximately where the break is located.

Other unmetered flows from fire flows, system flushing, and network maintenance can also be identified and quantified for accounting purposes. In addition, overall network performance and usage patterns can be better monitored with sub-meter zones. The addition of flow meters at the locations described in this memorandum will assist in improving the accuracy of the TAW network hydraulic model. The model will, in turn, assist TAW in improving service and water quality and in planning for future improvements.

Steps involved in selecting sub-meter zone locations include: 1) Identifying locations where metering of network flow is already in place; 2) Identifying locations where existing zones are currently unmetered; and 3) Determining locations where new sub-metering zones would be beneficial.

Existing Locations of Sub-Metering Stations

Major Pump Stations

All of TAW's 13 major pumping stations and all high service pumps at the Citico Water Treatment Plant are equipped with flow meters; however, not all of the flow is metered at the Hill City station. Also, one of the existing meters was recently found to produce incorrect flow values, and needs to be repaired or replaced. (This discovery was made during calibration of the TAW IDSE hydraulic model by CTI personnel.) All flow meters are monitored remotely via the TAW SCADA system. Table 1 lists the major pumping stations and the individual meters.

Table 1 - List of Pump Stations with Existing Flow Meters

Pump Station Name	Meter Name
East Brainerd	East Brainerd
East Ridge	East Ridge A East Ridge B East Ridge C East Ridge D
Elder Mountain	Elder Mountain
Elmendorf	Elmendorf
Hill City (Note: One additional meter is needed at this station and one meter needs replacement)	Hill City 12 inch Hill City 16 inch
Lookout Mountain	Lookout Mountain A Lookout Mountain B
Mission Ridge	Mission Ridge A Mission Ridge B
New York	New York
Rossville	Rossville
Ryall Springs	Ryall Springs
South Mission	South Mission A South Mission B
St. Elmo	St. Elmo A St. Elmo B
Walden's Ridge	Walden's Ridge
Citico Water Treatment Plant	HS Pump 11 HS Pump 16 HS Pump 17 HS Pump 18 HS Pump 19 HS Pump 20

It is recommended that two additional meters be installed at the Hill City station.

Remote Read Customer Consumption Meters

TAW has installed wireless data loggers which transmit flow information via cellular phone on approximately 132 flow meters within the system. These data loggers are named "Meter-Master Cello" by their manufacturer, F. S. Brainard Company. They are installed on a range of customer sizes, from the largest to smaller ones. By installing the "cellos," TAW has in effect created 132 sub-metering zones. This should eventually provide TAW with a good source of useful information that could be incorporated into the SCADA system equations for calculating on a real-time basis the quantity of water being consumed in each pressure zone. The data could also be used to determine the approximate NRW water in each zone. However, the current technology needs improvement to become more consistently reliable, with less loss of communication and data. Additional meters on the largest customers could be retrofitted with remote monitoring equipment after the technology improves.

Other Existing Sources of System Flow Information

Tank Levels

TAW currently has potential flow monitoring capabilities at its storage tanks via information on changes in tank water levels. There are 17 existing tank level transducers within the TAW system which are remotely monitored by the TAW SCADA system. Changes in tank levels represent flows into or out of the distribution system. These flows represent sub-meter zones that can be utilized to determine nighttime demand patterns and NRW. Flows can be calculated automatically once the appropriate equations are programmed into the SCADA system (with each tank's dimensions and the changes in tank level over known time increments). These calculations are not currently performed by TAW but were conducted by CTI to determine diurnal flow patterns for the USEPA IDSE hydraulic model. It is recommended that the necessary calculations be programmed into the TAW SCADA system. This will allow these flows into and out of all storage tanks to be included in the calculation of the baseline nighttime flows. Table 2 lists the tank levels currently being monitored by the SCADA system.

Table 2 - Existing Tank Level Meters (Transducers)

Existing Tank Level Meters (Transducers)
East Brainerd Tank
East Ridge Reservoir
Elder Mountain Tank
Elder Mountain Receiving Tank
Lookout Mountain Tank
Lookout Valley Tank
Mission Ridge 2 Tank
Mission Ridge Triple Tank
Mountain Creek Tank

Existing Tank Level Meters (Transducers)
North End Tank
Red Bank Tank
Ryall Springs Tank
South Mission Ridge Tank
South End Tank
St. Elmo Tank
Walden's Ridge Tank
White Oak Tank

Proposed Locations For Sub-Meter Stations

Minor Pump Stations

None of the 15 minor pumping stations have flow meters. Table 3 lists these stations. Metering of these stations would not only provide excellent sources of sub-metered flow, it would also provide very useful information regarding the performance of the station's pumps.

Table 3 - List of Minor Pump Stations (Currently do not have flow meters)

Pump Name	Street Address	Suction Pressure Zone	Discharge Pressure Zone	Pump Number
Berkley Circle	Berkley Circle	Hill City	Berkley Circle	1
Crestview	Knollwood Drive	Hill City	Crestview	1, 2
Crestwood	Crestwood Avenue	Hill City	Crestwood	1, 2
Cumberland Rd.	Cumberland Road	St. Elmo	Elder Mountain	1
Johnson Blvd.	Johnson Blvd. & Dayton Blvd.	Hill City	Johnson Blvd.	1
Maple Hill	Cummings Highway & Kelley's Ferry	St. Elmo	Maple Hill	1, 2
Minnekahda	Minnekahda Drive	Hill City	Minnekahda	1, 2
Panorama	East Brainerd Rd.	East Ridge	Panorama	1, 2
Red Bank	Pickering Ave.	Hill City	Hill City (White Oak)	3, 4
Rolling Acres	Cummings Highway & Old Kelly's	St. Elmo	Rolling Acres	1, 2
South End	Bedford Street & Dayton Street	(South End Reservoir)	Citico	1, 2
Stuart Heights	Ozark Circle & Haywood	Hill City	Stuart Heights	2

Pump Name	Street Address	Suction Pressure Zone	Discharge Pressure Zone	Pump Number
Summit Ave.	Summit Ave. & Dayton	Hill City	Summit Ave.	1
Windridge	Pineville Rd.	Hill City	Windridge	1, 2, 3
Windy Hill	Windy Hill	Ryall Springs	Windy Hill	1

To reduce NRW by creating additional sub-metering zones, it is recommended that flow meters be installed at all of the above 15 pumping stations. Our opinion of the installed costs for these additional meters, including materials, labor, etc., for the meter, enclosure, electrical, and telemetry connection costs are shown in Table 4. The additional operational costs would be negligible.

Table 4 - Booster Pump Station Upgrade

Flow Meter Installation

Station	Pipe Size (inches)	Total
Berkley Circle	8	$14,277
Crestview	6	12,462
Crestwood	6	12,462
Cumberland Rd.	6	12,462
Johnson Blvd.	2	8,771
Maple Hill	4	10,358
Minnekahda	3	9,564
Panorama	6	12,462
Red Bank	12	18,833
Rolling Acres	8	14,277
South End	24	13,257
Stuart Heights	2	8,771
Summit Avenue	2	8,771
Windridge	8	14,277
Windy Hill	4	10,358
	TOTAL	$181,362
*Costs include meter, valves, enclosure, electrical, labor, and contingencies.		

Existing Pressure-Reducing Valves

Pressure-reducing valve (PRV) locations can be utilized to measure flow into zones which have been separated to reduce operating pressure to an acceptable service range. PRV's can be equipped with flow meters so that they serve a dual purpose of reducing pressure and sub-metering.

There are 15 PRV's in the TAW system, as listed in Table 5.

Table 5 - List of Existing TAW PRVs and Costs of Adding Flow Meters

Street Address/Location	Size (Inches)	Type & Operating Range	Cost for Flow Meter Addition*
Woodnymph Tr @ Fairydell Tr.	6	CLA-VAL 30-300 psi	5,000
	2	Cash-Acme	6,000
Woodnymph Tr. South of Lula Lake Road	1 ½	Cash-Acme	6,000
Scenic Hwy @ Winterview Lane	2	Cash-Acme 400 psi	6,000
Hardy Trail	8	CLA-VAL 30-300 psi	5,000
Bonnieville Circle & Brown Ferry Road		Cash-Acme	6,000
Andrea Dr. @ Boydston Dr.	2		6,000
E. 51st St. @ 17th Ave.	6	CLA-VAL 30-300 psi	5,000
E. 51st St. @ 17th Ave.	2	Cash-Acme 75-150 psi	6,000
E. 51st St. @ 17th Ave.	2	Ueller 25-84 psi	6,000
Rossville Booster Station	8	CLA-VAL 30-300 psi	5,000
Rossville Booster Station	2	CLA-VAL 30-300 psi	5,000
400 Block Thompson St.	2	Cash-Acme 75-150 psi	6,000
Signal Mountain Rd. @ Signal Mountain Receiving Tank	8 REL/SUS	CLA-VAL 20-200 psi	5,000
Signal Mountain Rd. @ Russel St.	6	CLA-VAL 30-300 psi	5,000
* Note: Costs are for materials only.			

None of the above PRV's listed have flow meters at the present time. CLA-VAL manufactures a device which could be used to retrofit its PRV's such that they would also meter flow. Many of the TAW PRV's are made by CLA-VAL, and these could be retrofitted to measure flow for approximately $5,000 each; alternately, they could be simply be replaced with a newer version which also measures flow for approximately $6,000 each. If the PRV cannot be retrofitted with a flow meter, it would be less expensive to replace the PRV with a newer one equipped with a flow meter than to add a flow meter to the PRV installation. This is because in most cases a new concrete enclosure would be required to access and maintain the new flow meter.

Proposed Pressure-Reducing Valves

Technical Memorandum No. 3 recommends six new PRV locations, including two in the South Mission Ridge pressure zone, one in the Lookout Mountain zone, and three in the St.

Elmo zone. Two additional potential locations have a lower priority and may be considered in the future (one each in the East Ridge zone and Mission Ridge zone). It is recommended that all new PRV's be equipped with flow measuring devices built internally. Location maps for the proposed PRVs are found in Technical Memorandum No. 3. The approximate cost for each of these PRV's equipped with flow meters would be $6,000.

Additional Sub-Meter Zones

CTI has reviewed the hydraulic model for this system in light of the above discussion and the "Main Break Analysis" in Technical Memorandum No. 1. We have identified four additional sub-meter zones which could be created within the areas with the highest number of main breaks. These four new zones are shown on the figure entitled "Sub-Meter Zones." These areas would be separated by installing flow meters at key locations to monitor flow into or out of these zones. Using this method of zone separation, no additional closed valves would be required. Therefore, there would be no negative impact on service in the area, including pressure, fire flow, or water quality. In order to minimize costs, insertion type meters and wireless reporting capabilities are recommended at the locations indicated. The opinion of capital cost to create these additional zones is $ 9,000 per metering station.

Summary Of Sub-Meter Zones

Following is a summary of existing and proposed sub-metering zones:

Existing pressure zones	27
Existing "Cello" consumption meter zones	132
Proposed new PRV zones	6
Proposed new sub-meter zones	4
TOTAL existing and proposed sub-meter zones	169

Maximum and Minimum Flows For Each Sub-Metering Station

The maximum and minimum flows for each sub-metering station, where meters do not already exist, have been calculated by the network hydraulic model which was created for IDSE compliance. A list of the largest of these flows is provided in Table 6 and 7 below.

Table 6 - Maximum and Minimum Flows for Pumps and PRVS

	Maximum Flow (gpm)	Minimum Flow (gpm)
Berkley Circle Pump Station	100	8
Crestview 1	250	0
Crestview 2	250	0
Crestwood 1	377	346
Crestwood 2	200	0
Cumberland Road	122	28
Hill Pointe	9	7

SUB-METER ZONES

	Maximum Flow (gpm)	Minimum Flow (gpm)
Johnson Boulevard Pump Station	30	2
Maple Hill	50	1
Minnekahda	200	7
Panorama 1	150	0
Panorama 2	100	0
Maple Hill	50	0
Minnekahda 2	150	0
Red Bank 3	1,395	0
Red Bank 4	800	0
Rolling Acres 1	125	0
Rolling Acres 2	125	0
South End Pump Station 1	3,880	0
South End Pump Station 2	2,800	0
Stuart Heights	72	11
Summit Avenue	30	1
Windridge 1	200	0
Windridge 2	200	0
Windridge 3	1,000	0
Windy Hill	30	11
PRVs		
Existing Lookout 6-inch	114	45
Existing Lookout 6-inch	14	5
Existing Lookout 6-inch	0	0
Existing Lookout/St. Elmo 6-inch	29	11
Existing Citico 2-inch	652	469
Existing Citico 6-inch	652	469
Existing Mission Ridge 2-inch	3	2
Existing Signal Mountain 6-inch	0	0
Existing Suck Creek 6-inch	28	20
Proposed SMR 3-inch	180	88
Proposed SMR 8-inch	157	76
Proposed St. Elmo North 6-inch	627	220
Proposed St. Elmo North 2-inch	7	3
Proposed St. Elmo South 8-inch	335	243
Proposed East Ridge 12-inch	1,356	0
Proposed Lookout 6-inch	220	87
Proposed Hill City 6-inch	78	56
Proposed Mission Ridge 6-inch	72	0

Table 7 - Maximum and Minimum Flows for Insertion Meters

Meter No.	Maximum Flow PRV (gpm)	Minimum Flow PRV (gpm)	Diameter (inches)	WaterGEMS Label
1	52	22	6	P-21
2	325	147	12	P-14
3	1,138	233	16	P-48
4	1,469	447	24	P-12
5	2,777	800	30	P-16
6	2,039	1,222	30	P-18
7	2,200	863	24	P-24
8	4,872	3,151	30	P-45
9	278	149	10	P-25
10	984	492	24	P-20
11	381	8	12	P-10
12	750	331	8	P-29
13	226	136	6	P-36
14	3,488	2,585	20	P-44
15	2,055	1,521	16	P-41
16	1,370	991	12	P-40
17	526	153	12	P-28
18	2,216	1,470	16	P-34
19	198	130	6	P-32
20	565	358	12	P-38

Potential Negative Effects On TAW Network Due To Sub-Meter Zones

The potential negative effects on TAW network due to sub-meter zones including pressure, fire flows, and water quality were reviewed utilizing the network hydraulic model. The effects vary by type and location of sub-metering zone as described below:

- ***Sub-meter zones created by existing pumping station service areas:*** For existing metering zones, no negative effects will be created by the addition of flow meters.
- ***Sub-meter zones created by adding flow meters to existing PRV's or replacing PRV's:*** Since these metering zones are existing, no negative effects will be created by the addition of flow meters.
- ***Sub-meter zones created by adding new metering PRV's:*** Service pressures will, of course, be reduced in these new zones; however, the loss of water due to leakage from new or existing main breaks will also be reduced. Maximum fire flows will likewise be reduced, but not below acceptable standards. Care was taken in the creation of these zones to make certain that minimum flow and pressures could be maintained. Likewise, water quality would be not be affected significantly, since water ages in these areas did

not change appreciably according to the network hydraulic model. These impacts were studied and reported in more detail in Tech Memo No. 3.

- *New sub-meter zones:* Since these new areas would be separated and monitored by installing flow meters at key locations without closing any valves, there would be no impact on service pressure or fire flows.

In summary, it is our opinion that the addition of the flow meters and sub-metering zones discussed in this memorandum will provide immediate and long-term benefits to TAW, including the reduction of sufficient NRW to pay for the new meters. Additionally, the knowledge gained about the consumption and loss of water throughout its network will assist TAW in improving its service, water quality, and ultimately customer satisfaction.

Technical Memorandum #3 – Strategy Analysis

Non-Revenue Water Loss Reduction – Reduced Pressure Zones

Prepared for

Tennessee American Water

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Submittal Date:	October 2007
Black & Veatch Project No.:	145895 / CTI Project No. C06070-2

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REDUCED PRESSURE ZONES

Introduction

The purpose of this memorandum is to identify areas of the Tennessee American Water (TAW) system where distribution pressures can be reduced in order to decrease non-revenue water (NRW). Typically, distribution systems are operated in such a way as to provide good service pressure during peak demand periods; however, during low demand periods this same pressure can put strain on the system, especially in lower elevations and areas with dynamic topology. It has been demonstrated that leakage flow rates are proportional to the pressures applied by pumps or by elevation head. The frequency of new main breaks can also be affected by pressure. Therefore, pressure management is an important factor in decreasing NRW. Reducing distribution system pressure is a preventive measure that can decrease leakage and main breakage without negatively impacting level of service or operational protocols.

Because of the variance of the topology in the TAW system, extreme high and low pressures can be difficult to isolate and stabilize. Table 1 shows the elevation ranges found in a few major pressure zones. TAW desires to keep minimum service pressures at 40 pounds per square inch (psi) and maximum pressures at 180 psi, while keeping fire flow at a minimum of 500 gallons per minute (gpm) with 20-psi residual pressures.

Table 1 – Minimum and Maximum Ground Elevations by Pressure Zone

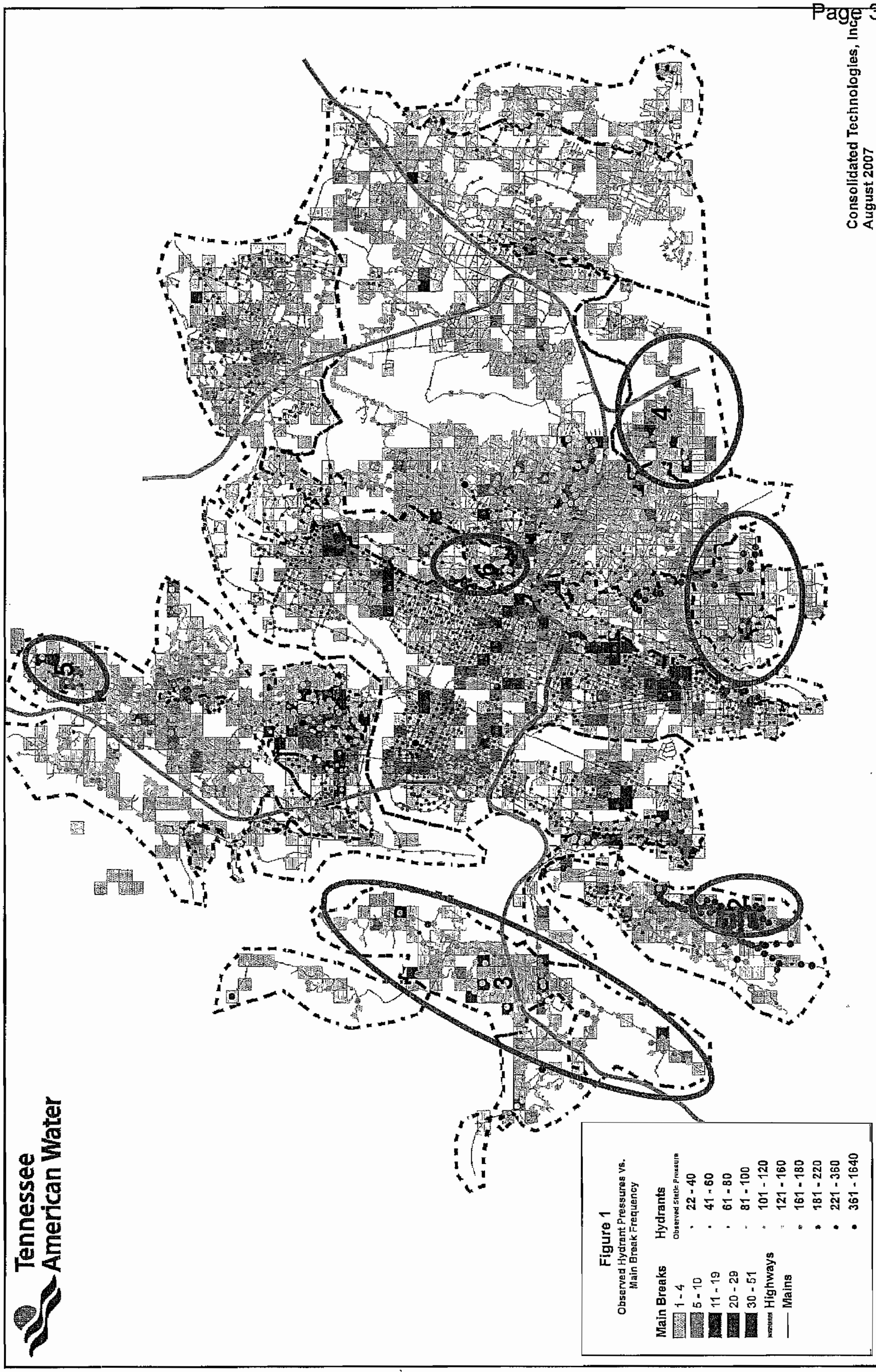
Pressure Zone	Minimum	Maximum
Mission Ridge	656'	1152'
Lookout Mountain	766'	2150'
St. Elmo	644'	1035'
Hill City	640'	1029'
East Ridge	650'	1000'

Identifying Potential Reduced Pressure Zones

Potential reduced pressure zones (RPZ) were determined based on three factors:

- High-pressure areas.
- Frequency of main breaks.
- Ease of zone isolation.

Areas of high pressure were located using TAW's database of observed hydrant pressures (Figure 1), which are recorded annually. Comparison of this data with the hydraulic model predictions resulted in a good correlation (Figure 2). Next, main break data was checked for the high-pressure areas to determine a relationship between water loss and high pressures. The third factor used in determining possible RPZ areas was ease of zone isolation, pressure-reducing valve (PRV) placement, and closed valve locations. Priorities were given to areas with the most breaks and highest pressures, then to the areas with the least complicated isolation. The selected areas can be seen on Figure 1 on the following page.


Tennessee American Water
Figure 1
Observed Hydrant Pressures vs. Main Break Frequency
Main Breaks
1 - 4
5 - 10
11 - 19
20 - 29
30 - 51
Highways
Mains
Hydrants
Observed Static Pressure
22 - 40
41 - 60
61 - 80
81 - 100
101 - 120
121 - 160
161 - 180
181 - 220
221 - 360
361 - 1640
1
2
3
4
5
6
Consolidated Technologies, Inc
August 2007

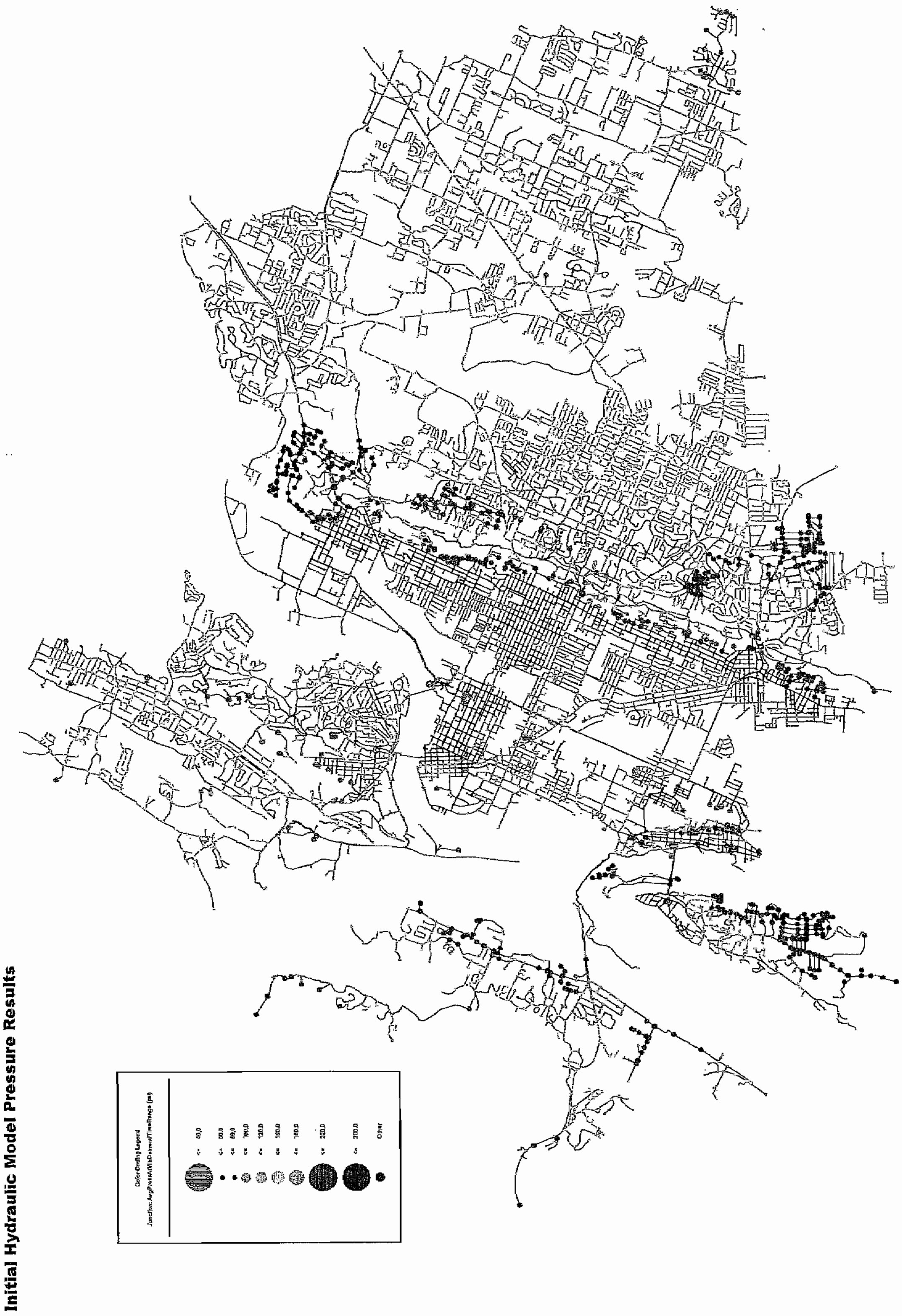


Figure 2
Initial Hydraulic Model Pressure Results

Using the TAW hydraulic distribution model, CTI compared pressures and fire flow capabilities before and after installation of PRVs. The 24-hour hydraulic simulation included a diurnal curve. Pressures at the lowest demand period (2 a.m. to 5 a.m.) were used to determine high-pressure areas. Minimum, maximum, and average pressures at junctions in the RPZ were compared before and after PRV installation. Minimum fire flow and residual pressures were checked in each area after the RPZ was created.

Subsequent sections evaluate the following areas as potential RPZs:

1. South Mission Ridge
2. Lookout Mountain
3. St. Elmo
4. East Ridge
5. Hill City
6. Missionary Ridge

RPZ No. 1 - South Mission Ridge

The first RPZ evaluated was the South Mission Ridge area, which is noted as having possible surge issues (Area No. 1 on Figure 3). As recommended in Technical Memorandum No. 4, two PRV's were simulated to reduce pressure in this area. Figure 3 displays the placement of the two proposed PRV's and the proposed closed valve used to isolate this RPZ. Valves not labeled are existing closed valves. (Refer to Figure 2 for the junction pressure color coding legend.) These PRV's were set at a hydraulic grade line (HGL) of 1,140 feet to isolate the area and reduce pressures while still maintaining the required minimum pressures and fire flows. PRV 1 was set at an 8-inch diameter located in an 8-inch-diameter line, while PRV 2 was set at a 3-inch diameter in a 6-inch line. Table 2 shows the reduction in pressure, and Table 3 demonstrates that all hydrants meet minimum TDEC fire flow requirements.

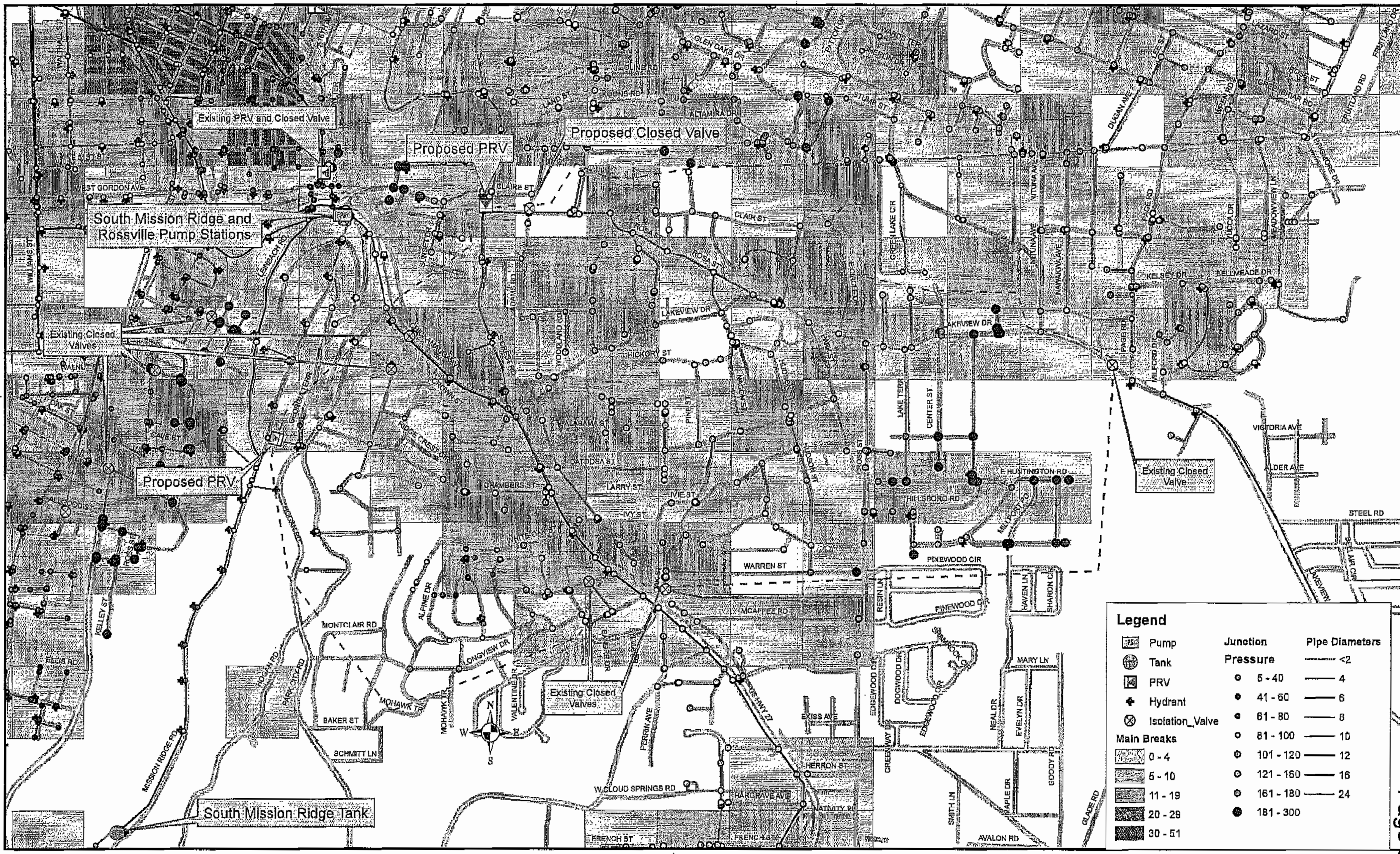
Table 2 - Pressures for RPZ No. 1 – South Mission Ridge Area

Pressure	Before PRV (psi)	After PRV (psi)
Minimum	74.3	43.3
Maximum	221.0	189.5
Average Zone	164.1	134.4

Table 3 - Minimum Fire Flow Results for RPZ No. 1 - South Mission Ridge Area

Node Label	Elevation (ft)	Static Pressure (psi)	Fire Flow Available (gmp)	Fire Flow Minimum Needed (gpm)	Pressure (Calculated Total Residual Lower Limit, psi)
21455	820.7	136.2	1039.45	500	102.2

Figure 3 - RPZ No. 1 -- South Mission Ridge Pressure Results



RPZ No. 2 - Lookout Mountain

Proposed RPZ Area No. 2 is on Lookout Mountain, where pressures are currently above 250 psi in certain areas. One 6-inch PRV was simulated on the north side with an HGL setting of 2020 feet and five closed isolation valves. This provided the largest area of reduced pressures with the fewest configuration changes. Isolation of areas north of the new RPZ was not possible without major configuration changes, and pressure reductions to the south provided inadequate fire flow results at higher elevations. Average pressures in this area were reduced by 40 percent. Figure 4 shows the PRV placement and isolation valves for this scenario.

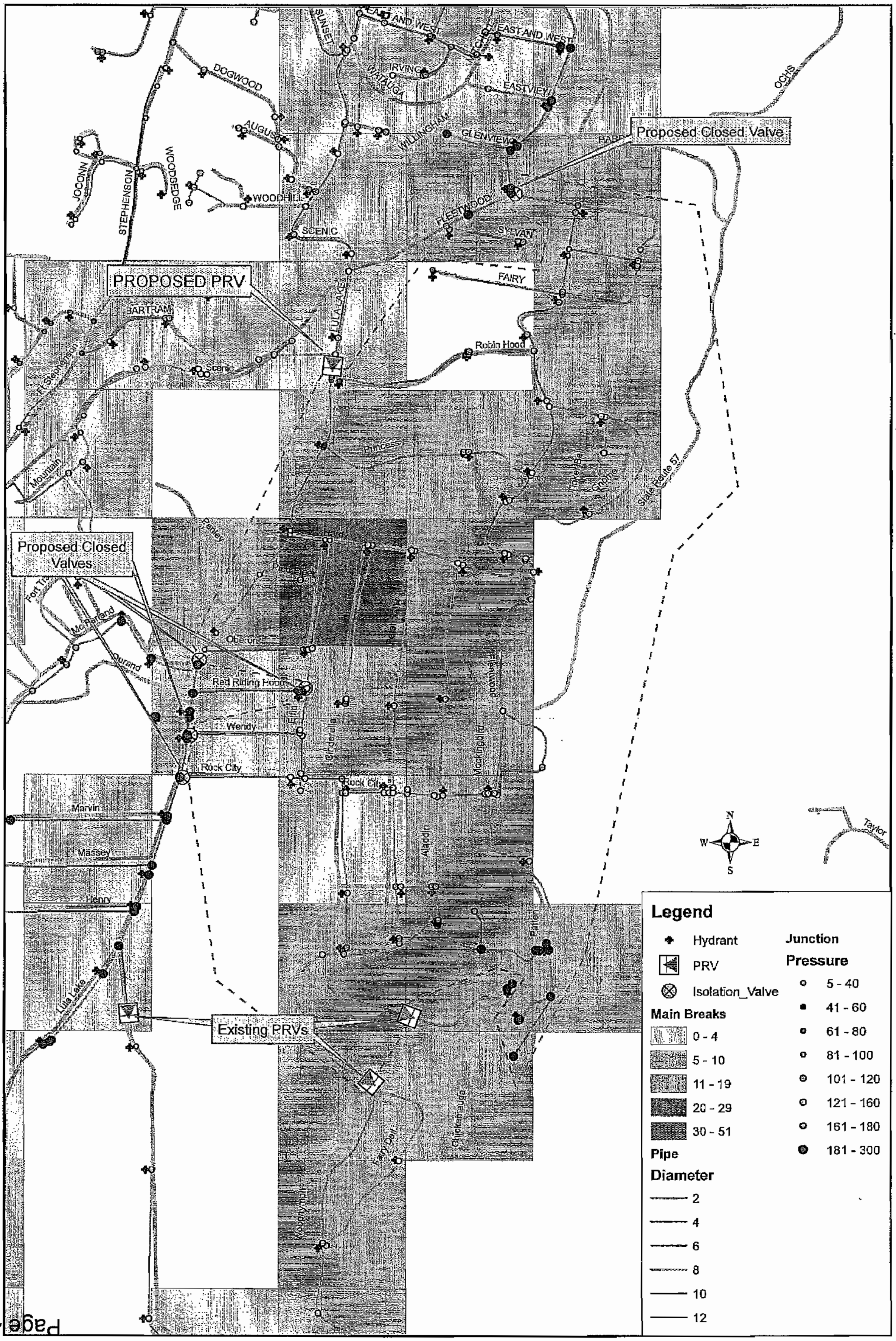
Table 4 - Pressures for RPZ No. 2 – Lookout Mountain

Pressure	Before PRV (psi)	After PRV (psi)
Minimum	157.9	65.1
Maximum	300.6	206.8
Average Zone	229.8	135.9

Table 5 - Minimum Fire Flow Results for RPZ No. 2 – Lookout Mountain

Node Label	Elevation (ft)	Static Pressure (psi)	Fire Flow Available (gmp)	Fire Flow Minimum Needed (gpm)	Pressure (Calculated Total Residual Lower Limit, psi)
20865	1,821.90	82.9	525.89	500	25

Figure 4 - RPZ 4 -- Lookout Mountain Pressure Results



RPZ No. 3 – St. Elmo

RPZ Area No. 3, the St. Elmo Pressure Zone, was chosen mainly for the number of breaks and the relatively high pressures. Essentially, two RPZs have been isolated - north and south. Two PRV's were simulated on the north side, with an HGL setting of 973.3 feet and five closed isolation valves. PRV 1 has a 6-inch diameter and PRV 2 has a 2-inch diameter. PRV 3 has a 6-inch diameter simulated on the south side with an HGL setting of 862.8 feet. Three isolation valves were closed for the south side zone. The large mains going through the center of the pressure zone were left open to maintain the Lookout Valley Tank levels and HGL.

Minimum pressure for this area was found to be lowest at the junction prior to the Elder Mountain Pump Station, at 6.7 psi even before the PRV's were added (Table 6). Because the PRV's had little or no effect on the minimum pressure, the PRV's were assumed to be acceptable. Table 7 shows that the fire flows are adequate. Average pressures in this area were reduced by 24 percent, mostly in areas of frequent breakage. Figure 5 shows PRV placement and isolation valves, and Figure 6 shows the pressure results for the entire area.

Table 6 - Pressures for RPZ No. 3 – St. Elmo

Pressure	Before PRV (psi)	After PRV (psi)
Minimum	6.7	7.4
Maximum	186.2	174.8
Average Zone	155.8	118.0

Table 7 - Minimum Fire Flow Results for RPZ No. 3 – St. Elmo

Node Label	Elevation (ft)	Static Pressure (psi)	Fire Flow Available (gmp)	Fire Flow Minimum Needed (gpm)	Pressure (Calculated Total Residual Lower Limit, psi)
9880	830	55.6	719.15	500	34.7

Figure 5 - RPZ No. 3 -- St. Elmo Pressure Zone PRV and Closed Valve Placement

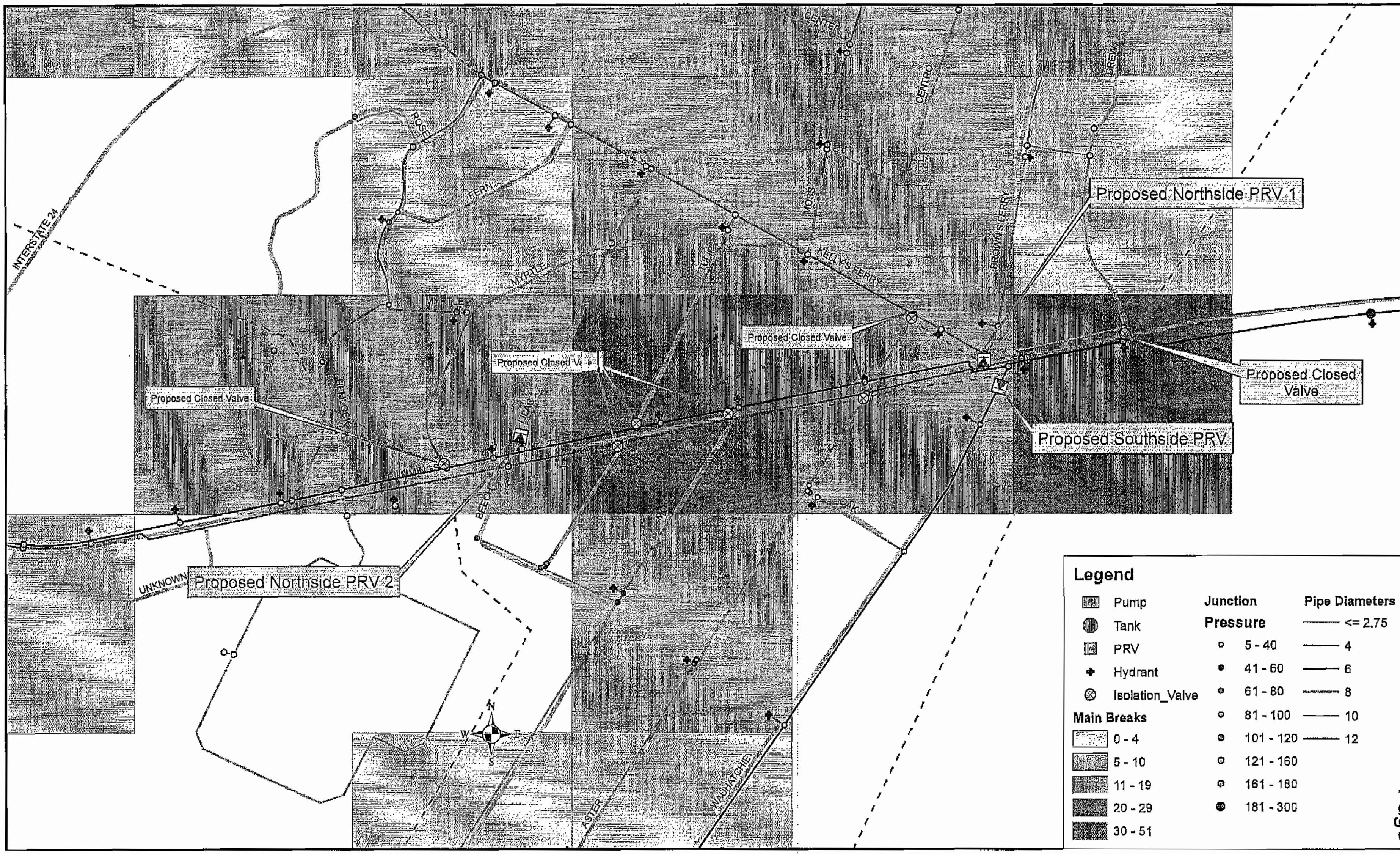
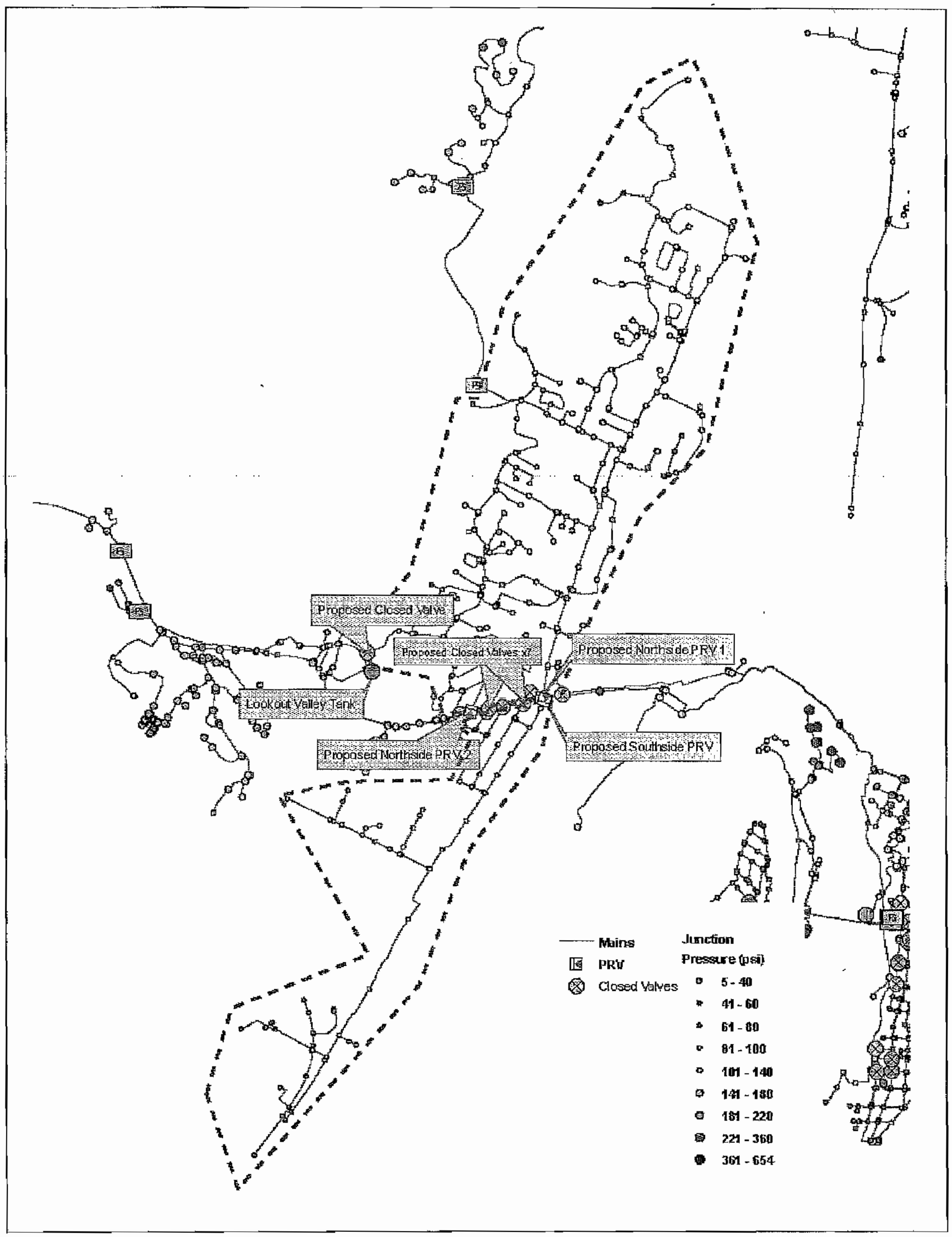


Figure 6 - RPZ No. 3 – St. Elmo Pressure Zone Pressure Results



Figures 7 and 8 demonstrate the HGL changes of the two tanks in the St. Elmo pressure zone resulting from the proposed PRV's and closed valves. The timing of filling/emptying is somewhat affected in the Elder Mountain Receiving Tank. However, the Lookout Valley Tank seems minimally affected, and both tanks still function with their required capacity.

Figure 7: Elder Mountain Receiving Tank Hydraulic Grade-Line Graph

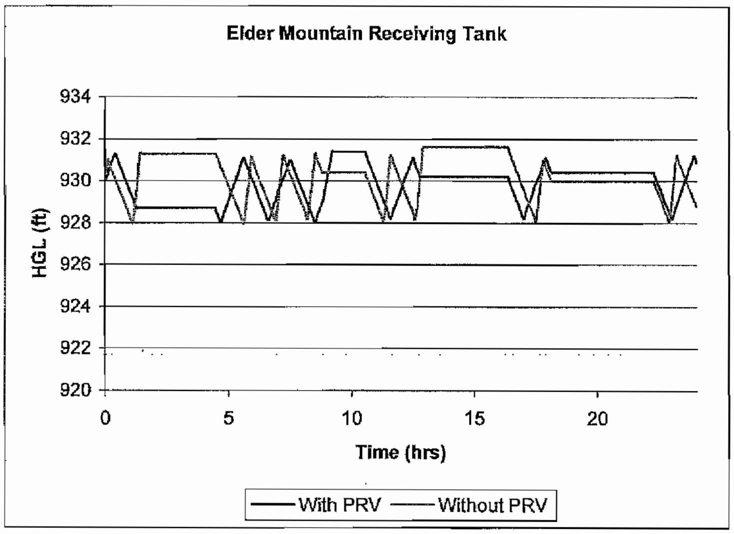
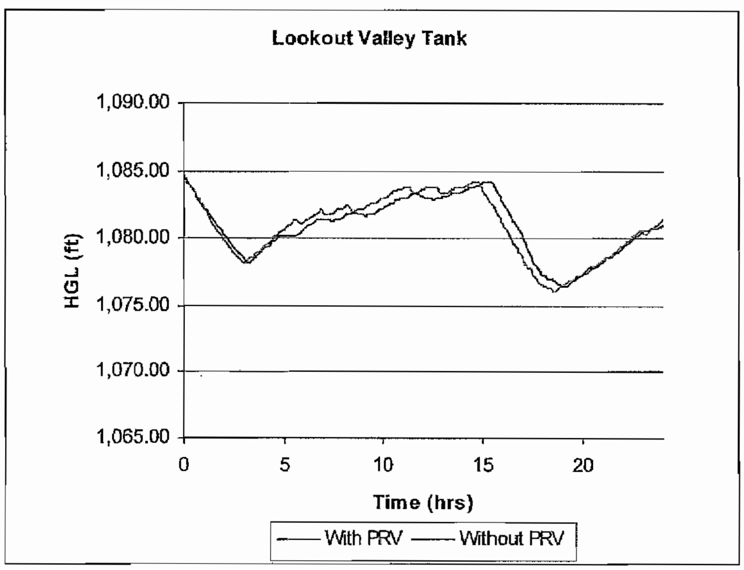


Figure 8: Lookout Valley Tank Hydraulic Grade-Line Graph



RPZ No. 4 – East Ridge

Area No. 4, the East Ridge Pressure Zone, was also chosen for its excessive number of breaks and relatively high pressures. One 12-inch PRV was simulated on the west side with an HGL setting of 895 feet, and only one valve required closing on the upstream side. No valves were closed on the downstream side, since this did not affect pressure reduction due to the direction of system flow and pressure gradients. Average pressures in this area were reduced by 25 percent (Table 8), chiefly in the low elevation areas with frequent breakage. Minimum results for the fire flow simulation are indicated in Table 9. Figure 9 shows the PRV placement and isolation valves for this scenario.

Table 8 - Pressures for RPZ No. 4 – East Ridge

Pressure	Before PRV (psi)	After PRV (psi)
Minimum	69.1	48.6
Maximum	139.9	111.6
Average Zone	119.6	88.7

Table 9 - Minimum Fire Flow Results for RPZ No. 4 – East Ridge

Node Label	Elevation (ft)	Static Pressure (psi)	Fire Flow Available (gmp)	Fire Flow Minimum Needed (gpm)	Pressure (Calculated Total Residual Lower Limit, psi)
16466	763.8	49.1	606.4	500	26.2

Figure 9 - RPZ No. 4 -- East Ridge Pressure Results

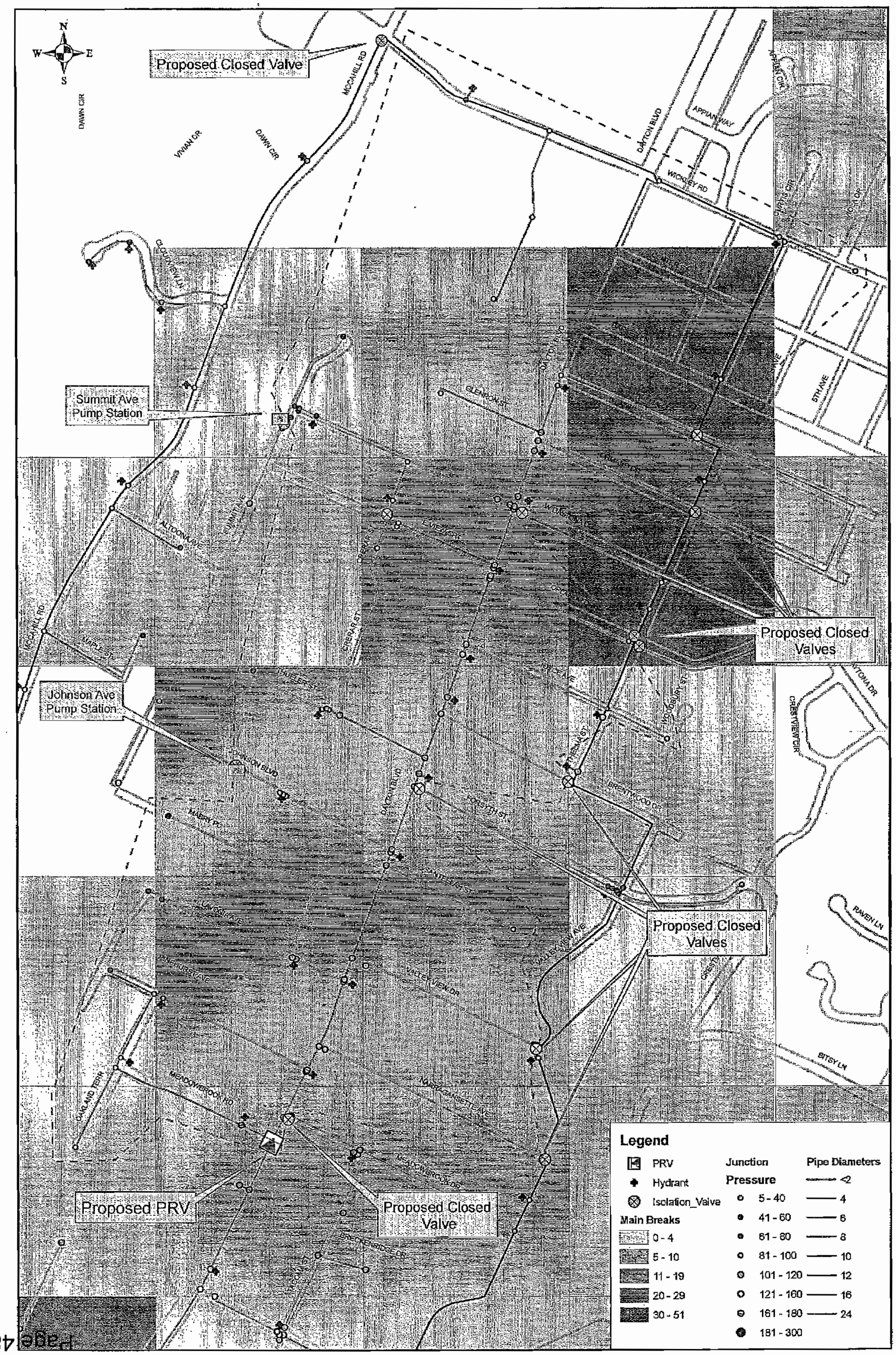
RPZ No. 5 – Hill City

The Hill City pressure zone, like Areas 3 and 4, was chosen for the large number of breaks and the relatively high pressures. However, this area was difficult to isolate because it also serves customers in the higher elevations. Twelve isolation valves were closed so that higher elevations could be served by lines outside the RPZ. One 6-inch PRV was simulated on the south side with an HGL setting of 1,012 feet. Figure 10 depicts PRV placement and isolation valves. Average pressures were reduced by only 7 percent, as shown in Table 10, while minimum pressures actually increased due to isolation from the higher pressures. Fire flow requirements could not be met on 11 out of the 37 hydrants in this scenario; therefore, this area is not a feasible RPZ.

Table 10- Pressures for RPZ No. 5 – Hill City Pressure Zone

Pressure	Before PRV (psi)	After PRV (psi)
Minimum	39.5	39.7
Maximum	150.1	141.5
Average Zone	95.3	89.5

Figure 10 - RPZ No. 5 -- Hill City Pressure Results



RPZ No. 6 - Missionary Ridge

The Missionary Ridge area has one of the highest rates of main breaks in the TAW system. Located in the middle of the system with three pressure zones overlapping in some instances, it is difficult to isolate. Figure 11 shows the potential RPZ before the PRV is input (including the frequency of main breaks), and Figure 12 shows this area afterward. Existing pressure zones are outlined in black to demonstrate the isolation.

One 6-inch PRV was simulated on the south with an HGL setting of 1,133 feet. Upstream flow was revised to feed from the south main lines to the north lines, reducing pressure. The zone is completely isolated using two closed valves and one check valve. The PRV acts as a closed valve under normal operation and is necessary only during fire flow conditions, according to the simulation. Average pressures in this area were reduced by 18 percent (Table 11). Minimum results for fire flow simulation are shown in Table 12.

Table 11 - Pressures for RPZ No. 6 – Mission Ridge

Pressure	Before PRV (psi)	After PRV (psi)
Minimum	85.6	79.6
Maximum	214.7	182.7
Average Zone	164.9	136.0

Table 12 - Minimum Fire Flow Results for RPZ No. 6 – Mission Ridge

Node Label	Elevation (ft)	Static Pressure (psi)	Fire Flow Available (gmp)	Fire Flow Minimum Needed (gpm)	Pressure (Calculated Total Residual Lower Limit, psi)
10946	920.3	153.2	849.77	500	96.9

Figure 11: RPZ No. 6 – Pressures Before PRV

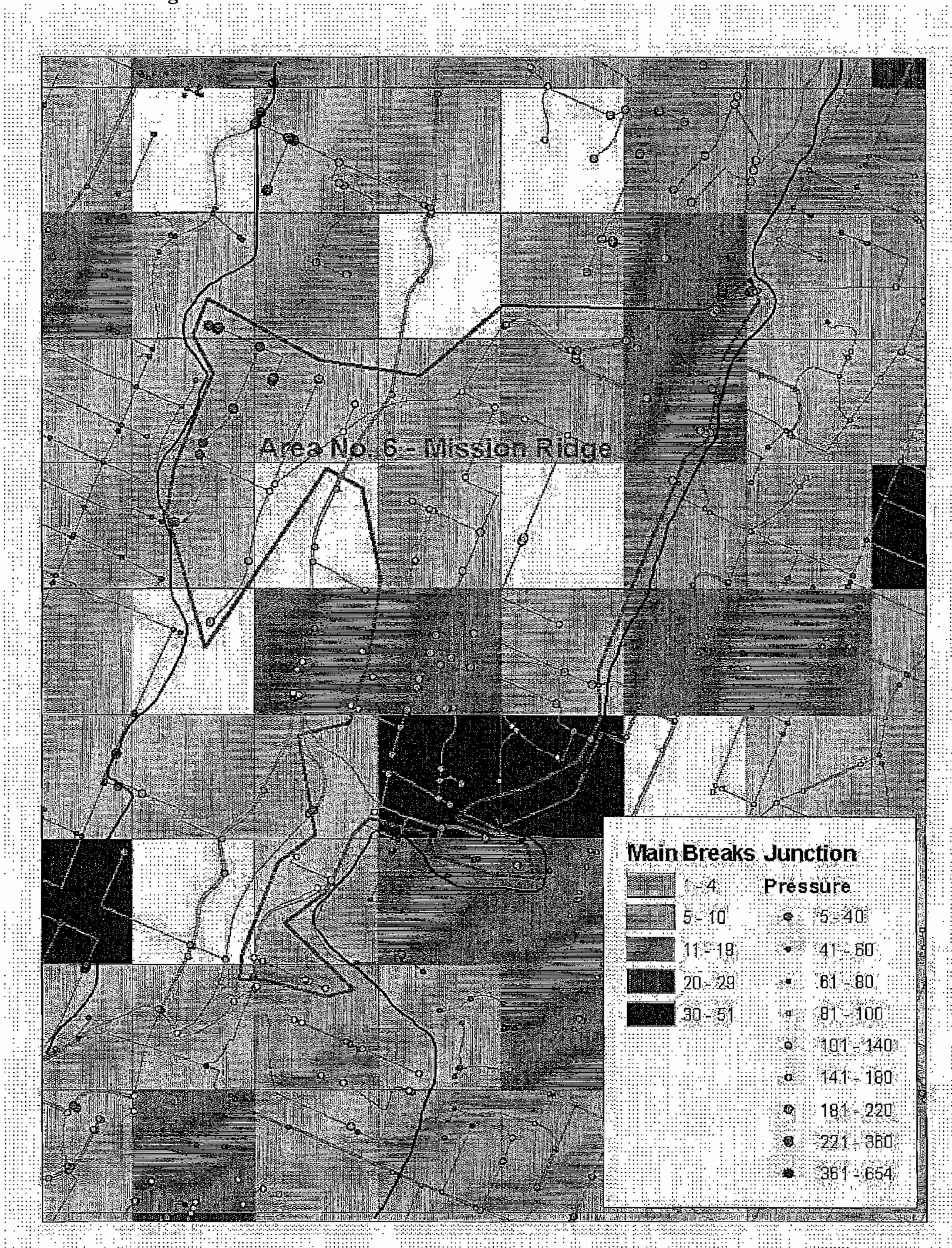
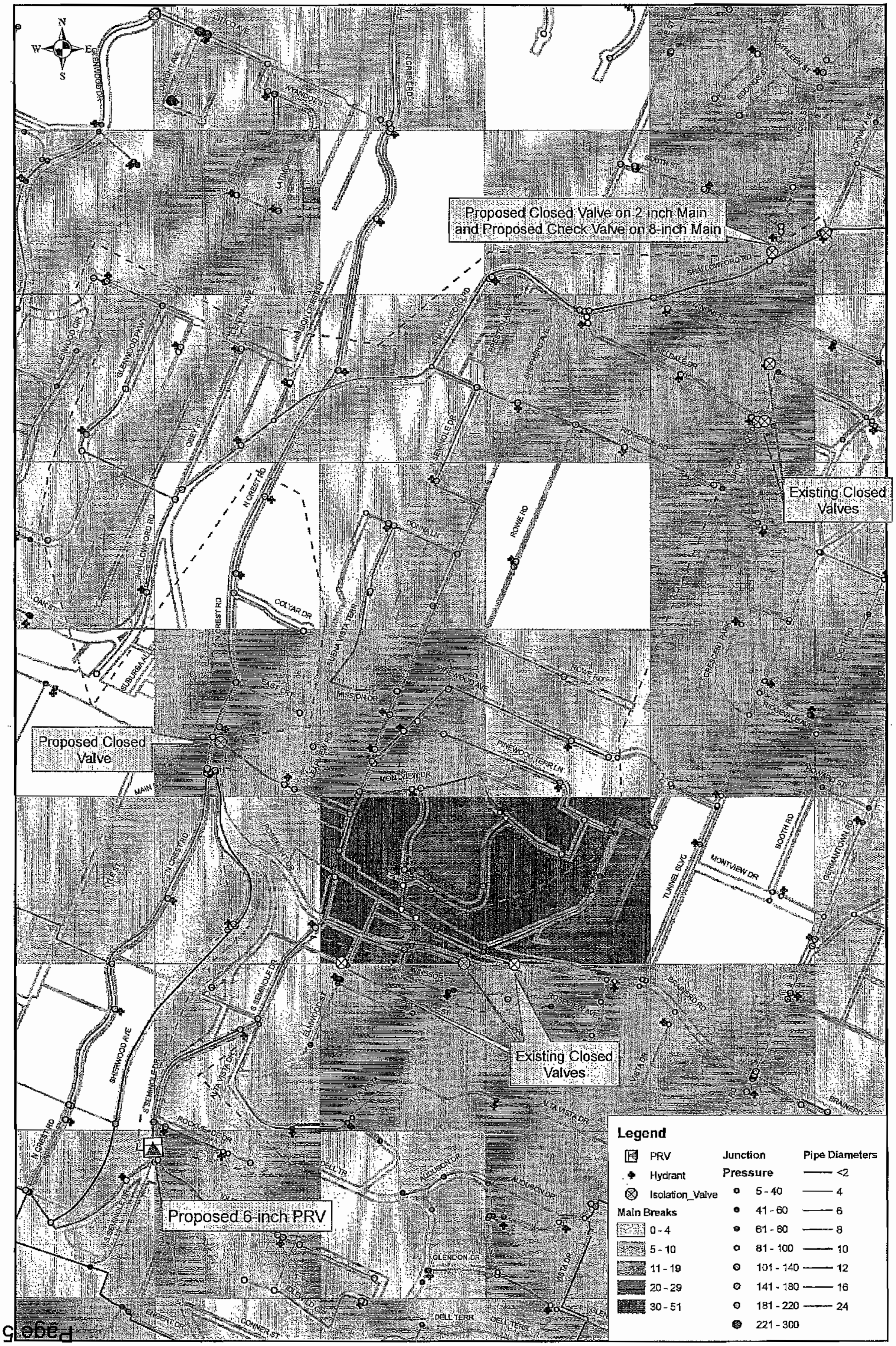


Figure 12 - RPZ No. 6 -- Mission Ridge Pressure Results



Conclusions

Once all the potential RPZs were isolated, the number of main breaks in a 6-year period (2000 - 2006) were determined for each zone (Table 13). It is assumed that a proportion of these will be prevented by reducing pressures. For instance, in the newly proposed St. Elmo North RPZ, 58 percent of the breaks that occurred in the main St. Elmo pressure zone may be prevented.

Table 13- Number of Breaks Potentially Reduced

Potential RPZ	Number of Breaks from 2000 to 2006	Percentage of Breaks, Main Pressure Zone
No. 1 – South Mission Ridge	75	25
No. 2 – Lookout Mountain	23	21
No. 3 – St. Elmo North	116	58
No. 3 – St. Elmo South	8	4
No. 4 - East Ridge	104	10
No 5 – Hill City	27	7
No. 6 – Mission Ridge	47	16

To address NRW loss caused by high pressures in the distribution system, a minimum of three new RPZs are recommended, listed below by priority:

1. Area No. 1 – South Mission Ridge Area
   - Install two PRV's as shown on Figure 3. PRV 1 is an 8-inch and PRV 2 is a 3-inch. PRV 1 should have an inlet pressure of 90 psi and an outlet pressure of 55.1 psi.
   - Close one valve.
2. Area No. 2 – Lookout Mountain
   - Install a 6-inch PRV with an inlet pressure of 130 psi and outlet pressure of 97.2 psi.
   - Close five valves.
3. Area No. 3 – St. Elmo Pressure Zone

   North

   - Install two PRVs for the north side RPZ as shown on Figure 5. (PRV 1 is a 6-inch diameter and PRV 2 is a 2-inch diameter.) PRV 1 should have an inlet pressure of 175 psi and an outlet pressure of 131.3 psi. PRV 2 should have an inlet pressure of 162 psi and an outlet pressure of 118.3 psi.

It is recommended that TAW also at some point consider reducing pressures in the following areas because of the high pressures, main breaks, and ease of isolation:

Area No. 3 – St. Elmo Pressure Zone

South

- Install an 8-inch PRV with an inlet pressure of 178 psi and an outlet pressure of 83.4 psi as shown on Figure 5.
- Close three valves.

Area No. 4 – East Ridge

- Install a 12-inch PRV with an inlet pressure of 130 psi and an outlet pressure of 93.7 psi.
- Close one valve.
- Install check valve on one pipe.

Area No. 6 – Mission Ridge

- Install a 6-inch PRV with an inlet pressure of 115 psi and an outlet pressure of 110 psi.
- Close two valves.
- Install check valve on one pipe.

Hydraulic analysis of 24-hour and fire flow simulation indicates that the above recommendations will allow the system to meet minimum acceptable standards set by TDEC and TAW. The following table lists locations and ID's for the above-recommended PRVs, closed valves, and check valves. TAW may opt to include insertion meters at check valve locations for sub-metering zone purposes.

Table 14- Locations of RPZ Components

Proposed RPZ	Proposed PRVs	Proposed Isolation Valve Numbers	Other Notes for RPZ Configuration
Area No. 1 – South Mission Ridge	6-inch (see Fig. 3) 8-inch (see Fig. 3)	V6728	Open V8373
Area No. 2 – Lookout Mountain	6-inch on Lula Lake Road before intersection with Robin Hood Trail	V16774 V19176 V16220 V7227	Close no-name valve on 6-inch main on Fairy Trail at intersection with West Fleetwood Drive
Area No. 3 – St. Elmo North	6-inch at Cummings and Browns Ferry Rd. 2-inch at Cummings and Lilac Ave.	V17543 V17534 V19652 V15965	Close no-name valve on 6-inch main on Kelly's Ferry Rd. (See Fig. 6) northeast of V17524

REDUCED PRESSURE ZONES

Proposed RPZ	Proposed PRVs	Proposed Isolation Valve Numbers	Other Notes for RPZ Configuration
Area No. 3 – St. Elmo South	12-inch on Wauhatchie Pike just off Cummings Hwy	V19570 V16302 V19653	
Area No 4 – East Ridge	12-inch on Ringgold Rd., between the East End and Springvale intersections	V18698	8-inch check valve flowing into RPZ on Sanctuary at Ridgetop Rd.
Area No. 6 – Mission Ridge	6-inch on S. Seminole Drive between the Sioux and Rockmead Intersections	V4850 V1198	8-inch check valve flowing into RPZ on Moss St. at Shallowford Rd.

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BLACK & VEATCH

Technical Memorandum #4 – Rossville Area Distribution System Transient Analysis

Prepared for

Tennessee American Water Company

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Submittal Date: November 2007

Black & Veatch Project No. 145895.0100

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The objective of this Technical Memorandum was to review the results of the recent hydraulic analysis of the Tennessee American Water Company (TAWC) Chattanooga water distribution system to evaluate steady state service and surge pressures, particularly in the Rossville and Missionary Ridge zones, and recommend options for lowering both where practical. These zones were targeted for analysis because of the high potential for surge pressures due to the length of the transmission main, the nature of the pipeline profile, the high amount of static lift, high service pressures, and the high number of reported main breaks.

Figure 1 shows the locations and frequency of reported water main breaks in the overall TAWC water system. Figure 2 shows water main breaks in the Missionary Ridge and Rossville pressure zone area. Figure 3 shows areas of pressures greater than 180 psi in the Rossville and Missionary Ridge. The color coded breaks do not necessarily indicate that all the breaks occurred on the lines shown, but indicate the number of breaks in close proximity to the pipe shown that have been assigned to that pipe by the model. As shown, there are portions of the two pressure zones of concern that are under steady state pressure in excess of 180 psi.

The system hydraulic model was constructed and calibrated by CTI Engineers using WaterGEMs v. 8. In order to conduct the transient surge analysis the water distribution system that includes the Rossville pump station, the Fort Oglethorpe meters, the Fort Oglethorpe tank and connecting water mains was set up in an MWH H20SURGE transient model. The transient modeling was conducted to estimate how system pressures are affected when a pump in the Rossville pump station is disengaged due to power outage or other reason. A second scenario analyzed was when the Cla-Val valve on the inlet to the Fort Oglethorpe standpipe closes. Recommendations were developed for reducing problems with low and high transient pressures.

H20SURGE Model Development

An MWH H20SURGE analysis was used to perform the analysis. H20SURGE analyzes transients by use of the wave characteristics method which is partially based on the more traditional method of characteristics. This method produces essentially the same results as the method of characteristics, and is based on tracking the movement and magnitude of pressure waves as they move along pipes and are reflected and transmitted at the junctions between fixed-length time steps. Friction effects are considered in a distributed manner.

To conduct the surge analysis and MWH H20SURGE model was created by converting the relevant portion of the WaterGEMs V8 model into an EPANET hydraulic model. The EPANET hydraulic model was then converted to an H20NET hydraulic model. Finally, the H20NET model into a H20SURGE model by adding pipe wave speed, known existing and proposed air release and air vacuum valves, pressure relief valves, pump inertia, and valve(s) used for stopping or controlling flow.

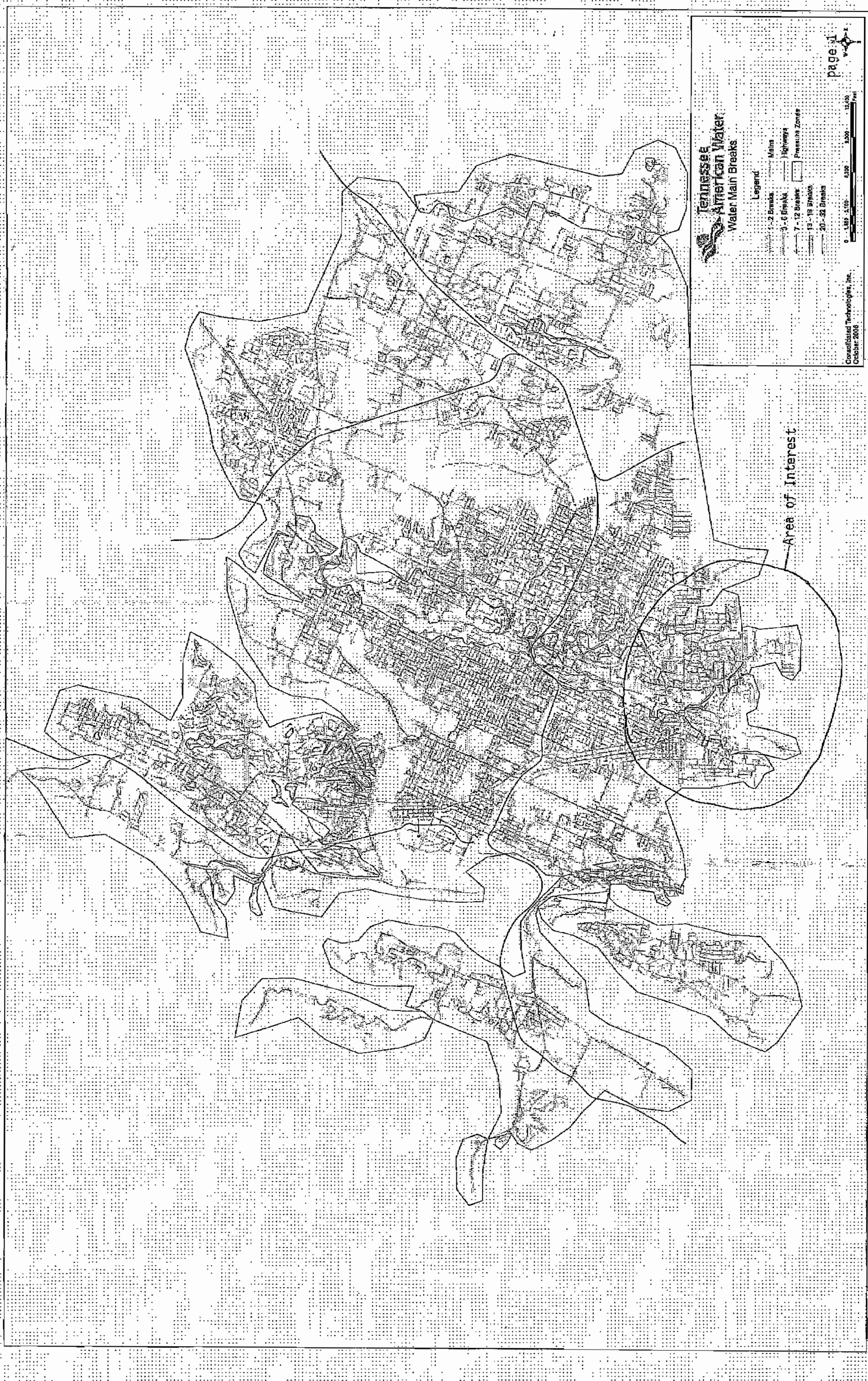

Tennessee American Water
Water Main Breaks
Legend
1 - 2 Breaks
3 - 6 Breaks
7 - 12 Breaks
13 - 19 Breaks
20 - 32 Breaks
Mains
Highways
Pressure Zones
0 1,550 3,100 6,200 9,300 12,400 Feet
page 1
Consolidated Technologies, Inc.
October 2008
Area of Interest

Figure 2 - Reported Main Breaks in the Study Area

Break color code: 1-2 Breaks 3-6 Breaks 7-12 breaks 13-19 Breaks 20-32 Breaks

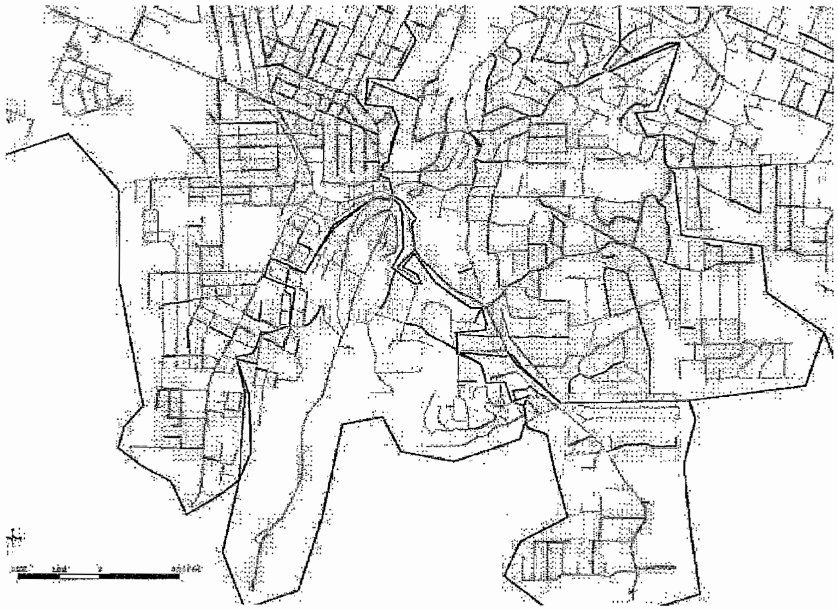
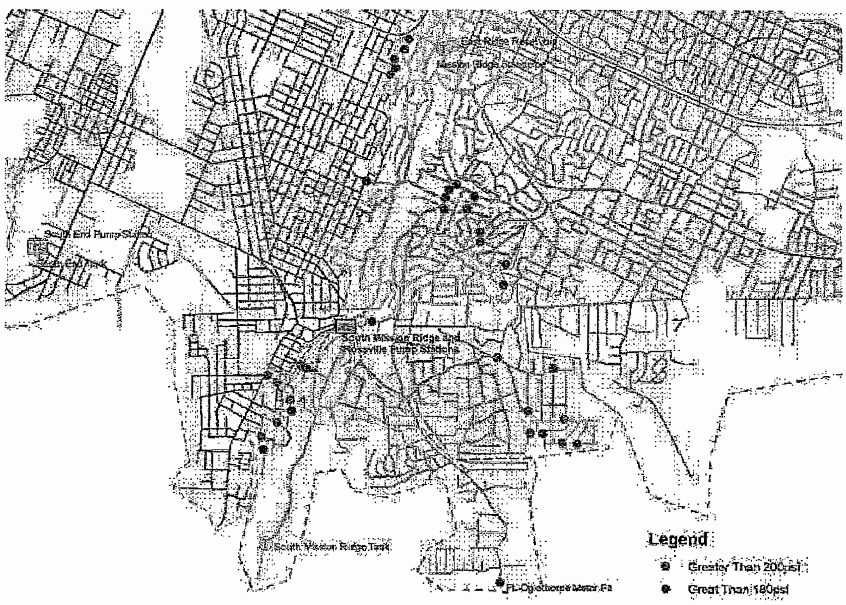


Figure 3 - Areas of Pressure Grater than 180 psi in the Rossville and Missionary Ridge Services Areas



The water mains in the H20SURGE model included approximately 13,000 linear feet of existing 12-inch cement mortar lined cast iron water transmission main running along Chickamauga Avenue and Lafayette Rd from the Rossville pump station to the Fort Oglethorpe meter pit. The model also included the existing 2, 4, 6 and 8-inch water distribution mains connecting to the 12-inch transmission main. From the Fort Oglethorpe meter pit, 1,600 linear feet of 12-inch cement mortar lined cast iron main connects to 5,200 linear feet of 8-inch ductile iron main connecting to the Fort Oglethorpe tank.

Evaluation of these mains showed a pronounced hump in the 12-inch main along Chickamauga Avenue approximately 3,000 ft. downstream of the Rossville pump station. This hump has a maximum elevation of approximately 895 ft and is problematic from a surge standpoint. The elevation range of the water mains in the model begins at 730 ft. MSL and rises to approximately 927 ft. MSL. The available data indicates that the existing water mains in the model are primarily ductile or cast iron. Many of the existing water mains in this area of the system can be considered near or past their expected service life.

Data provided by TAWC included:

- Fort Oglethorpe tank level SCADA records
- SCADA pressure records recorded at two places along Chickamauga Ave.
- As-built plans of the Rossville pump station and
- Large user flow records

This data was reviewed and applied in the construction of the H2OSURGE model.

Black & Veatch made four basic assumptions in the H2OSURGE model, based on communications between TAWC personnel and CTI, and on feedback from the Fort Oglethorpe water system operator. These assumptions were:

- An 8-inch diameter cone valve is on the discharge of the pump in the Rossville pump station. The cone valve closes in 5 seconds upon power outage.
- An 8-inch diameter Cla-Val type valve is operational at the Fort Oglethorpe tank which closes in 45 seconds when the tank is near full.
- The Fort Oglethorpe tank has an overflow elevation of 978 ft. MSL.
- There are no air valves, pressure relief valves, or other surge control devices anywhere in the system served by the Rossville pump station.

In the steady state analysis, before the transient occurs, one VFD pump is in operation in the Rossville pump station. The pump is set to maintain 145 psig on the pump station discharge manifold, and delivers approximately 1,200 gpm to the system. There is a pressure of 26 psig on the pump suction, which results in a HGL elevation of 865 feet. The elevation of the pump centerline is at EL 803.

The surface water elevation (SWEL) at the Fort Oglethorpe tank was assumed at 977 feet MSL. Water demand in the H2OSURGE model totals 1.03 mgd, of which 0.06 mgd serves customers located between the Rossville pump station and the Fort Oglethorpe meters. The remaining 0.97 mgd demand was placed at a node approximately 700 ft. upstream of the Fort Oglethorpe standpipe. The Hazen-Williams equation was used to estimate pipe head loss. Hazen-Williams coefficients used in the H20SURGE model were the same as those used in the WaterGEMs model constructed by CTI. The coefficients ranged from 130 to 150.

Two scenarios were modeled with H20SURGE. The first involves closing the Cla-Val valve on the Fort Oglethorpe stand pipe in order to estimate the resulting pressure rise in the system, while using the VFD pump at the Rossville pump station to try to maintain a set pressure at the pump station discharge. The second scenario is a pump trip due to power outage or other electrical failure at the Rossville pump station.

Surge Concepts

Rapid changes in flow in closed conduits cause pressure waves that travel both upstream and downstream from the point of origin. These waves travel at the sonic wave speed (a) of the pipe. The sonic wave speed in water transmission pipes is primarily dependent on pipe material, pipe diameter, and the amount of dissolved air in the water. The calculation of wave speed is as shown:

$$a = ((K/p/(1+C(K/E)(D/e))^{0.5}$$

Where: $C = 1-u^2$ ($u = 0.3$ for ductile iron pipe and 0.25 for cast iron pipe)

K = bulk modulus of elasticity

D = inside pipe diameter

p = fluid density

E = bulk modulus for pipe material

e = pipe wall thickness

The wave speed used in the H20SURGE model is that of the existing 12-inch cast iron pipeline and the existing 8-inch ductile iron pipeline, since these two diameters make up the transmission main that connects the Rossville pump station to the Fort Oglethorpe tank. The wave speed calculations for these mains are included in Appendix A.

A very small amount of dissolved air in the water will decrease "a" by a significant amount, thus usually lessening the severity of transient pressures. Since this transient analysis used the maximum wave speed numbers (calculated with zero dissolved air), the results are generally considered to be conservative.

The critical period of a pipeline in seconds, (Tc) is calculated by the formula Tc=2L/a, where L is the length of the pipeline in ft and "a" is the sonic wave speed of the pipe. The length of the transmission main from the Rossville pump station to the Fort Oglethorpe tank is approximately 19,600 ft. The calculated critical period of the transmission main is 9.2

seconds (Appendix A). In order to minimize transient pressures resulting from a valve closure on this transmission main, the valve closure needs to occur in a time not less than 4 to 10 times Tc or 37-92 seconds.

In order to make the H20SURGE model a more accurate representation, a Cv curve for the Cla-Val valve on the inlet of the Fort Oglethorpe tank was provided by the valve manufacturer and was added to the model. A Cv curve for the cone valve, based on a Henry Pratt type, was also added to the model.

Finally, two design guidelines were followed for the transient analysis:

- Keep estimated minimum transient pressures above zero psig at all times throughout all water mains.
- Keep estimated maximum transient pressures as low as possible in order to limit water main breaks.

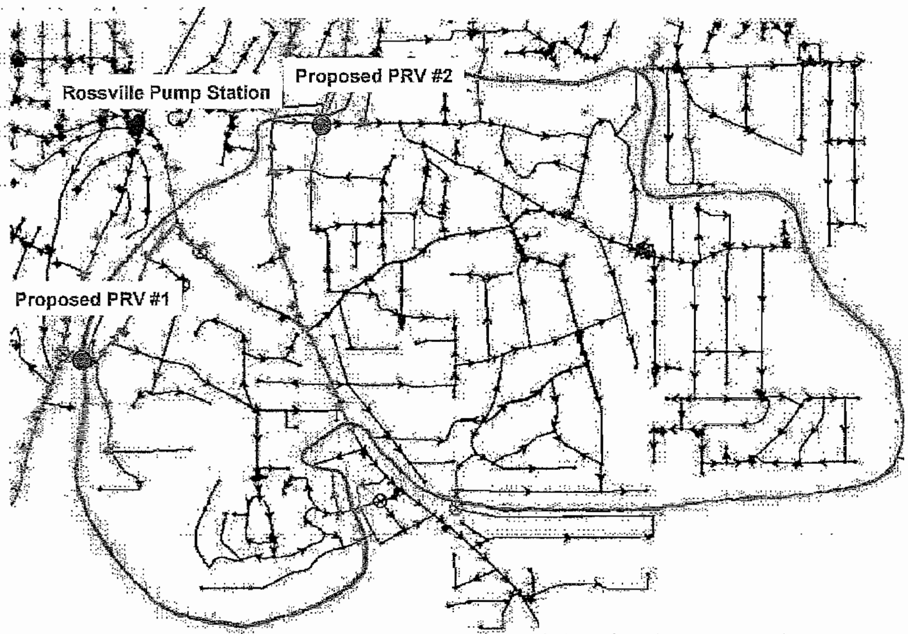
Analysis and Discussion of Results

A limited steady state analysis of the Missionary Ridge/Rossville pressure zone area was also conducted using the 24-hour scenario in the WaterGEMS model. The analysis was performed in response to number of water main breaks in the area as shown in Figure 1 and 2 and the high system pressures shown in Figure 3.

The objective of the analysis was to see if system pressures could be lowered in the study area while maintaining a minimum distribution system pressure of 35 psi during maximum day demand, and at least 20 psi in all parts of the water distribution system during a 1,000 gpm fire demand. Methods used to lower system pressures included installation of pressure reducing valves, moving to adjacent lower pressure zones, running booster pumps at slower speeds, and running storage tanks at lower levels.

Pressure reducing valves (PRVs) and system configurations were tested and analyzed at in the service area to reduce steady state pressures. Model analysis showed that steady state pressures in the Lakeview area and in the areas north and south of Chickamauga Avenue could be reduced with the installation of PRVs as shown in Figure 4. The model showed that operating PRVs at these locations will reduce pressures in part of the Missionary Ridge pressure zone as well. PRV 1 is 8-inch diameter and PRV 2 is 3-inch diameter. The model showed that both PRVs should optimally be set to maintain a downstream HGL of approximately 1140 feet. At this setting pressures in the area would be reduced by approximately 40 psi, while maintaining a minimum system pressure of 40 psi. The installation and operation of the PRVs would still enable TAWC to meet the required 25 psi necessary for a 1,000 gpm fire flow. The model showed that operation of the South Missionary Ridge pumps, the Mission Ridge standpipe and the South Mission Ridge tank would not be affected.

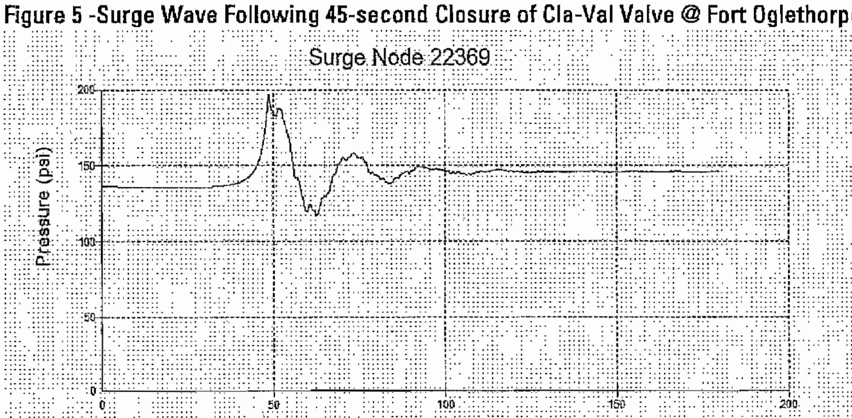
Figure 4 - Location of PRVs to Reduce Steady State Pressures in Southern Section of Missionary Ridge Pressure Zone



Next, the system was analyzed in order to identify means of reducing transient surges rippling through the system resulting from valve closure or pump malfunction.

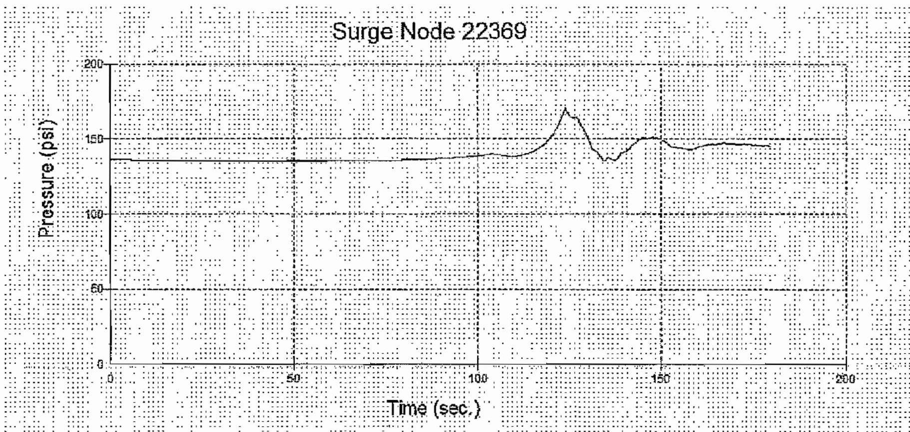
Figure 5 shows the results of a 45 second closure of the existing Cla-Val valve on the inlet of the Fort Oglethorpe tank, starting at time = 3 seconds. The transient pressure was modeled at the Fort Oglethorpe meter pit on the downstream side. The results show that pressure rises significantly from approximately 138 psi to approximately 195 psi.

Figure 5 -Surge Wave Following 45-second Closure of Cla-Val Valve @ Fort Oglethorpe Tank



The analysis was repeated with a 120-second closure of the existing Cla-Val valve. Figure 6 shows the results with the modified operation. The resulting maximum pressure is less, at approximately 168 psi. This scenario was modeled in the existing system, with no improvements.

Figure 6 - Surge Wave Following Modified 120-second Closure of Cla-Val Valve @ Fort Oglethorpe Tank



The second transient analysis examined the disengagement of the pump at Rossville pump station. Figures 7-9 show the transient surge results of this scenario. The transient pressures were measured at the Rossville pump station discharge manifold (Figure 7), at Fergis Rd/Chickamauga Avenue (Figure 8), and on Gilbert Drive (Figure 9). All results show an unacceptable amount of negative pressures, cavitation, and pressure spikes that are much higher than the initial steady state pressure. Unacceptable transient pressure results were shown throughout the entire system in this run.

Figure 7 - Modeled Existing Condition Transient Surge @ Rossville Pump Station Following Pump Shutdown

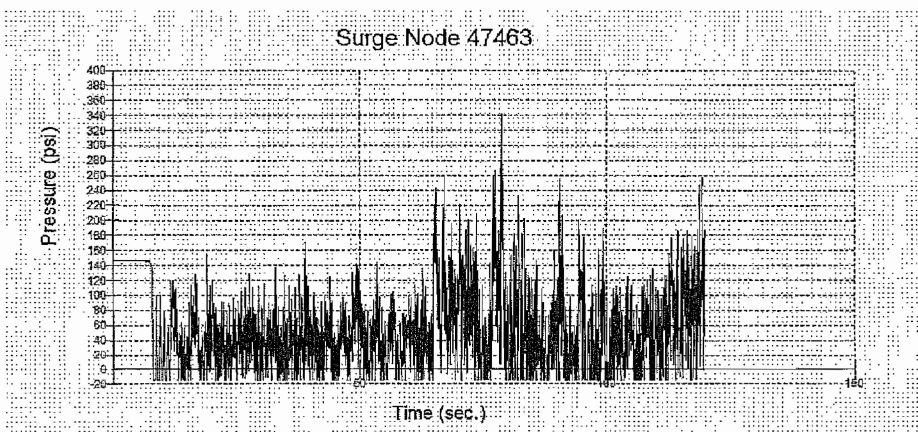


Figure 8 - Modeled Existing Condition Transient Surge @ Fergis Rd/Chickamauga Avenue Following Rossville Pump Station Pump Shutdown

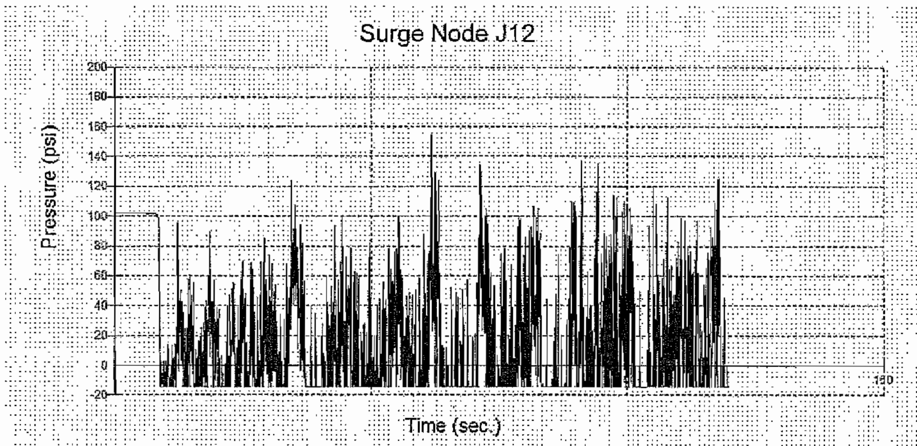
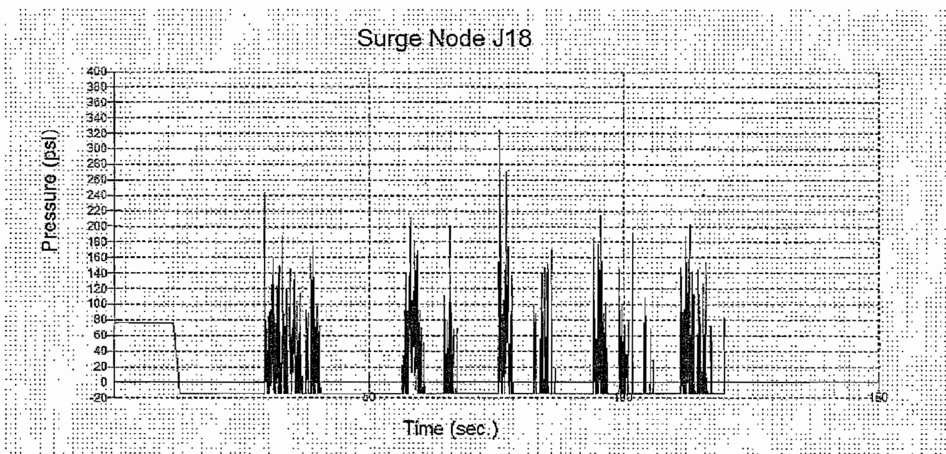


Figure 9 - Modeled Existing Condition Transient Surge @ Gilbert Drive Following Rossville Pump Station Pump Shutdown



The analysis was then repeated under three potential solution scenarios:

- Installation of three, 2-inch combination air release valve installed at or very near Chambers/Summer streets (MSL EL 919 ft), Fergis Road/Chickamauga Ave (MSL EL 897 ft) and on Gilbert Drive (EL 929 ft) and a 500 gallon capacity closed surge tank connected to the discharge manifold of the Rossville pump station.
- A 2-inch combination air release valve in place of the surge tank, with the combination air release valves.
- A 4-inch surge anticipator valve in place of the surge tank, with the combination air release valves.

A combination air valve is an air release valve combines the functions of an air release valve and an air vacuum valve to control air binding and column separation. The air release valve feature functions to release air from the water main to prevent air binding of the water main. The air vacuum valve feature minimizes transients by opening when sensing pressures at or below 0 psig. This prevents vacuum pressures inside of the water main, which can result in collapse or facilitate intrusion of contaminants. Air vacuum valves also prevent column separation and a destructive water hammer situation from occurring by preventing a drop in pressure to vapor pressure (approximately -14.7 psig).

Surge anticipator valves and closed surge tanks are common devices for limiting transient pressures in water transmission systems. These devices are often installed on pump station discharge headers. A surge anticipator valve quickly opens upon sensing an unusually low pressure on the pump station discharge header (or upon power outage), and stays open for a brief period of time, and then slowly returns to a closed position. A surge anticipator valve can limit maximum transient pressures but does little to control minimum transient pressures. Closed surge (hydro pneumatic) tanks are very effective at limiting maximum and minimum transient pressures. These tanks usually contain about half air and half water, and act as surge suppressors.

Figures 10-12 show the results of Scenario 1. With a surge tank forty-percent full of air the H2OSURGE model shows results that the transient activity is reduced and pressures are maintained between zero psi and the initial steady state pressure at the three locations. Transient pressures throughout the model are within the design guidelines.

Figure 10 - Transient Pressure Surge @Rossville Pump Station Discharge Manifold

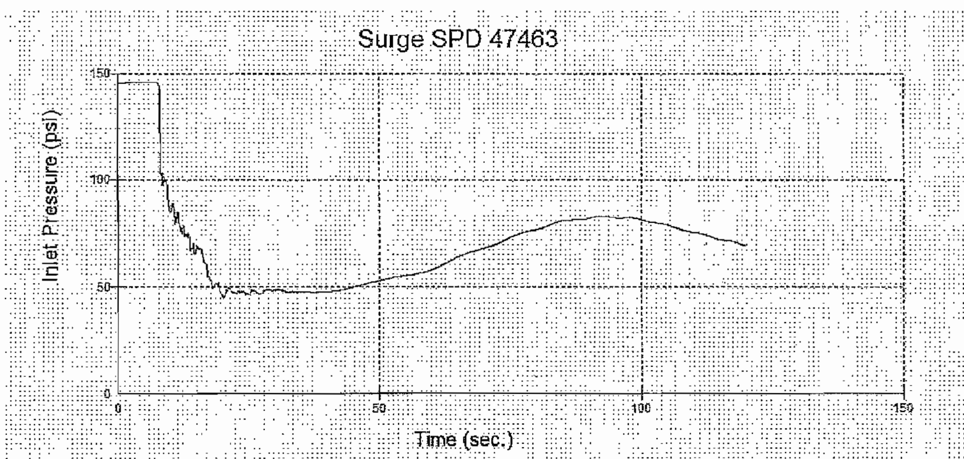


Figure 11 - Transient Pressure @ Fergis Road and Chickamauga Avenue

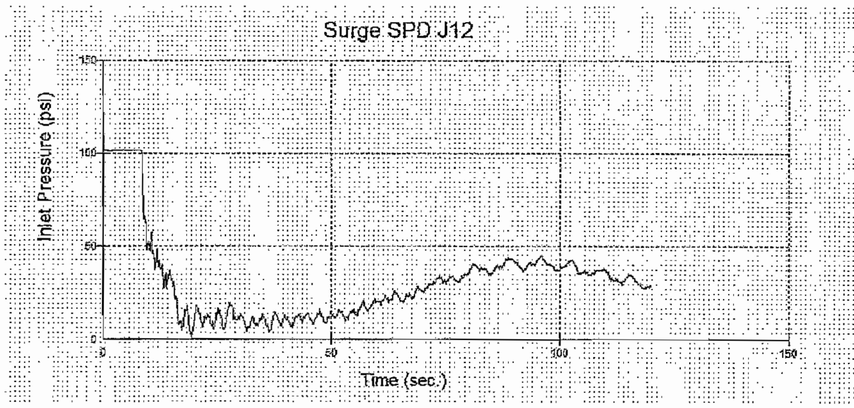
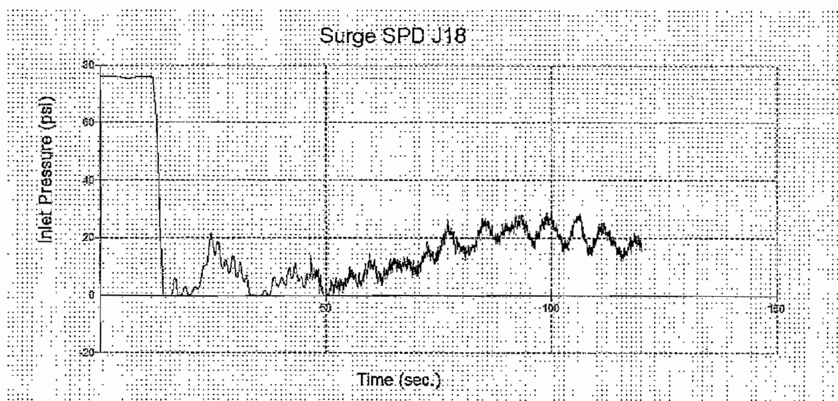


Figure 12 - Transient Pressure @ Gilbert Drive (MSL Elev. 929 ft.)



The other two scenarios lessened the severity of surges in the Rossville-Fort Oglethorpe transmission system somewhat, but did not approach the effectiveness of the surge tank scenario, primarily due to the elevation changes in the transmission system.

Recommendations

The following recommendations pertain to distribution system steady state pressures:

1. Install PRVs at the locations shown in Figure 4. PRV 1 is 8-inch diameter and PRV 2 is 3-inch diameter. Both should be set to maintain a downstream HGL of approximately 1140 feet.

2. All PRVs should be maintained regularly in accordance with manufacturer's recommendations.

3. The areas now served as the Missionary Ridge pressure zone located below MSL elev. 770 can be moved to the adjacent Citico pressure zone, which is shown with the green pipes on Figure 2. This would result in pressure reductions of approximately 10 psi.

4. It is recommended that VFD pumps speeds be reduced and system storage be operated at lower levels to reduce system pressures. The analysis shows that there is minimal impact on the water system if conducted in an orchestrated manner during times of low to average water demand.

The following four recommendations pertain to minimizing transient surges occurrence in the Missionary Ridge/Rossville area:

1. Increase the linear Cla-Val valve actuation time from forty-five seconds to 120-seconds. This will reduce transient pressures resulting from the valve closure, especially in the water transmission system near the Fort Oglethorpe meter pit.

2. All PRVs should be maintained regularly in accordance with manufacturer's recommendations.

3. Install combination air release valves at the highest points in the transmission/distribution system at or very near Chambers and Summers Streets, Fergis Road and Chickamauga Ave, and on Gilbert Drive. The 2-inch diameter air release orifice diameter should be verified at final design.

4. Install a 500-gallon closed surge tank with 3-inch diameter connecting pipes in the Rossville pump station at the discharge manifold. The tank should be operated at a 60/40 water/air ratio. Confirm tank design before construction.

5. Monitor transient pressures at the proposed locations for combination air release valves (Recommendation #2) and the Rossville pump station discharge. Equipment should be minimally capable of recording pressures every five seconds.

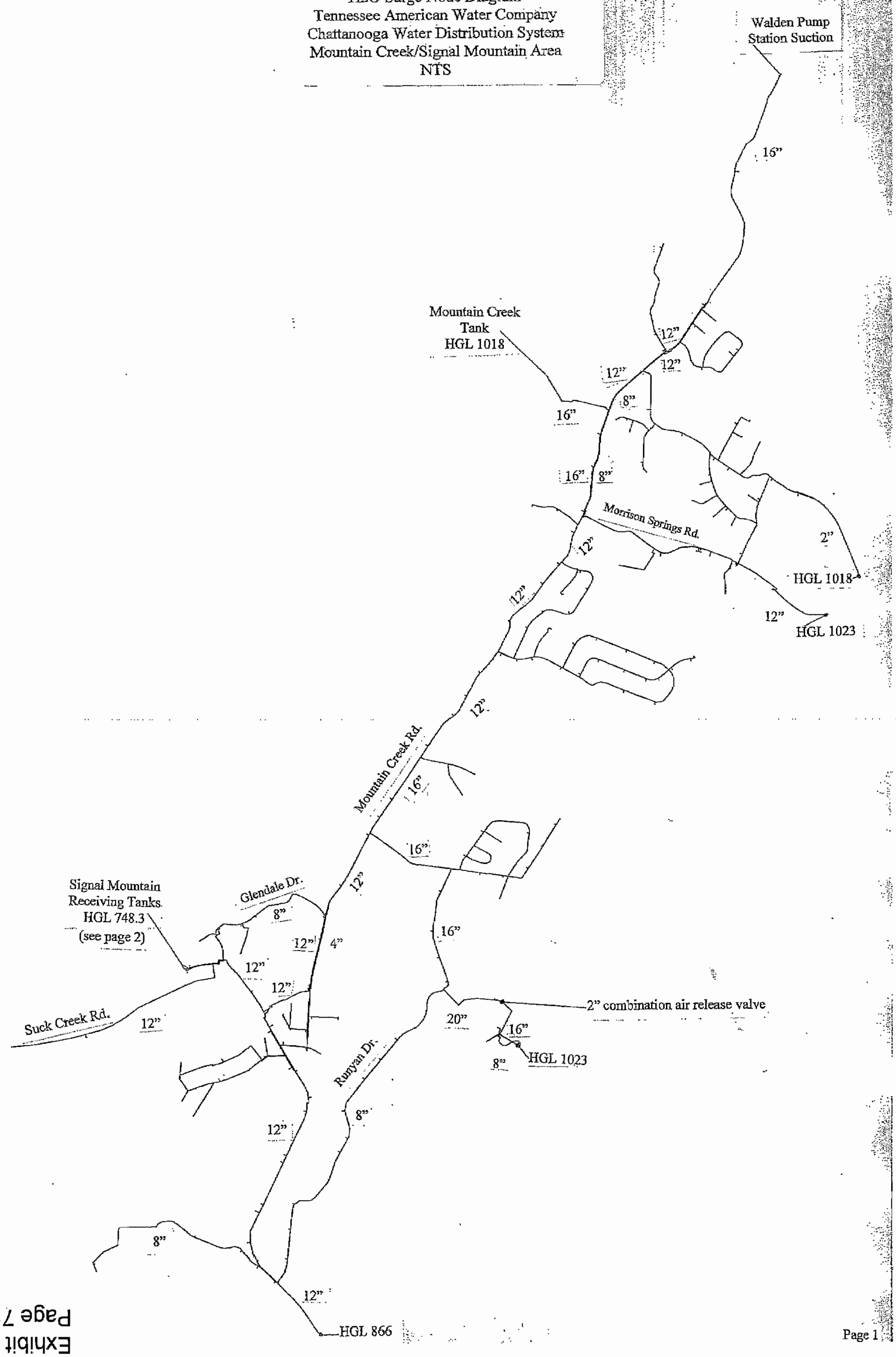
Estimated transient pressures in all existing piping were acceptable in all H20SURGE runs when the recommendations above were included in the system. Estimated maximum pressures were much lower, and minimum estimated transient pressures were in accordance with the design guidelines.

Appendix A

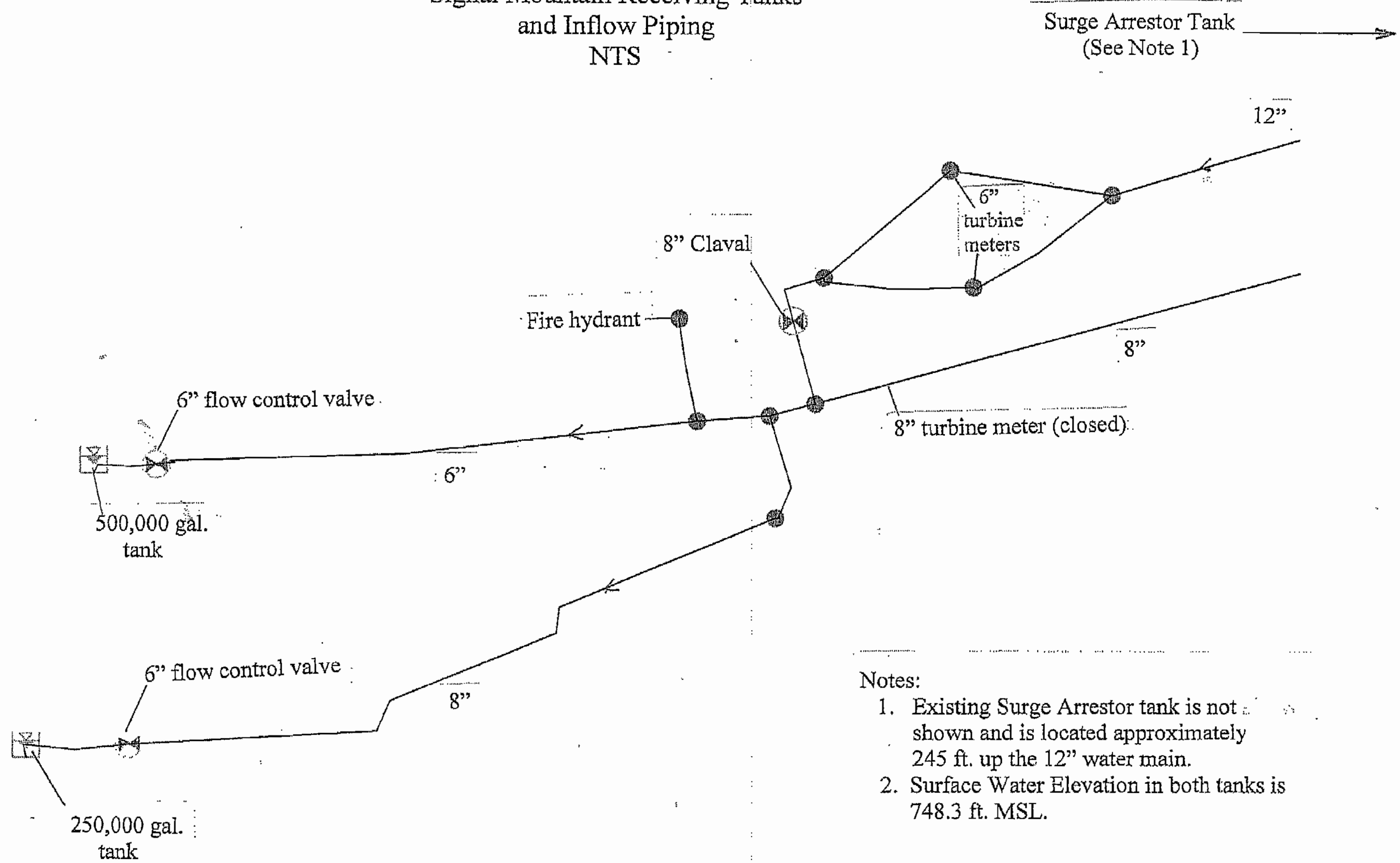
Rossville Area Transient Analysis

Wave Speed Calculations

H2O Surge Node Diagram
Tennessee American Water Company
Chattanooga Water Distribution System
Mountain Creek/Signal Mountain Area
NTS



Node Diagram
Signal Mountain Receiving Tanks
and Inflow Piping
NTS



Notes:
1. Existing Surge Arrestor tank is not shown and is located approximately 245 ft. up the 12" water main.
2. Surface Water Elevation in both tanks is 748.3 ft. MSL.

TNAW
Signal Mountain Area Transient Analysis, pipe wave speed and transmission main critical period
Pipe Wave Speed, a for 16-inch CIP and DIP, 12-inch CIP&DIP, and 8-inch DIP.
Wave speed is with zero dissolved air.

Pipe	D, inside pipe dia., inches	pipe wall thickness, inches	K, bulk modulus of elasticity, lb/sq ft	ρ, fluid density, slugs/cu. ft	C, correction factor for type of restraint	E, bulk modulus for pipe material, lb/sq ft	D, inside pipe dia., ft	e, pipe wall thickness, ft	a, wave speed, ft/second	Approx. length, ft feet
16-inch DIP	16.80	0.3	4.59E+07	1.94	0.91	3.59E+09	1.40	0.025	3786	4215.00
16-inch CIP	16.00	0.89	4.59E+07	1.94	0.94	2.61E+09	1.33	0.074	4272	1232.00
12-inch DIP	12.64	0.28	4.59E+07	1.94	0.91	3.59E+09	1.05	0.023	3940	5979.00
12-inch CIP	12	0.75	4.59E+07	1.94	0.94	2.61E+09	1.00	0.063	4327	5101.00
8-inch DIP	8.55	0.25	4.59E+07	1.94	0.91	3.59E+09	0.71	0.021	4115	116.00
									Total length, ft	16643.00

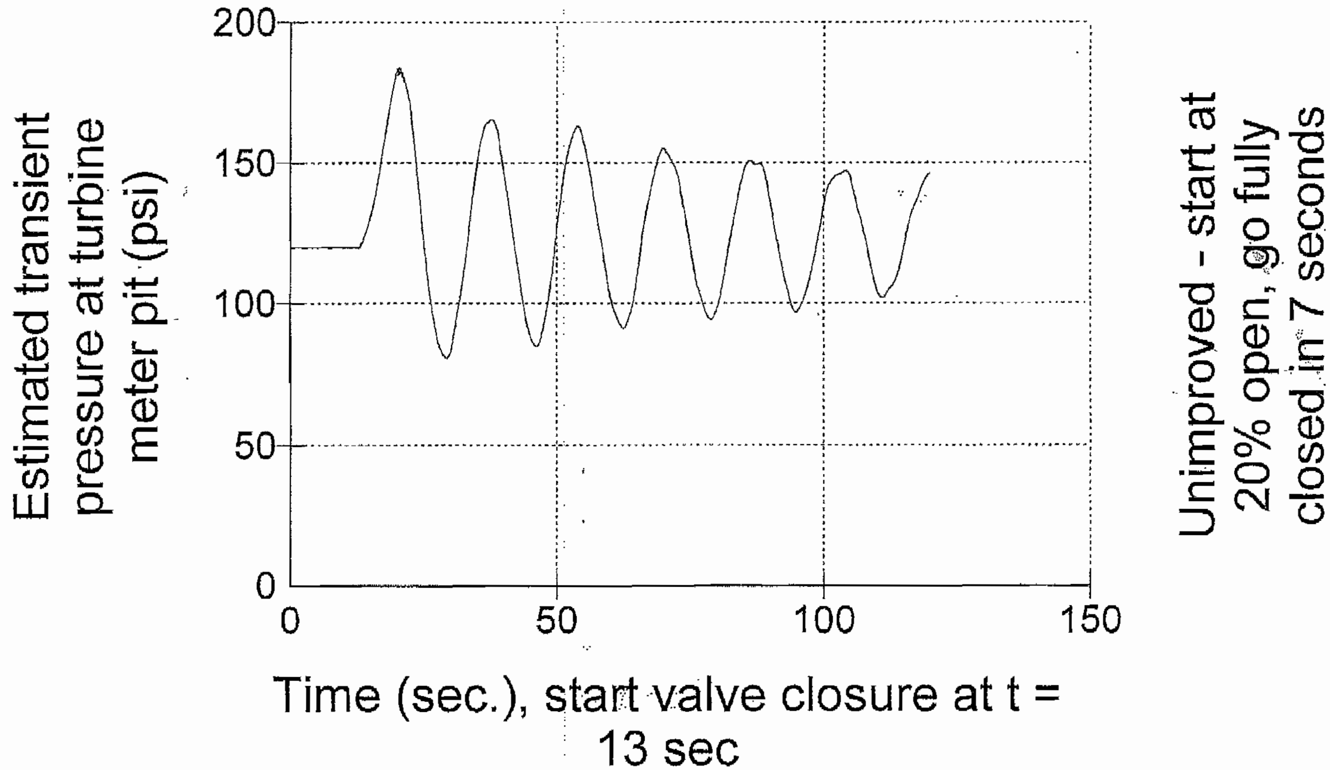
Critical period of the transmission main Critical period = 2L/a where L is the length of the transmission main and a is the wave speed
Calculate the weighted critical period as follows:

2L = 16643x2 33286 ft
weighted a 4045 fps

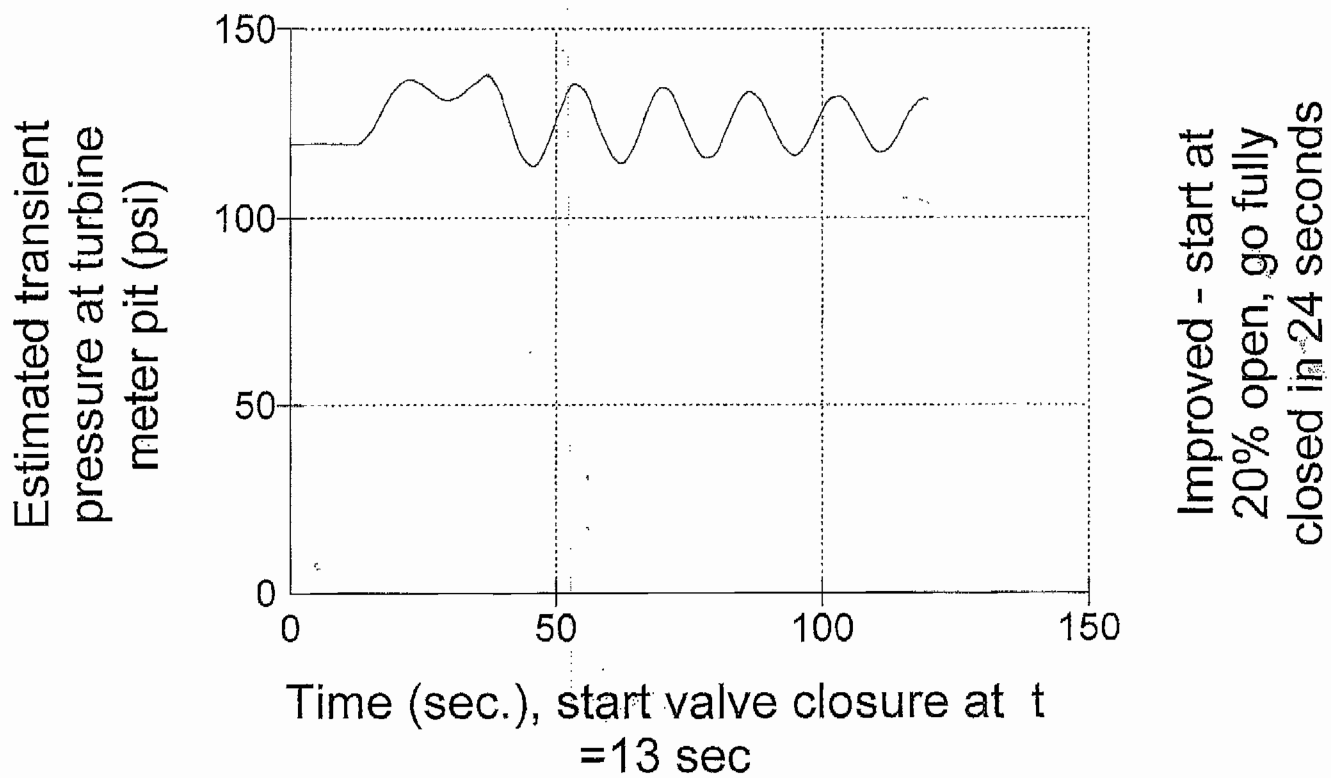
Critical period = 8.2 seconds

Notes:
1. C = 1 -u^2, which means that the pipe is anchored against axial movement throughout.
u, Poisson's ratio 0.3 for DIP, 0.25 for CIP
2. The pipe wave speed formula is:
'a = ((K/p/(1+C(K/E)(D/e))^2
3. 8-inch DIP assumed to be CL350, 12-inch and 16-inch CIP assumed to be Class D, and 16-inch DIP assumed to be CL250.

Close one 6-inch fcv, 35 second linear closure



Close one 6-inch fcv, 2 minute linear closure



BUILDING A WORLD OF DIFFERENCE® BLACK & VEATCH

Technical Memorandum #5 – Small Meter Inaccuracies & Testing

Prepared for

Tennessee American Water Company

Non-Revenue Water Loss Reduction Strategy Analysis

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Black & Veatch Project No. 145895.0100

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Small Service Meter Testing Program

Every small service meter (2" or less) in the distribution system registers a relatively insignificant volume of water itself, but as a whole these small meters are the means of delivering the largest percentage of TAWC's water. Therefore, collectively, small meter inaccuracies can have a dramatic impact on water accounting.

Poor meter performance can result from improper meter installation and mechanical wear and tear. Most states legislate a meter testing/replacement time interval to protect customers from over registering meters. Under registering meters however, result in lost revenue and unaccounted-for water use. In Tennessee, each utility is allowed to set its own schedule for small meter replacement. Currently, TAWC has a goal of replacing small meters every twelve years based on meter age.

A meter testing and replacement program is a management tool to reduce apparent water losses, optimize revenues, and bill customers fairly. The economic advantage of meter testing has been documented time and again, however many of these examples are the result of concentrated rehabilitation after long periods of non-maintenance. These experiences provide little information on standardizing a frequency for a continuous program (AWWA Manual M6). Unfortunately, there is no specific best management practice regarding frequency of testing because it is a utility specific determination. Beyond the regulatory requirements, for which there are none for TAWC beyond approval of the utility designed program by the Tennessee State Utility Board, the economic value of a meter testing and replacement program is dependent on water rates, water quality, and removal, testing, repair and installation costs.

TAWC records from 2004 through 2006 show that the water system has delivered water through 75,409 service meters. Of these, 74,891 (97%) are 2-inches or less. The database shows that ninety-nine percent (99%) of the system's meters are small meters manufactured by two makers, Trident (88%) and Badger Meter (11%). Table 1 summarizes the breakdown of the meters according the TAWC's meter records by size and percentage in the system.

Table 1. Summary of Meters by Size and Percentage of Total

Meter Size (inches)	Total Number in System	Percentage of Total Meters
5/8	69,618	92%
3/4	351	<1%
1	2,363	2%
1-1/2	653	<1%
2	2,257	2%
3	69	<1%
4	77	<1%
6	18	<1%
8	4	<1%
Unknown	1	<1%

The meter database also contains date of installation entries. Table 2 shows the recorded installation date (year) of all the meters on record for which data was available. The TAWC database includes one installation record each for the years 2015 and 2016. Obviously in error, these entries are not included in the total. Additionally, the database included 22,521 entries without date of installation records. According to TAWC staff, these connections are not in service and not included in Table 2.

Table 2. Summary of All Meter Installations Per Year Since 1982

Install Year	Meters Installed	Install Year	Meters Installed
1982[b]	1	1996	5,417
1986	1	1997	4,641
1987	3	1998	6,247
1988	1	1999	5,870
1989	2	2000	6,635
1990	19	2001	4,863
1991	36	2002	5,571
1992	67	2003	3,229
1993	97	2004	4,393
1994	1,715	2005	7,106
1995	4,796	2006[a]	16,505

a. Total installed through August 2006.
b. No data available for 1983-1985.

There are two approaches to determining the testing/replacement of small meters: age-based and performance-based. An age-based approach is the replacement of a meter on a pre-determined schedule based on how long the meter has been in service as determined by its date of installation without consideration of its performance. In contrast, a performance-based approach removes meters from the system only when they are shown to be the worst performing by category or performing outside of acceptable parameters, regardless of age. While the difference may be subtle, a performance-based testing approach provides benefits that the age-based approach does not such as:

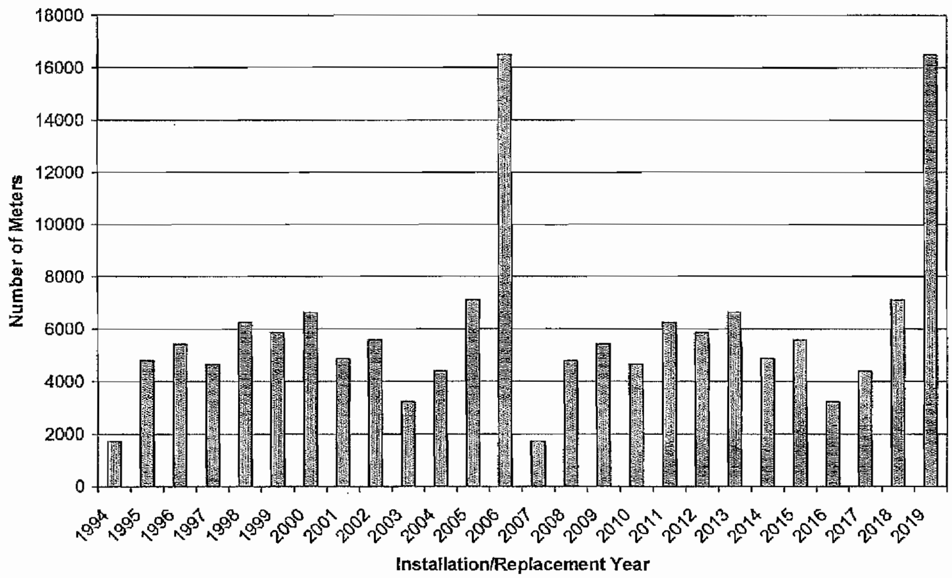
- Prioritization of meter replacement based on defensible data generated by accepted statistical analysis methodology
- Greater potential to reduce non-revenue water and increase revenues
- Means of levelizing replacement costs

In the field, meter performance is a function of a variety of interacting variables including age, level of use, water quality, installation, system pressure, manufacturer, manufacturing processes, and materials of construction. If all of these variables could be applied equally, an age-based approach would be valid. In practice, each of these variables can impact performance differently within the same system. When the impact of these variables is not equal an age-based program can result in well functioning meters being taken out of service combined with poorly performing meters remaining in service. When this occurs the result is wasted resources and reduced revenue or unfair billing.

The current TAWC age-based practice is to schedule meters for replacement when they reach a service life of 12 years from the date of installation. The core assumption of this age-based approach is that all variables are equal and each meter has a predetermined service life based solely on age. Once that service life is reached the meter is no longer considered accurate and that a newer meter will perform better than an older one. The age-based approach requires TAWC to maintain, at a minimum, accurate meter installation records and replace meters on schedule. No meter testing program is required.

The challenge created by a strict age-based program is that unless meters are replaced at their assigned time the program can become backlogged. Further, if a spike in installations occurred in the past, a corresponding spike in replacements will occur in the future. If TAWC continues with a strict age-based approach it will face both of these challenges. Figure 1 shows installation data from Table 2 and projected replacement needs through 2019 (assuming a thirteen year life cycle) for a strict age-based program.

Figure 1. Installation and Replacement Cycle for Age-Based Meter Replacement Program



The peak installation activity reported in 2006 by TAWC will recur cyclically. The only option available to alleviate this cycle will be to replace meters in advance of their projected service life and allow others to remain in service beyond their projected service life.

A performance-based approach does not rely on meter age as the determining factor for scheduled replacement. Instead, the performance-based approach uses a random sample pool of meters for a given sample set that are selected and tested. The assumption of the performance-based approach is that all meters of a given sample set are performing, on average, the same as the representative sample set. When the performance of the sample set tests are compared, replacement is then prioritized based on performance not age.

TAWC's meter records were analyzed with the objective of identifying potential sample pools and establishing a statistical basis for testing. The MS Access database consisted of 75,409 active account entries for meters two inches and smaller. The entries included data on year of installation, meter size, type, manufacturer, and a unique identifier.

Unfortunately, the installation data does not lend itself to a meaningful comparative categorization beyond date of installation, because of the lack of variation. For example, meter size and meter type do not provide a means of categorization and comparison since 92% of the small meters are of one type (100CF) and 92% are of one size (5/8-inch). A similar situation exists with an attempt to analyze by manufacturer as 99% of all meters in the data base are supplied by two manufacturers.

Black & Veatch has evaluated the meter database and the structure of the TAWC system and identified two potential options for creating sample sets. The first is "year of installation" which is possible, but poses a drawback created by the widely varying annual rates of installation between 1994 and 2006. The second potential categorization is by pressure zone location. This approach creates more evenness in the data.

Categorizing the meter by "year of installation" provides thirteen sample sets for each year from 1994 through 2006. Using Equation 1 to determine sample size, one-hundred meters would need to be pulled from each category to provide a statistically valid sample set.

Equation 1.

$$n = \frac{N}{1 + N(e)^2}$$

n = Sample size
N = Number of population
e = sampling error

The calculation assumed a confidence level of 95%, sampling error of +/- 10%, and a maximum degree of variability value of 0.5. This approach provides a conservative size sample pool of 100 meters for each of the thirteen "year of installation" categories for a total of 1,300 meters annually for testing.

While this method is statistically valid, it does not address the wide variability between the population sizes of the meters between years that vary between 1,715 and 16,505 meters. Using this approach TAWC would be faced with drastically varying change-out rates depending on which category was identified as the worst performing. The 2006 installations are the newest meters in the system, however, at some time in the future they will be identified as underperforming and require replacement. The resulting scenario is the same as if an age-based approach were used: a replacement effort two to five times that of the other years. This scenario is compounded by not knowing when those meters will begin to inadequately perform.

The second option identified was a modified categorization by pressure zone. Strict adherence to the pressure zone concept would result in potential replacement spikes due to the large size of the East Ridge and Citico zones relative to the other twenty-one zones. Therefore, the option was modified to dampen the spikes of the larger zones, as well as eliminating the year 2006 installation spike, by creating sample sets organized by a sub-division or combination of the twenty-three pressure zones.

Taking into account the relative sizes of the pressures zones, fifteen sample sets were developed with the objective of lessening the impact of the larger zones and increasing the representation of the smaller zones. Using this approach the Citico and East Ridge Zones were each split into four separate sample sets. To addresses the smaller zones the smallest twenty zones were combined into three sample sets. The result is fifteen sample set zones as shown in Table 3.

Table 3. Meter Sample Sets Determined by Pressure Zone

Sample Set	Estimated number of meters based on zone demand
Citico 1	8383
Citico 2	8383
Citico 3	8383
Citico 4	8383
East Ridge 1	5344
East Ridge 2	5344
East Ridge 3	5344
East Ridge 4	5344
Mission Ridge	2913
Rossville/Ryall Springs	3034
St. Elmo	2383
Lookout Mountain	2035
Combined Zone 1[a]	3216
Combined Zone 2[b]	3216
Combined Zone 3[c]	3752

a. Windy Hill, Panorama, Hill City, Berkely Cir., Cumberland Rd., Summit Ave.
b. Elder Mtn., Cameron Hill, Maple Hill, Rolling Acres, Windridge, Walden
c. Lone Oak, Suck Creek, Stuart Hts., Hill Pointe, Johnson Blvd., Minnekahda

Exact meter counts were not available for each sample set zone. Therefore, in order to develop and distribute initial meter counts based on pressure zone demand data from the hydraulic model the following steps were used:

Step 1 - The daily demands (million gallons per day) assigned per pressure zone were divided by total system demand of 35 million gallons. This provided a percent demand per pressure zone.

Step 2 – Since the available data listed only a single demand for the smallest twenty pressure zones that demand was equally distributed across each of the twenty pressure zones.

Step 3 – The percentage of demand for each zone was the multiplied by the total number of meters in the system to approximate the number of meters in each pressure zone.

Step 4 - The two largest pressure zones (Citico and East Ridge) were then divided into four sub zones to reduce the number of meters per sample set. For this estimation, the number of meters were distributed equally across each of the four sub-areas.

While a complete database of meter locations by pressure zone is not currently available, if the presented correlation between zone demand and the number of meters is assumed relatively accurate, then a percentage of meters identified for replacement each year is demonstrated in Table 3.

Because of the population sizes of each zone, the application of Equation 1 (confidence level of 95%, sampling error of +/- 10%, and a maximum degree of variability value of 0.5) the sample size required of each category for statistical validity would be 100 meters for a total of 1,500 meters annually for testing.

This analysis was developed as an initial evaluation of the applicability of the approach. Should TAWC decide to implement such an approach a more rigorous analysis and determination of the combination and division of pressure zones for sample set categorization should be undertaken.

TAWC also has a desire to estimate total water loss due to small meter inaccuracies. To do this, Equation 1 can be applied to the TAWC system in its entirety. Applying the same statistical variables (confidence level of 95%, sampling error of +/- 10%, and a maximum degree of variability value of 0.5) Equation 1 yields a sample size of 100 meters as representative for the 74,891 meters in the system. The mean inaccuracy of the sample pool meters could then be multiplied across the system to determine a system wide level of over or under metering. This approach is designed to estimate apparent water loss system wide. It does not provide adequate information to prioritize meter replacement.

Based on the estimation of apparent water loss due to system wide inaccuracies, TAWC can conduct a cost-benefit analysis of a more in-depth small meter testing and replacement program. Table 4 summarizes the testing requirements for the three statistical options discussed.

Table 4. Comparison Summary of Statistical Meter Testing Options					
Meter Testing Program	Total Number of Meters Represented	Range of Category Population	Number of Categories	Meters Tested Per Category	Total Meters Tested Annually for Statistical Analysis
Option 1: Categorization by date of installation	74,891	1,715-18,000	13	100	1,300
Option 2: Categorization by modified pressure zone	74,891	2,035 – 8,383	15	100	1,500
Option 3: System wide	74,891	74,891	1	100	100

The following recommendations are provided regarding the identification of small meter inaccuracies:

- Randomly select 100, 5/8-inch meters from the system for performance testing to determine estimate of apparent water loss from system wide meter inaccuracies.
- Based on the findings of the system-wide testing, conduct a cost-benefit analysis for the potential water recovered and the cost of statistical meter testing and replacement program.
- Should a meter testing and replacement program be justified by the costs, develop a statistical, performance based program for implementation.

If a statistical, performance program is justified Appendix A is provided (an excerpt from AWWA Manual M6, Water Meters – Selection, Installation, Testing, and Maintenance (1999)) that describes the statistical testing approach. Under the approach testing would be conducted annually. The replacement of meters could be determined in one of three ways:

- Annually worst performing
- Running performance comparison
- Performing outside of parameters

Implementation will require a capital cost for setting up the program, securing space to conduct testing and a multiple meter testing bench. The benefits of such an approach include:

- Creation of a theoretical 12 - 15 year rotation cycle for all meters in the system that is in alignment with the current target of 12 year replacement.
- A statistically defensible basis for replacement.
- Reduction of non-revenue water loss by systematic removal of worst performing meters.
- The modified pressure zone approach provides a leveling of meter repair and replacement program annual costs by dampening the 2006 installation spike and a potential diagnostic

tool for system conditions demonstrated by meters of a certain zone repeatedly testing poorly.

Appendix A

Example Performance Based Statistical Testing Method

Excerpted from AWWA Manual M6 (1999)

Testing Interval

Ongoing meter-testing programs have long been advocated by AWWA and are required by most public utility commissions. It is in the best interest of both the utility and the customer that testing of meters be part of an ongoing maintenance program. Statistical testing is a management tool. As utility managers strive to make good management decisions, data to assist the decision making is essential. Statistical testing provides the data to make cost-effective management decisions.

The chemical and physical characteristics of water are the most important factors affecting the performance of a meter. Because the characteristics of water vary throughout the country, an arbitrary number of years is not the criterion to use for determining the length of time between tests. From an economic standpoint, a meter should remain in service until it ceases to register within accepted accuracy limits. Because meter testing programs are costly, prudent management dictates that meters should be left in service as long as practical. Because of these variable factors, it is recommended that a utility's own test results be used to determine the length of time its meters should remain in service between tests.

The following guidelines were established so that a utility could establish its own periodic meter-test intervals based on its historical data. The guidelines are designed to be flexible so that different test intervals may be established for different types of meters or for different manufacturers' meters. Time intervals may even be established for new meters that differ from those for repaired meters. Different time intervals may also be established for meters in areas supplied with water from different sources if those sources result in water-quality variances.

Meters will be considered to be in compliance with these guidelines if both of the following conditions are met:

1. Ninety-five percent of the meters scheduled for tests on a periodic basis are actually tested. (It must be recognized that 100 percent of the meters scheduled for test cannot always be tested through no fault of operational procedures.)
2. At least ninety-five percent of the meters actually tested register results within the accuracy limits shown in Table 5-1 for both normal and minimum test-flow rates. These accuracy limits are determined prior to any adjustment or repair of the meter after- it has been in service for a period of time. Only meters tested in conjunction with the periodic testing program should be used in computing average periodic accuracy results.

Statistical Sample Testing

Sample testing is an alternative method to evaluate the performance and service life of 5/8-in. (15-mm) through 1-in. (25-mm) meters. In addition to providing insight into variables affecting meter performance, this method also allows the utility to monitor the overall accuracy of its meters. Sampling is a useful management tool in addressing metering activities, as well as, identifying problems with specific meters.

Most utilities' metering programs involve a change-out policy once a meter has reached a certain age or predetermined life expectancy. These programs assume that all newly purchased meters perform better than the older meters in the system. If this assumption is wrong then the utility may be exchanging meters that are more accurate than those remaining, therefore producing a loss of revenue. Statistical sample testing identifies the poorest performing meters and allows the utility to exchange meters based on performance.

Statistical data is used and accepted throughout the business world as an excellent tool for making informed management decisions. Information developed from sample testing will provide the utility with data in which trends analysis can be made and performance levels for specific meters can be identified.

The first step to implementing a sample testing program is to understand and identify the established statistical methods. This may be accomplished through educational training or by referencing basic statistical methods in textbooks.

After developing a basic understanding of statistical sampling, the following steps should be implemented:

1. Determine desired confidence level.
2. Determine appropriate sample lot size for the confidence level.
3. Determine criteria for testing (size, age, volume, type).
4. Randomly select and retrieve.
5. Test and document.
6. Analyze test data.
7. Report with recommendations.

The following is an example that identifies the benefits of sample testing and performance-based meter change-outs versus annual change-out based on age. In this example, a 95 percent confidence level is achieved. The appropriate lot size to achieve a 95 percent confidence level was determined to be a minimum of 70 meters for a particular set year, regardless of total population size. The criteria used in this example to sample test meters was the year in which the meter was put in service, "set year." A minimum of 70 meters from each sample lot (set year) is randomly pulled from field service and is returned to the meter test facility for shop testing.

Testing standards identified in this manual should be followed and adhered to. Extreme care should be used when retrieving and testing sample metering to best duplicate field accuracy/conditions. The example data includes an overall weighted average determined by assigning weights such as 15 percent-70 percent-15 percent to the low, intermediate, and high test results, respectively (Statistical sampling technique for controlling the accuracy of small water meters. Penchih Tao. Journal AWWA. June 1982.).

Based on established statistical methods, reports such as Table 5-5 can be developed from the sample data. If these data were used to exchange meters based on performance, the meters set in 1982 would be scheduled for exchange. If the exchange criteria were based on age, the utility would exchange meters more accurate than others in the system, therefore not being cost-effective.

Although confidence levels are lost, the sample data can be queried by purchase year (Table 5-6) and by consumption (Table 5-7). Reviewing the data in different ways will identify the group or type of meters that are least accurate. In Table 5-6, purchase year 1982 is again identified as the least accurate group of meters in the sample data.

Table 5-5 1989 sample test meters test results—set date

Set Date	Flow Rates Low	Flow Rates Intermediate	Flow Rates High	Overall Weighted Average
1988	94.72	100.63	90.30	99.54
1987	97.66	100.90	99.63	100.22
1986	86.27	100.98	99.58	98.56
1985	88.86	100.68	98.97	98.65
1984	72.11	100.08	98.61	95.61
1983	79.34	100.02	97.95	96.61
1982	70.09	98.38	98.28	94.43
1981	71.76	100.34	98.82	95.83
1980	71.70	101.03	99.59	96.43
1979	86.20	100.96	99.43	98.52
1978	78.84	100.98	99.68	97.43
1977	88.85	99.90	99.68	98.21
1976	89.07	98.88	99.11	97.44
1975	82.24	100.50	99.46	97.61
1974	90.35	101.24	99.66	99.37
1973	89.50	101.38	99.94	98.38

		Slow Meters (accuracy 98.5 percent)				Accurate Meters (accuracy 98.5–101.5 percent)				Fast Meters (accuracy 101.5 percent)				Entire Population	
Set Year	Number of Meters Tested	Number of Meters	Percentage of Total	Average	Standard Deviation	Number of Meters	Percentage of Total	Average	Standard Deviation	Number of Meters	Percentage of Total	Average	Standard Deviation	Average	Standard Deviation
88	79	3	3.80	83.38	1.78	76	96.20	100.18	0.51	0	0.00	0.00	0.00	99.54	3.27
87	79	1	1.27	84.07	0.00	78	98.78	100.43	0.51	0	0.00	0.00	0.00	100.22	1.90
86	79	12	15.19	88.18	5.56	66	83.54	100.38	0.51	1	1.27	103.15	0.00	98.56	4.93
85	77	13	16.88	91.12	6.13	64	83.12	100.18	0.63	0	0.00	0.00	0.00	98.65	4.27
84	77	31	40.26	89.17	6.70	46	59.74	100.04	0.68	0	0.00	0.00	0.00	95.67	6.84
83	78	31	39.74	91.67	8.87	47	60.26	99.86	0.58	0	0.00	0.00	0.00	96.61	6.90
82	78	37	47.44	88.40	13.73	40	51.28	88.84	0.67	1	1.28	101.56	0.00	94.43	11.07
81	80	34	42.50	90.53	5.99	46	57.50	99.74	0.66	0	0.00	0.00	0.00	95.83	6.02
80	77	24	31.17	87.81	4.46	53	68.83	100.32	0.85	0	0.00	0.00	0.00	96.42	6.34
79	79	12	15.19	88.61	4.86	67	84.61	100.29	0.67	0	0.00	0.00	0.00	98.52	4.64
78	79	21	26.58	88.76	6.43	54	68.35	100.49	0.64	4	5.06	101.55	0.00	97.43	5.95
77	80	15	18.75	87.63	20.57	62	77.50	100.60	0.61	3	3.75	101.66	0.10	98.21	10.20
76	75	14	18.67	85.99	21.87	59	78.67	100.01	0.72	2	2.67	101.97	0.24	97.44	10.95
75	77	21	27.27	91.82	7.99	55	71.43	99.92	0.72	1	1.30	102.60	0.00	97.61	5.72
74	79	12	15.19	92.54	4.82	63	79.75	100.32	0.71	4	5.06	101.97	0.27	99.37	3.19
73	25	2	8.00	89.62	4.00	22	88.00	100.14	0.65	1	4.00	102.25	0.00	99.38	3.18

Total Number of Meters Tested—1,198
Total Number of Slow Meters—283 Percent of Total—24
Total Number of Accurate Meters—898 Percent of Total—75
Total Number of Fast Meters—17 Percent of Total—1

Sample ⅝ in. (15 mm) and ⅝ in. × ¾ in. (15 mm × 20 mm) meters by set year

Table 5-6 1989 sample test meters test results—purchase date

Purchase Date	Low	Flow Rates Intermediate	High	Overall Weighted Average
1988	96.93	100.59	99.36	99.71
1987	94.77	100.78	99.48	99.65
1986	94.21	100.98	99.70	99.77
1982	63.28	93.71	98.30	93.34
1981	77.91	100.62	98.59	96.84
1980	87.84	100.62	98.84	97.09
1979	79.82	101.03	99.49	97.61
1978	84.71	100.98	99.62	98.34
1977	88.41	99.98	99.71	98.21
1974	88.38	99.54	99.11	97.80
1973	91.41	101.13	99.72	99.46

		Slow Meters (accuracy 98.5 percent)				Accurate Meters (accuracy 98.5–101.5 percent)				Fast Meters (accuracy 101.5 percent)				Entire Population	
Purchase Year	Number of Meters Tested	Number of Meters	Percentage of Total	Average	Standard Deviation	Number of Meters	Percentage of Total	Average	Standard Deviation	Number of Meters	Percentage of Total	Average	Standard Deviation	Average	Standard Deviation
88	51	1	1.96	83.22	0.00	50	98.04	100.04	0.49	0	0.00	0.00	0.00	99.71	2.38
87	75	3	4.00	82.88	1.22	72	96.00	100.35	0.49	0	0.00	0.00	0.00	99.65	3.47
86	85	4	4.71	85.66	0.27	81	95.29	100.47	0.52	0	0.00	0.00	0.00	99.77	3.18
82	112	68	60.71	89.03	11.14	44	39.29	99.99	0.68	0	0.00	0.00	0.00	93.34	10.27
81	122	42	34.43	91.23	6.16	80	65.57	99.76	0.65	0	0.00	0.00	0.00	96.84	5.40
80	214	61	28.50	89.53	7.37	152	71.03	100.08	0.70	1	0.47	103.15	0.00	97.09	6.22
79	76	17	22.37	88.03	4.27	59	77.63	100.38	0.72	0	0.00	0.00	0.00	97.61	5.56
78	115	22	19.13	89.22	5.56	89	77.39	100.34	0.65	4	3.48	101.55	0.00	98.34	5.11
77	86	16	18.60	87.50	19.73	66	76.74	100.59	0.60	4	4.65	101.63	0.10	98.21	9.95
74	120	21	17.50	86.77	18.76	93	77.50	100.01	0.75	6	5.00	102.14	0.28	97.80	9.38
73	23	5	21.74	96.30	2.43	17	73.91	100.27	0.77	1	4.35	101.55	0.00	99.46	2.14

Total Number of Meters Tested—1,079
Total Number of Slow Meters—260 Percent of Total—24
Total Number of Accurate Meters—803 Percent of Total—74
Total Number of Fast Meters—16 Percent of Total—1

Sample ⅝ in. (15 mm) and ⅝ in. × ¾ in. (15 mm × 20 mm) meters by purchase year

Table 5-7 1989 sample test meters test results—consumption

Per 1,000 Gallons Consumption		Flow Rates Low	Flow Rates Intermediate	Flow Rates High	Overall Weighted Average
01	0–100	89.42	100.36	98.87	98.50
02	100–200	86.03	100.81	99.31	98.37
03	200–300	86.79	100.70	99.22	97.49
04	300–400	73.81	99.72	99.12	98.49
05	400–500	79.61	100.47	99.01	97.13
06	500–600	81.18	99.43	99.03	96.63
07	600–700	72.75	100.73	99.25	96.31
08	700–800	67.02	100.87	99.28	98.55
09	800–900	84.56	101.02	99.25	98.28
10	900–1,000	81.88	100.08	99.40	97.67
11	1,000–1,100	83.87	98.73	99.40	96.60
12	1,100–1,200	80.61	100.88	99.38	97.61
13	1,200–1,300	89.58	101.35	99.48	99.31
14	1,300–1,400	89.58	101.19	99.22	100.04
15	1,400–1,500	96.36	101.00	99.22	97.67
16	1,500–1,600	87.41	99.53	99.26	97.67

		Slow Meters (accuracy 98.5 percent)				Accurate Meters (accuracy 98.5–101.5 percent)				Fast Meters (accuracy 101.5 percent)				Entire Population	
Cons. Rng	Number of Meters Tested	Number of Meters	Percent-age of Total	Average	Standard Deviation	Number of Meters	Percent-age of Total	Average	Standard Deviation	Number of Meters	Percent-age of Total	Average	Standard Deviation	Average	Standard Deviation
01	120	14	11.67	88.44	10.59	105	87.50	100.19	0.54	1	0.83	103.15	0.00	98.50	5.99
02	144	23	15.97	87.98	5.18	121	84.03	100.34	0.59	0	0.00	0.00	0.00	98.37	5.01
03	148	32	21.62	87.83	5.38	115	77.70	100.15	0.68	1	0.68	101.55	0.00	97.49	5.68
04	120	37	30.83	87.97	15.72	81	67.50	126.26	0.75	2	1.67	101.64	0.09	96.49	9.53
05	98	34	34.69	91.26	6.04	63	64.29	100.22	0.69	1	1.02	101.55	0.00	97.13	5.69
06	76	25	32.89	89.52	16.40	51	67.11	100.11	0.66	0	0.00	0.00	0.00	95.63	10.66
07	75	25	33.33	88.21	5.19	48	64.00	100.30	0.76	2	2.67	101.90	0.35	96.31	6.50
08	90	21	23.33	93.15	5.68	67	74.44	100.15	0.74	2	2.22	101.88	0.33	98.55	4.11
09	52	11	21.15	91.30	5.99	41	78.85	100.16	0.74	0	0.00	0.00	0.00	98.23	4.60
10	61	18	29.66	91.66	5.59	43	70.49	100.18	0.74	0	0.00	0.00	0.00	97.67	4.98
11	42	9	21.43	83.18	24.33	32	76.19	100.20	0.70	1	2.38	102.17	0.00	96.60	13.40
12	37	11	29.73	91.68	5.83	25	67.57	100.06	0.67	1	2.70	101.55	0.00	97.61	5.08
13	30	5	16.67	93.79	5.22	23	76.67	100.25	0.78	2	6.67	102.20	0.40	99.31	3.36
14	24	4	16.67	93.76	4.94	19	76.17	100.20	0.72	1	4.17	102.25	0.00	99.21	3.25
15	21	2	9.52	96.15	0.00	18	85.71	100.38	0.61	1	4.76	101.55	0.00	100.04	1.40
16	58	13	22.41	89.76	11.58	43	74.14	99.87	0.73	2	3.45	101.76	0.14	97.67	6.97

Total Number of Meters Tested—1,196
Total Number of Slow Meters—284 Percent of Total—24
Total Number of Accurate Meters—895 Percent of Total—75
Total Number of Fast Meters—17 Percent of Total—1

Before The

PUBLIC SERVICE COMMISSION

Of The

STATE OF TENNESSEE

in re:

TENNESSEE-AMERICAN WATER COMPANY

(Docket No. U-87-7534)

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Testimony

of

William H. Novak

****

March 1988

Q. State your name for the record, please.

A. My name is William H. Novak.

Q. By whom are you employed, Mr. Novak, and what is your position?

A. I am employed by the Tennessee Public Service Commission as a Financial Analyst.

Q. How long have you been employed by the Commission?

A. Approximately five years. Prior to my employment by this Commission, I was employed as an auditor with the Tennessee Department of Audit.

Q. What is your educational background and what degrees and licenses do you hold?

A. I have a Bachelors degree in Business Administration from Middle Tennessee State University with a major in Accounting. I am also licensed to practice as a Certified Public Accountant in Tennessee, and am a member of the American Institute of Certified Public Accountants.

Q. Mr. Novak, have you testified previously in a case involving Tennessee-American Water Company?

A. Yes. I previously presented testimony before this Commission in docket U-86-7402.

Q. What is the purpose of your testimony in this case?

A. The purpose of my testimony is to present information to the Commission on what the Staff considers to be the appropriate test period and test period adjustment methodology. Specifically, I will testify on the computation of the Staff's revenues, expenses, working capital, income taxes, and revenue conversion factor. Mr. Baugh will testify on the Staff's calculation of rate base and taxes other than income. As supervisor of the audit team conducting the investigation of this rate case, I am also responsible for the theory of all adjustments made by the Staff in arriving at our estimate of the Company's rate of return under present rates, and the calculation of revenue deficiency.

Q. Would you please explain the overall procedures used by the Staff in this case?

A. We first reviewed the Company's financial exhibits and underlying workpapers. In addition, we prepared information requests for data that was not included in the Company's exhibits or workpapers. We also performed an on-site audit of the Chattanooga office, during which we reviewed the Company's financial records. Our normal approach is to adjust the historical test period to compensate for the net effects of all known and reasonably anticipated changes which might occur. The primary concern of the Commission in setting rates is to set rates which are just and reasonable, i.e., rates which are sufficient to cover the operating expenses of a utility, and to allow a reasonable return on its investments used in providing services to its customers. The Staff normally analyzes a twelve month historical period of operations called a "test period" which is based on the Company's books, to test a utility's earnings under present rates. The revenues, expenses, and rate base may then be adjusted as necessary to properly reflect the Company's historical earnings. Since rates are set for the future, the Staff then attempts to determine what future events are likely to transpire which will change or alter the historical test period results. Changes can occur which cause either an increase, or a decrease, in earnings. Changes also occur which cause the company's investment to increase or decrease. The historical test period is therefore adjusted in order to compensate for the net effects of all known and reasonably anticipated changes which might occur.

Q. **What test period and adjusted test period have you adopted for this case?**

A. We have accepted the 12 months ended June 30, 1987 test period as proposed by the Company, and have made adjustments to reflect known and reasonably anticipated changes. Throughout my testimony, I will refer to an "attrition period". The attrition period represents the time period through which we have made these known and reasonably anticipated changes. In this case we have used as an attrition period, the 12 months ending March 31, 1989, since this will be the first year any new rates granted by the Commission would be in effect.

Q. **Have you caused to be filed a multi-page document** consisting of 15 schedules?

A. Yes. (Introduce Exhibit #-- with 15 schedules).

Q. Would you explain Schedule 1 of the Staff's Exhibit and summarize the Staff's findings in this case?

A. Schedule 1 shows the Staff's results of operations under presently approved rates. The Staff's attrition net operating income is $4,816,064, or $186,057 less than the Company's net operating income of $5,002,121. The Staff's attrition rate base is $55,591,033, or $2,368,520 less than the Company's rate base of $57,959,553. The Staff's return on rate base is 8.66% or 0.03% higher than the Company's return of 8.63%. The Company requested a $2,174,843 increase in rates to produce a 10.94% overall return. The Staff's analysis indicates that an increase of $1,485,050 will be necessary to produce a 10.30% return as adopted by Dr. Klein. This concludes the summary of the Staff's analyses; a detailed explanation follows.

Q. Mr. Novak, please explain the differences between the Staff and the Company's total operating revenues.

A. As shown on Staff Exhibit, Schedule 8, the Staff projects total operating revenues of $19,785,129 for the attrition period. This is $184,828 less than the Company's projection of $19,969,957.

Q. How did the Staff's revenue projection differ from the Company's?

A. The Staff has tied its revenue calculation to the calculation of plant in service as described by Mr. Baugh. To do this, the Staff took a ratio of prior period plant additions to customer additions and then applied this ratio to the attrition period plant additions. These customer additions were then multiplied by an average CCF usage per customer giving added sales volumes. This procedure was followed for residential and commercial classes only since these customer additions are directly related to plant additions. Revenues for all other customer classes were computed by taking the test period sales volumes and multiplying by the appropriate tariff rate.

Since the Staff has reduced the amount of plant to be added in the attrition year, a corresponding reduction was made for added customers in the Staff's revenue calculation. While Mr. Baugh will testify more fully on the Staff's calculation of plant in service, I would like to point out that if the Commission should decide to make an adjustment to the Staff's revenue, a corresponding adjustment should be made to plant in service.

Q. How were the Staff's other revenues computed?

A. Other revenues consist of Sewer Billing Revenues, Miscellaneous Service Revenues, Rents From Water Property, and Miscellaneous Revenues. These revenues were computed by taking the test period volume or activity for each account and multiplying by the appropriate tariff rate.

Q. Mr. Novak, during your audit did you discover any irregularities in regards to other revenues?

A. Yes, we discovered two instances in which the Company was charging a rate which was not approved by this Commission. The first instance involved sewer billings to Catoosa County, Georgia for $1.00 per bill. The tariff currently in place provides for a rate of 42.9 cents per bill. The rates of the customers located in the State of Georgia are not regulated by the Public Service Commission of the State of Georgia, but are regulated by this Commission. The $1.00 rate was set by a contract between the Company and Catoosa County but was never approved by this Commission. Since the Staff's field investigation, the Company has amended its contract with the County to include the tariff rate of 42.9 cents per bill as authorized by this Commission.

The second instance in which the Company was charging for services without a tariff provision, involved the utility making a charge for meter replacements. When the Company finds that someone is stealing water, they remove the meter from the premises. To reinstall this meter the Company had been imposing a $90.00 charge which was never approved by this Commission. After the Staff inquired about this charge, the Company agreed that it was not authorized in the tariff and has ceased any future charges. However, they have filed a tariff in this case asking for this charge to be approved.

Q. Which expenses are you responsible for?

A. I am responsible for all the Operation and Maintenance (O&M) expenses except for depreciation expense.

Q. Please explain the procedures used in arriving at your projections for Operations and Maintenance Expense.

A. In arriving at O & M Expense, two different approaches were used. For expenses such as Salaries and Wages, Employee Benefits and Property Insurance, in which the rates for the attrition period are reasonably certain, a price-out of projected rates and anticipated quantities was used. Other expenses, however, could not be priced-out since the rates for future periods are not reasonably certain. For these expenses, the test period amount (normalized for unusual items), was adjusted by a growth factor to arrive at the attrition period amount. This growth factor is composed of both an inflation and a customer growth factor. These expenses are summarized on Staff Exhibit, Schedule 7, and shown in detail on Staff Exhibit, Schedules 9 through 11.

Q. Mr. Novak, please explain the Staff's calculation of Working Capital.

A. As shown on Staff Exhibit, Schedule 4, Working Capital consists of various items such as cash, inventories, prepayments, deferred debits, and results of the lead lag study. Working Capital represents the average amount of capital provided by investors in the Company.

over and above the investment in plant and other specifically identified rate base items.

The results of the lead lag study are shown in detail on Staff Exhibit, Schedules 5 and 6. A lead-lag study measures the cash working capital furnished by either the customers or the investors, as the case may be, to meet the day-to-day needs of providing service to the customer. The lead-lag study has been used by this Commission in the majority of its recent decisions involving major utilities and in my judgment is a useful tool in measuring the appropriate cash working capital allowance to include in the rate base. If the study shows that revenues are collected after the payment of expenses, the investors are furnishing some of the funds to meet these expenses. On the other hand, if revenues are collected before the costs are paid, the Company has available to it, customer funds which may be used to finance fixed and current investment items on a continuous basis. We have reviewed the study prepared by the Company and have used the resulting lead and lag days and applied them to the attrition period revenues and expenses.

Q. Mr. Novak, are there any major areas of disagreement between the Company and the Staff concerning working capital?

A. As far as I know, there is only one major area of disagreement which needs to be discussed. This concerns sewer billings and collections which the Company performs for various municipalities in the Chattanooga area. As a result of the Company holding these collections on the average of 25 days before making payment to the city, it has available $1,156,872 in non-investor, interest free funds. Since they are cost free funds available to finance operations, the rate payers should not be required to pay the Company a return on assets financed by this cost free source of capital.

Q. Mr. Novak, did the Company also include sewer collection in their Working Capital calculation?

A. No they did not. The Company has proposed to treat the sewer collections as an increase to operating income by multiplying the average sewer collections by the short-term debt rate of 8.5%. The Company's rationale for this treatment is that dollars collected for sewer billings from the customers of the Sewer Authorities and the subsequent "float" time are used to either decrease short-term borrowings or invest in repurchase agreements. The Company goes on to argue that Tennessee-American's customers should benefit from this "float" time by increasing present rate revenues by the amount of the interest savings.

Q. Mr. Novak, does the Staff agree with this approach.

A. No, we do not. The Company has used these funds over a period of years to build additional plant. By reducing rate base by the amount of these contributions, interest expense is also reduced since it is a product of the rate base times the weighted cost of debt. Proper utility accounting would call for these collections to be used to reduce rate base to prevent the Company from earning a return on funds which were not supplied by the investors. In fact, this was the method adopted by the Commission in the Company's previous case.

Q. How were the Staff's income taxes calculated?

A. The Tennessee Excise Tax and Federal Income Tax is computed based on the attrition year revenues and expenses as developed by the Staff. These calculations are shown on Staff Exhibit, Schedule 13. The Staff has based its FIT calculation on the new tax laws that will be in effect during the attrition period.

Q. How was the amount for the Staff's allowance for funds used during construction (AFUDC) computed

A. The Staff has used the test period amount of $2,874, shown on Staff Exhibit, Schedule 7, as reasonable for the attrition period. AFUDC represents the debt and equity return on assets used to construct plant. This return is capitalized and then recovered through depreciation expense.

Q. Would you now discuss the Staff's revenue conversion factor as shown on Staff Exhibit, Schedule 15?

A. Yes. The revenue conversion factor of 1.632260 should be multiplied by any net operating income deficiency the Commission might find in this case to gross the revenues up to cover the additional taxes which will result from additional revenues. This conversion factor reflects the impact of recent changes in the tax law.

Q. Does this conclude your testimony?

A. Yes it does.