CAPITAL COST RECOVERY CHARGE REPORT

City of Ann Arbor, Michigan

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Executive Summary

The City of Ann Arbor (City) utilizes a capital charge program that attempts to provide adequate cost recovery for the initial capital investment in its water and sanitary sewer systems. The water and sewer systems have been designed to provide sufficient capacity for both current customers and anticipated future growth in customer connections, presumably to City build out. As new connections tap into the systems, a payment is required to help fund the previous system capacity investment. In some cases, an additional payment is required to help pay for new system assets (main extensions) where none currently exist yet are needed to serve these new connections. Over the years, payment mechanisms have included past special assessments, connection fees, improvement charges and, in the case of developers, contributed assets (usually main extensions).

The City's current capital charge program funding mechanisms consist of connection fees, improvement charges and in the case of developers, contributed assets. The connection fee and improvement charge structures and levels are the primary focus of this analysis. The reason why these funding mechanisms are the focus of this study is that the affordability and methodologies associated with them have been called into question by various community stakeholders over the years, including the University of Michigan, local developers, and individual home and business owners. Complaints about methodologies have centered on the inequities of the program and the complexities of program fee and charge calculations. To address these concerns, the City has made a series of modifications to program approaches and implementation procedures over the past two decades. Unfortunately, the good intentions of the City have created further layers of complexity and confusion, thus generating more concerns and customer complaints. In some cases, where past inequities were resolved, new inequities were created.

From the City's perspective, the capital charge program has been equally frustrating. For example, in development situations where outside City township properties would connect to the systems, the City funded the township property's share of project costs and continued to carry those expenses until the benefiting township property annexed to the City which could be many years later. At the time of annexation, the township property owners would then pay their historical recorded shares of the project cost as approved by the City Council, however without inflation or interest adjustment. Depending on the time of an annexation, the City may or may not have recovered its cost of temporarily financing the project. The City property owners on the other hand paid their fair share of the project cost from the beginning – thus raising the equity issue. Overall, project costs and associated special assessment and improvement charges varied widely due to specific project conditions and time of annexation, thereby resulting in similarly situated parcels, receiving similar benefit, but receiving widely disparate improvement charges. As equity became the City goal, code changes to the capital program created an increasingly complex maze of fee calculations.

In addition, the City has found that the current capital program is difficult to administer as well as explain to customers. Researching past property payments, determining the value of older mains adjacent to connecting properties, and explaining the program methodologies have proven to be frustrating procedures for City staff, thus creating inherent inefficiencies in staff workload related to the program. Consequently, potential transparency issues have arisen, from a customer's perspective.

Therefore, the intent of this study is to establish an equitable, understandable, defensible cost recovery philosophy and charge structure for customers connecting to the City's water main and/or sanitary sewer systems. The capital cost recovery charge calculations in this study use a recoupment (buy-in) approach that identifies the demand that new connections place on the City's water and sanitary sewer systems. The demand units required per connection are multiplied by the cost per unit for each component of each utility system and summed to determine the gross charge. Debt service credits are then calculated and deducted from the gross charge to arrive at a net charge per water connection.

To calculate the charges, industry standards (those primarily endorsed by the American Water Works Association) and professional best practices were utilized. The section below identifies the recommendations of the analysis. Following this section, the report discusses general background related to capital charge development and then portrays the water and sanitary sewer charge analyses.

RECOMMENDATIONS

The recommendations of the capital cost recovery charge analysis are summarized as follows:

- Using the buy-in or recoupment approach to fee development, Black & Veatch has established new water and sewer capital cost recovery charge schedules for City consideration. Tables 1 and 2 illustrate these proposed charges. Note that these charges may be subject to credits as discussed on page 4 and later in the body of this report.

Table 1 – Recommended Water Capital Cost Recovery Charge Schedule

Line No.	Meter Size (in)	Buy-In Component per Meter Equivalent	Flat Cost per Meter	Capital Cost Recovery Charge
	Displacement Meters			
1	0.62	$5,054	$220	**$5,274**
2	0.75	$5,054	$220	**$5,274**
3	1.00	$8,424	$220	**$8,644**
4	1.50	$16,848	$220	**$17,067**
5	2.00	$26,957	$220	**$27,176**
	Magmeters			
6	0.75	$9,266	$220	**$9,486**
7	1.50	$22,745	$220	**$22,964**
8	2.00	$37,065	$220	**$37,285**
9	2.50	$84,239	$220	**$84,459**
10	3.00	$126,359	$220	**$126,578**
11	4.00	$210,598	$220	**$210,818**
12	6.00	$471,740	$220	**$471,959**
13	8.00	$614,947	$220	**$615,166**
14	10.00	$985,599	$220	**$985,819**
15	12.00	$1,482,611	$220	**$1,482,830**

Note: Charges may be subject to credits as detailed in this report.

Table 2 – Recommended Sewer Capital Cost Recovery Charge Schedule

Line No.	Meter Size (in)	Buy-In Component per Meter Equivalent	Flat Cost per Meter	Capital Cost Recovery Charge
	Displacement Meters			
1	0.62	$6,587	$120	**$6,707**
2	0.75	$6,587	$120	**$6,707**
3	1.00	$10,978	$120	**$11,098**
4	1.50	$21,956	$120	**$22,076**
5	2.00	$35,130	$120	**$35,250**
6	3.00	$96,608	$120	**$96,728**
7	4.00	$153,694	$120	**$153,814**
	Magmeters			
8	0.75	$12,076	$120	**$12,196**
9	1.50	$29,641	$120	**$29,761**
10	2.00	$48,304	$120	**$48,424**
11	2.50	$109,782	$120	**$109,902**
12	3.00	$164,672	$120	**$164,792**
13	4.00	$274,454	$120	**$274,574**
14	6.00	$614,777	$120	**$614,897**
15	8.00	$801,406	$120	**$801,526**
16	10.00	$1,284,445	$120	**$1,284,565**

Note: Charges may be subject to credits as detailed in this report.

- In development scenarios whereby a developer is required to construct and install main extensions to serve a development project, Black & Veatch recommends the City provide a credit in recognition of the costs of the extensions borne by the developer. Credits would be applied to the gross capital charge obligation for the development project. For the water system, main extension credit is proposed to be 51.4 percent and for the sanitary sewer system, the credit is proposed to be 11.0 percent. These credits would also be applied in redevelopment situations whereby a currently vacant lot once paid a past special assessment for water and/or sewer capacity and is now seeking to connect to the utility system(s) again with a similar sized demand profile, i.e. similar sized meter and requested capacity. Details on the development of these credits are located in the body of this report.
- In development scenarios whereby an existing development area that has not been previously served by City water and/or sanitary sewer service is now required to connect to a utility system. In these instances, a new main extension is required to facilitate this connection and would be constructed and installed by the City, rather than by a developer. In this scenario, the existing properties that are required to connect to the system would be responsible for the cost of the main extension in addition to their buy-in charge obligation. For the water system, Black & Veatch recommends that the extension charge per residential equivalency unit (or ¾ inch meter) be $18,275. For the sanitary sewer system, Black & Veatch recommends that the extension charge per residential equivalency unit (3/4 inch meter) be $19,972. These charges would be in addition to the capital cost recovery charges listed in Tables 1 and 2. Details on the development of these credits are located in the body of this report.
- Black & Veatch recommends the City implement the following Fire Line Lead capital charges for new fire line connections related to the water system. Table 3 presents the proposed charges.

Table 3 – Recommended Fire Line Lead Capital Charges – Water System (Compared to Full Capital Cost Recovery Charge)

Line No.	Fire Line Pipe Size (in)	Capital Cost Recovery Charge	Fire Line Lead Charge
1	0.75	$9,486	**$3,369**
2	1.50	$22,964	**$8,155**
3	2.00	$37,285	**$13,241**
4	2.50	$84,459	**$29,994**
5	3.00	$126,578	**$44,953**
6	4.00	$210,818	**$74,869**
7	6.00	$471,959	**$167,610**
8	8.00	$615,166	**$218,468**
9	10.00	$985,819	**$350,101**
10	12.00	$1,482,830	**$526,608**

- Black & Veatch recommends the City discontinue collecting a Fire Line Lead capital charge for new fire line connections related to the sanitary sewer system. Based on Black & Veatch's experience with fire line lead charges and industry experience, few if any public agencies charge a fire line lead capital charge related to a sanitary sewer system. Our agency comparative survey results also indicate that none of the surveyed agencies exact a similar charge for fire leads related to sewer
- As part of this study, the City asked Black & Veatch to review and analyze the City's current practice of developing and updating miscellaneous service fees such as water turn-on/turn-off functions, field operation requests (taps), and winterization services. The City calculates such fees by a time and materials approach. Staff regularly updates costs by applying labor and material cost inflators and also reviews time effort for each fee service on a periodic basis. Black & Veatch routinely performs miscellaneous fee analyses for utility agencies throughout the United States. The time and materials approach used by the City is similar to the one that Black & Veatch would use in this case. Therefore, Black & Veatch agrees with the approach and implementation process utilized by the City and recommends that the City continue its practice of routine reviews and updates to the labor effort and materials factors that comprise miscellaneous fee development.

Introduction

The City of Ann Arbor, Michigan, retained Black & Veatch to perform a water and wastewater system capital cost recovery study. The study was intended to establish an equitable, understandable, defensible cost recovery philosophy and fee structure for customers connecting to the City's water main and/or sanitary sewer systems. This report provides the background, methodology, and findings regarding this current study.

PURPOSE OF CAPITAL COST RECOVERY CHARGES

Often called by different names (development fees, connection fees, system development charges, improvement charges, and excess capacity charges), utility capital cost recovery charges are one-time payments used to contribute the proportional share for capital improvements previously made that resulted in available capacity for future demand. The contributions can be solely used for capital investments thereby offsetting costs that would otherwise have to be borne by existing water customers. Capital cost recovery charges have limitations and should not be regarded as the total solution for utility infrastructure financing needs. Rather, they should be considered one component of a comprehensive portfolio to help ensure adequate provision of utility public facilities with the goal of maintaining current levels of utility service within a community or within a service area. Typically, capital cost recovery charges can only be used for capital-related improvements, not for utility operating or maintenance costs.

BACKGROUND AND CURRENT FEE PROGRAM

The City of Ann Arbor's Public Services Area (AAPSA) is a municipal water utility that provides quality drinking water, sanitary sewage disposal, hydropower generation, and storm water services to a population of approximately 115,000 people within the City of Ann Arbor. AAPSA also provides water and sewer service to portions of Ann Arbor, Scio and Pittsfield Townships (population approximately 10,000). The entire AAPSA covers about 43 square miles and continues to attract residential and commercial development.

The City maintains and operates approximately 440 miles of water main, 370 miles of sanitary sewer, and has 22,478 residential connections and 5,843 commercial connections. Within the City's utility service area, approximately 350 buildable vacant lots remain not including larger parcels which could be split in the future; as well as 550 township parcels which will ultimately be served with City water and sanitary service.

Current Fee Program

The City's approaches to cost recovery for the initial capital investment in its water and sanitary sewer systems have been modified over the past several years with the intention of more suitably recovering those costs, in present value amounts, from customers connecting for the first time to those utilities, thereby reducing the burden to the existing customer base of carrying that burden. Concerns have been raised regarding the affordability and methodology of the modified approaches. As a result, an ordinance was passed by the Ann Arbor City Council to amend Chapter 12 of the City Code which establishes one of the City's cost recovery components, improvement charges for water and sanitary sewer, are calculated. The code amendment was intended to be for an interim basis to allow for this capital cost recovery study to be performed.

Fixed Improvement Charges

Prior to 2003, when water mains and/or sanitary sewers were constructed, the City special assessed each benefiting property in the City for their share of the particular project cost at the completion of the project. However, for any township properties that would ultimately utilize the utility line, the City could not special assess those properties as they were outside of the City's jurisdiction. As a result, the City funded their share of the project cost and continued to carry those expenses until the benefiting township property annexed to the City which could be many years later. At the time of annexation, the township property owners paid their historical recorded shares of the project cost as approved by the City Council at the time of the project, without adjustment. Depending on the time of an annexation, the City may or may not have recovered its cost of temporarily financing the project. The City property owners on the other hand paid their fair share of the project cost from the beginning. Overall, project costs and associated assessment and improvement charges varied widely due to specific project conditions and time of annexation, thereby resulting in similarly situated parcels, receiving similar benefit, but receiving widely disparate improvement charges.

In 2003, the City Code was amended to streamline the administration of the assessment and improvement charge process, establish equity of charges to new City parcels, improve the recovery of costs that are currently subsidized, reduce project timelines, and significantly improve communications with residents. The changes included the application of a "Fixed Improvement Charge" for the more frequently occurring improvement projects, i.e. the residential water main and residential sanitary sewer line.

The Fixed Water and Sanitary Sewer Improvement Charge are determined each year by adding the cost of the ten most recent utility projects constructed by the City, adjusted to current costs, and dividing that by the total number of units served. The actual cost of each water main project is cost forwarded to current dollars using the Handy-Whitman Index for "Distribution Plant – Mains, Average All Types". The same method is used for cost forwarding sanitary sewer projects except that the Engineering News Record Construction Cost Index is used for cost forwarding the project costs to current dollars.

The purpose of the 2003 code change was to recover the full cost of the water and sanitary sewer improvements without subsidy by current customers, including their future replacement, with properties paying the current cost of the improvement at the time of the connection through a Fixed Improvement Charge which is re-calculated annually.

In 2007, it was recognized that there were other connections to the city's water and sanitary sewer systems where the City was not made whole for its capital, operating and replacement costs. City Code was then amended to include and accomplish the following:

- Provide for individual vacant residential properties within the City to pay the fixed improvement charge at the time of initial connection to the water and/or sanitary systems, with an adjustment to the amount owed based on the decade the main was constructed. This approach recognizes that the property paid an initial share of the capital construction cost via special assessment, but has not yet contributed to the operation and replacement of the main.
- Provide for vacant non-residential properties within the City which had an historical improvement charge for the main it is connecting to, to pay the difference in the previously paid improvement charge and the cost-forwarded amount of the improvement charge. Again, this approach recognizes that the property paid an initial share of the capital construction cost but has not yet contributed to the operation and replacement of the main.
- Provide for vacant non-residential properties that are connecting for the first time to an existing City main that did not have an historical improvement charge paid directly to the City, to pay an improvement charge based on the proposed usage of the system and the costs of operating and replacing the system, recognizing that the property paid a share of the initial capital construction cost of the system through the land costs, but has not yet contributed to the operation and depreciation of the main.
- Provide for both residential and non-residential units within a development that connect to water and sanitary sewer mains constructed as part of that same development, to pay improvement charges after two years of the main(s) having become part of the City utility system, for a period of eight years, recognizing that while the developer has contributed these mains to the City, the City has to operate and fund the replacement of those systems without funding contribution from these units until they are connected and paying utility rates.

The purpose of these changes were to shift the financial burden for recovery of the investment to serve, including operation and replacement of the water and sanitary sewer systems, from current utility customers to those future customers for whom the investment is made, at the time of their initial connection to the system.

Connection Fee

The improvement charges described above cover the cost of the utility mains constructed to directly serve the property. There are other charges that are levied for each connecting property that cover the property's share of the system-wide costs and include such things as the transmission mains, water treatment plant, and wastewater treatment plant, as well as recover the City's cost for work and material to connect the home to the mains. There are several components to these charges and the costs depend upon the size of the connections (the larger the connection the greater the demand that is placed on the systems, and thus the higher cost). These charges include the following: sanitary sewer connection charge; sanitary sewer tap fee; water connection charge; water meter fee; and, water tap fee.

A connection charge fee schedule was implemented in 2004 and the corresponding fee depends on the size of the "water tap," which is the diameter of the water service line from the water main to the building. Prior to 2004, similar but smaller in scale charges, were in place called "water permit charge" and "sewer permit charge" and were based on the size of the water meter.

The connection charge fee schedule is currently based on the cross sectional area of the water tap with the assumption that the flow capacity for any given connection is limited by the cross sectional area of its service lead.

LEGAL FRAMEWORK

It is important to note that the State of Michigan does not have a specific statute that focuses on capital cost recovery charges. Therefore, the legal background presented herein explains the general framework under which most utility capital charge programs are developed throughout the United States. This framework is supported and endorsed by a variety of sources most notably the American Water Works Association (AWWA), the leading water utility organization in the country. Specifically, AWWA has developed a manual of practice for the setting of water rates, fees and charges. Within this manual, there is a chapter dedicated to the development and implementation of utility-related capital cost recovery charges. Black & Veatch professionals are regularly involved in the update of this manual as well as the capital charge chapter and bring this expertise and experience to bear on the Ann Arbor capital cost recovery charge program development.

While some states do have specific charge-related statutes, all jurisdictions should follow the basic principles associated with capital charge development as outlined in federal case law and relevant state legislation. (For this section the term 'development fees' and 'capital cost recovery charges' have the same meaning.) Both state and federal courts have recognized the imposition of development-related fees on new connections as a legitimate form of land use regulation, provided the fees meet standards intended to protect against regulatory takings. Land use regulations, development exactions and fees are subject to the Fifth Amendment prohibition on taking of private property for public use without just compensation. To comply with this requirement, development regulations must be shown to substantially advance a legitimate governmental interest. In the case of development fees, that interest is in the protection of public health, safety, and welfare by ensuring that development is not detrimental to the quality of essential public services. The means to this end are also important, requiring both procedural and substantive due process. The process followed to receive community input, public meetings with elected officials, provided opportunity for comments and refinements to development fees.

There is little federal case law specifically dealing with development fees, although other rulings on other types of exactions are relevant. In one of the more important exaction cases, the U.S. Supreme Court found that a government agency imposing exactions on development must demonstrate an "essential nexus" between the exaction and the interest being protected (*Nollan v. California Coastal Commission*, 1987). In a later case (*Dolan v. City of Tigard*, OR, 1994), the Court ruled that an exaction also must be "roughly proportional" to the burden created by development. However, the *Dolan* decision appeared to set a higher standard of review for mandatory dedications of land than for monetary exactions such as development fees.

There are three reasonable relationship requirements for development fees that are closely related to "rational nexus" or "reasonable relationship" requirements enunciated by a number of state courts throughout the U.S. Although the term "dual rational nexus" is often used to characterize the standard by which courts evaluate the validity of development fees under the U.S. Constitution, a more rigorous standard recognizes three elements: need, benefit, and proportionality. The dual rational nexus test explicitly addresses only the first two, although proportionality is reasonably implied, and was specifically mentioned by the U.S. Supreme Court in the *Dolan* case. The reasonable relationship language of the statute is considered less strict than the rational nexus standard used by many courts. Individual elements of the nexus standard are discussed further in the following paragraphs.

All new development in a community creates additional demand on some, or all, public facilities provided by local government. If the capacity of facilities is not increased to satisfy that additional demand, the quality or availability of public services for the entire community will deteriorate. Development fees may be used to recover the cost of development-related facilities, but only to the extent that the need for facilities is a consequence of development that is subject to the fees. The *Nollan* decision reinforced the principle that development exactions may be used only to mitigate conditions created by the development upon which they are imposed. That principle clearly applies to development fees. In this study, the impact of development on utility improvement needs is analyzed in terms of quantifiable relationships between various types of development and the demand for specific facilities, based on applicable level-of-service standards.

The requirement that exactions be proportional to the impacts of development was clearly stated by the U.S. Supreme Court in the Dolan case and is logically necessary to establish a proper nexus. Proportionality is established through the procedures used to identify development-related facility costs, and in the methods used to calculate development fees for various types of facilities and categories of development. The demand for facilities is measured in terms of relevant and measurable attributes of development, such as a ¾ inch metered connection average day or maximum day demand for water distribution.

A sufficient benefit relationship requires that development fee revenues be segregated from other funds and expended only on the facilities for which the fees were charged. Development fees must be expended in a timely manner and the facilities funded by the fees must serve the development or new connections paying the fees. However, nothing in the U.S. Constitution (or in the case of this study nothing in the Oklahoma statutes) requires that facilities funded with fee revenues be available exclusively to development paying the fees. In other words, benefit may extend to a general area including multiple real estate developments. Procedures for the earmarking and expenditure of fee revenues are mandated in state enabling legislation. All of these procedural and substantive issues are intended to ensure that new development benefits from the development fees they are required to pay. The authority and procedures to implement development fees is separate and complementary from the authority to require improvements as part of subdivision or zoning review.

GENERAL FEE METHODOLOGIES

There is no single established method for the determination of capital cost recovery charges that is both appropriate for all situations and completely equitable to all new customers. There are, however, various approaches which are currently recognized and utilized within the capital charge setting industry, some to a greater extent than others, by government agencies. These methods can be categorized as follows:

- **System Buy-In or Recoupment**. Fees are designed to derive from the new customer an amount per connection equal to the "equity" in the system attributable to similar existing customers. New development would pay for its share of the useful life and remaining capacity of existing facilities from which new development would benefit. (Note: The word "equity" refers to that portion of system value for which there is no offsetting debt. It does not imply ownership of, or title to, utility facilities.)
- **Incremental Cost-Pricing**. Fees are designed to derive from the new customer the marginal, or incremental, cost of system expansion associated with new customer growth. This method is based on the premise that new connections to a utility system should be responsible for those costs which

they cause to be incurred for the most recent or next increment of required system capacity, except as such costs are recovered from customer user fees or other utility service charges.

- **Planned Facility or Growth Approach**. Fees are based on a long-term CIP or master planning document that identifies facilities needed to provide additional capacity to the system required to support new connections. In effect, the level of service standard of the existing system is not adequate to support new connections. The additional capacity may or may not benefit existing customers. If existing customers would benefit in part by the addition of new facilities, the cost of this portion benefitting existing customers must be borne through revenues other than capital cost recovery charges.

Regardless of methodology employed, revenues derived from capital charges are commonly used to offset part or all capital costs to accomplish any of the following objectives:

- To pay the capital costs of capacity provided for growth.
- To provide rate relief to existing system users by recovering that portion of the annual existing and future capacity capital costs associated with growth, including debt service requirements and direct asset purchases from current revenues.
- To accumulate reserves to finance system improvements and expansions required to meet growth needs.

Based on discussions with City staff, the existing City of Ann Arbor water and sanitary sewer system assets contain excess capacity that new connections can utilize during the foreseeable future. As the City continues to monitor and plan for future connection demand, City staff should update the capital charge analysis to determine if additional capital projects are needed to accommodate growth. Given that there is sufficient capacity in the current water and sanitary sewer system assets, this analysis utilizes the Buy-In approach in most development project scenarios. For those development projects that require a main extension, a separate capital charge would be applied in addition to the buy-in charge. Both analyses are contained within this report.

Credits

Regardless of the methodology, a consideration of credits is important to the implementation of a defensible capital charge methodology. To the extent that other sources of revenue have funded a portion of the infrastructure that could be funded through a capital charge, a credit is applied to ensure fee payers are not double charged. This analysis is more clearly described later in this report.

Water Capital Cost Recovery Charge Analysis

Public utilities assess capital cost recovery charges to help offset costs for tapping into available system capacity and providing for new facilities to support future development. As discussed earlier, capital charges are based on the principle that new connections (and existing connections requiring additional capacity) should pay for required water system capacity. Capital charges represent the current demand requirement of each connection and are not transferable to any other connection or property located within the utility service area.

The cost of providing such capacity in Ann Arbor water system facilities can contribute significantly to the need for capital financing and service rates and/or taxes to support the financing. Collection of water capital cost recovery charges to partially or wholly finance new customer capacity requirements can, over time, significantly reduce the amount of financing and the magnitude of rate increases or taxes that otherwise might be needed. In addition, capital charges could generate additional revenues to meet future expansion requirements so that existing users are not burdened by the costs of expansion caused by growth in system use by new users.

WATER DEMAND AND SERVICE UNITS

Proposed water capital cost recovery charges for new Ann Arbor connections are charged on a per meter equivalent basis, with the amount based on the anticipated water capacity for each meter compared to the baseline meter size for the Ann Arbor water system – the ¾ inch meter (the City customer base does include 5/8 inch meters which are included in the baseline meter count. This meter size category is not considered as the baseline since the City no longer issues this meter size for new connections). Water meter size is often selected as the best available measure of demand, in both average and maximum terms, for water and wastewater customers. The size of a meter is a good indicator of demand because its physical design constrains the upper limits of the demand from a particular connection. Meters that are sized too small for a development project, or run outside the upper limits of capacity, can be replaced with more appropriate meter size categories by the City and consequently the City can collect additional capital charges as deemed appropriate by staff.

This mechanism differs from the current approach which utilizes water tap size as the charge basis. Table 4 presents the recommended equivalency table, showing the number of existing water accounts by meter size, the capacity of water meters of various sizes, and the equivalency factors based on flow capacity on a gallons per minute basis. The resulting calculations yield the total number of existing water service units by meter size.

Table 4 –Water Service Accounts and Units

Line No.	Meter Size	Meter Capacity	Meter Equivalents	Existing Accounts	Service Units
	(inches)	(gpm)		(accts)	
	Displacement Meters				
1	0.75 & smaller	30	1.00	23,741	23,741
2	1.00	50	1.67	1,867	3,112
3	1.50	100	3.33	946	3,153
4	2.00	160	5.33	663	3,536
5		Subtotal Displacement Meters		27,217	33,542
6	**Magmeters**				
7	0.75	55	1.83	1	2
8	1.50	135	4.50	4	18
9	2.00	220	7.33	16	117
10	2.50	500	16.67	1	17
11	3.00	750	25.00	135	3,375
12	4.00	1250	41.67	74	3,083
13	6.00	2800	93.33	30	2,800
14	8.00	3650	121.67	5	608
15	10.00	5850	195.00	3	585
16	12.00	8800	293.33	1	293
17		Subtotal Magmeters		270	10,899
18		**Total Water Service Accounts & Units**		**27,487**	**44,441**

The ratio of maximum demand (daily and hourly) to average day demand is a critical component of water utility planning and operational design. Water facilities are constructed to accommodate maximum customer flow (along with necessary fire flow capabilities). In calculating the Ann Arbor water capital cost recovery charge, demand is reflected in maximum hour terms since the water utility system was designed to meet that magnitude of peak demand, particularly at treatment plant facilities. Table 5 illustrates the development of the demand factors utilized in this study.

Using City utility master planning documentation, it was possible to determine average day and maximum hourly system demands. By dividing maximum hourly flow rate by the average daily flow rate, the analysis yields a maximum hourly ratio of 3.47. The maximum demand per service unit, in gallons per day, is derived by dividing the total number of water service units from Table 4 by the maximum hourly flow rate. The result is 1,157 gallons per day.

Table 5 – Water System Maximum Demand Analysis

Line No.	Utility System	Average Daily Flow (gpd)	Maximum Hourly Flow Rate (gal)	Max to Average Ratio	Service Units	Maximum Demand per Service Unit (gpd)
1	Water	14,800,000	51,400,000	3.47	44,441	1,157

Notes

(1) Sources: Wastewater Treatment Plant Facilities Master Plan, Service Conditions Assessment Technical Memorandum No. 1, Tables 1-1 & 1-3, May 2003; Water Distribution System Master Plan, Table 0-2, June 2010.

BUY-IN CHARGE METHDOLOGY

A bulk of the proposed water capital charge structure is based on the system buy-in approach (there may be development scenarios which require an additional main extension charge. This analysis will be discussed in a later section of this report). Per discussions with City staff, the current water system assets were oversized, in part, to accommodate future growth anticipated as part of future City build-out. It is widely recognized in the utility industry that major water infrastructure projects typically cannot be built to exact capacity and therefore can accommodate some magnitude of future additional demand.

To facilitate the construction of these facilities, the City water enterprise has used cash or debt financing paid by existing customers through rate revenue, charges for service or previously collected water capital improvement charges and connection fees. Debt service on the financing instruments has been paid through customer rates.

In many cases, future connections to the water system will not have paid for this past system investment (in some cases, past special assessments may have been paid and therefore will receive an appropriate credit) therefore, existing customers and water fund revenues have borne this initial cost of existing facilities, including the excess capacity available in the system which can in turn serve future connections. As such, new connections are obligated to bear their proportional share of the prior capital improvements by paying a capital charge commensurate with this investment. This principle is at the heart of the buy-in charge approach.

Existing Assets and Valuation Approaches

The water system is categorized by several major areas: water supply, treatment, and transmission and distribution. Additional assets support the water system including land, vehicles and related system equipment. Transmission facilities are pipelines 12 inches or greater in diameter, pump stations and potable water storage tanks. The distribution system generally consists of pipe 8 inches and smaller with associated valves, hydrants, and appurtenances. To adequately supply potable water to new connections, the City also needs non-capacity items such as land, administrative building space, vehicles and equipment. These costs are allocated on a per connection basis since the benefits of these costs are equitably and proportionately accrued per connection (as opposed to capacity on a per service unit basis).

The question then becomes how an agency should value these existing assets, and consequently the excess capacity available to new connections. The first step is to identify a proper basis for determining existing water asset value. To perform this analysis, the City provided its water fixed asset records and inventory lists which were analyzed by Black & Veatch. These records present detailed listings of each water system asset in use by the City's water fund, including asset name, water system function, date in service, useful life, original cost, and annual and accumulated depreciation.

From this point, a current valuation of the fixed assets must be determined. Various methods are employed to estimate the value of utility facilities required to furnish service to new users. The two principal methods commonly used to value a utility's properties are original cost and replacement cost, with or without considerations for depreciation of existing assets. The following sections provide an overview of each valuation approach.

Original Cost

The principal advantages of the original cost method lie in its relative simplicity and stability, since the recorded costs of tangible property are held constant. The major criticism levied against original cost valuation pertains to the disregard of changes in the value of money over time, which are attributable to inflation and other factors. As evidenced by history, prices have tended to increase rather than remain constant. Because the value of money varies inversely with changes in price, monetary values in most recent years have exhibited a definite decline; a fact not recognized by the original cost approach. This situation causes further problems when it is realized that most utility systems are developed over time on a piecemeal basis as demanded by service area growth. Consequently, each property addition was paid for with dollars of different purchasing power. When these outlays are added together to obtain a plant value, the result can be misleading and disproportionately low compared to present day value. This is particularly relevant for an older water system as the one operated in Ann Arbor.

Replacement Cost

Changes in the value of the dollar over time, at least as considered by the impact of inflation, can be recognized by replacement cost asset valuation. The replacement cost represents the cost of replacing the existing utility facilities with new facilities at current value. Unlike the original cost approach, the replacement cost method recognizes price level changes that may have occurred since original system construction.

The most accurate replacement cost valuation would involve a physical inventory and appraisal of water system components in terms of their replacement costs at the time of valuation. However, with original cost records available, a reasonable approximation of replacement cost plant value can most easily be ascertained by trending historical original costs. This approach employs the use of applicable cost indices to express actual capital costs experienced by the utility in terms of current dollars. An obvious advantage of the replacement cost approach is that it gives consideration to changes in the value of money over time. In this analysis, Black & Veatch used the annual Engineering News Record Construction Cost Index (ENR-CCI) factors for each year from 1919 (in-service date of oldest water system assets still in use) to 2014 to inflate original cost figures to estimate current replacement values for each asset.

Depreciation

Considerations of the current value of utility facilities may also be materially affected by the effects of age and depreciation. Depreciation takes into account the anticipated losses in plant value caused by wear and tear, decay, inadequacy, and obsolescence. To provide appropriate recognition of the effects of depreciation on existing utility facilities, both the original cost and replacement cost valuation measures can also be expressed on an original cost less depreciation (OCLD) and a replacement cost less depreciation (RCLD) basis. These measures are identical to the aforementioned valuation methods, with the exception that accumulated depreciation is computed for each asset account based upon its age or condition, and deducted from the respective total original cost or replacement cost to determine the OCLD or RCLD measures of plant value. The depreciation analysis is not applied to land since it is not a depreciable asset.

RCLD Method for Ann Arbor Water Capital Charge Analysis

For this analysis, Black & Veatch recommends the City utilize the RCLD method to value its existing system assets. There are several reasons to choose this approach. First, the water system assets are well-depreciated. Many of the assets have reached at least 50 percent of their useful life, and in several cases are older than 75 years and still in operation. This situation will require the City to renovate or replace many of these assets over the next 5 to 20 years. Furthermore, it is unlikely that all growth projected during this time period will be served by all older, depreciated facilities.

Table 6 shows the RCLD asset values utilized in the City's water capital cost recovery charge analysis. Asset data was provided by the City via its fixed asset records and inventory lists of existing assets. The water system assets are grouped into major categories and the replacement cost calculated by taking into account asset useful life and amount of depreciation. This table presents the summary of the original costs and RCLD values for each major water system component.

Table 6 - Water System Original Cost and Replacement Cost Values

Line No.	Water Asset Category	Estimated Original Cost ($)	Estimated RCLD Value ($)
1	Treatment	54,806,196	48,337,785
2	Supply	790,000	820,138
3	Transmission & Distribution	238,151,632	223,218,300
4	Storage	2,691,232	1,276,495
5	Construction-in-Progress	6,905,000	6,947,663
6	Pump Station	504,123	369,184
7	Vehicles	2,085,985	912,021
8	Equipment	109,054	11,507
9	Land	417,723	5,113,238
10	**Total**	**306,460,944**	**287,006,331**

Debt Service and Credits

Adhering to rational nexus criteria, this capital charge analysis considers credits for remaining debt because connections associated with new development (new and upsized connections to the water system), after they pay their respective capital charges and receive service, will contribute to this cost through utility rates applied to debt. In Ann Arbor, water system capital improvements have been partly financed through the issuance of debt (revenue bonds and low-interest state revolving fund loans). Customer utility rates help retire the outstanding principal and interest of this debt. Since new connections will be helping to retire outstanding debt that was issued to create existing capacity, capital cost recovery charges are reduced by the present value of the share of future rates that will be used to retire the outstanding debt.

There are several approaches used by utility development charge professionals to calculate a debt service credit to a capital charge. The typical approaches are the Sum of Interest approach, the Present Value approach and the Real Interest Cost approach. For this analysis, Black & Veatch utilizes a net present value approach using a real interest rate (nominal rate less inflation) as the discount rate rather than a nominal interest rate. Many impact fee analyses use the nominal rate to derive debt service credits. However, using a real interest rate better reflects a return on investment as well as a risk premium that could be granted to existing customers who have borne the risk of carrying initial system investment costs over time.

The water utility debt service schedules are presented on the next several pages in Tables 7 through 14. These tables illustrate the outstanding water system debt obligations related to capacity-providing water assets and their associated principal and interest payments. The tables also show the sum of the gross debt costs per gallon for each loan (gallons used reflect maximum hour demand in the water system), and the net present value of the sum of these gross debt costs on a per gallon basis. The sum of the net present value amounts is approximately $1.10 per gallon. The capacity figure used in this analysis is 51.4 million gallons per day (mgd) which represents the typical system maximum hourly demand and is consistent with the water system maximum demand shown in Table 4.

Table 7 – DWRF 2004A, 2004

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	DWRF 2004A, 2004 (7146-01)		**2.215%**			
1	2016	25,000	6,119	$ 31,119	51.4	$ 0.0006
2	2017	25,000	5,588	30,588	51.4	0.0006
3	2018	25,000	5,056	30,056	51.4	0.0006
4	2019	30,000	4,525	34,525	51.4	0.0007
5	2020	30,000	3,888	33,888	51.4	0.0007
6	2021	30,000	3,250	33,250	51.4	0.0006
7	2022	30,000	2,613	32,613	51.4	0.0006
8	2023	30,000	1,975	31,975	51.4	0.0006
9	2024	30,000	1,388	31,388	51.4	0.0006
10	2025	32,950	700	33,650	51.4	0.0007
11	2026	0	0	-	51.4	-
12	2027	0	0	-	51.4	-
13	2028	0	0	-	51.4	-
14	2029	0	0	-	51.4	-
15	2030	0	0	-	51.4	-
16	2031	0	0	-	51.4	-
17	2032	0	0	-	51.4	-
18	2033	0	0	-	51.4	-
19	2034	0	0	-	51.4	-
20	2035	0	0	-	51.4	-
21	2036	0	0	-	51.4	-
22	2037	0	0	-	51.4	-
23	2038	0	0	-	51.4	-
24	Total	$ 287,950	$ 35,102	$ 323,052		$ 0.0063
25	NPV 2015	$ 268,461	$ 33,395	$ 301,856		**$ 0.0063**

Table 8 – Series 2008-A

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2008-A		**4.270%**			
1	2016	1,075,000	859,877	$ 1,934,877	51.4	$ 0.0376
2	2017	1,125,000	816,044	1,941,044	51.4	0.0378
3	2018	1,175,000	770,211	1,945,211	51.4	0.0378
4	2019	1,225,000	722,377	1,947,377	51.4	0.0379
5	2020	1,275,000	672,544	1,947,544	51.4	0.0379
6	2021	1,335,000	620,544	1,955,544	51.4	0.0380
7	2022	1,400,000	566,060	1,966,060	51.4	0.0383
8	2023	1,465,000	505,925	1,970,925	51.4	0.0383
9	2024	1,525,000	438,875	1,963,875	51.4	0.0382
10	2025	1,600,000	368,843	1,968,843	51.4	0.0383
11	2026	1,675,000	294,566	1,969,566	51.4	0.0383
12	2027	1,725,000	215,234	1,940,234	51.4	0.0377
13	2028	1,750,000	132,801	1,882,801	51.4	0.0366
14	2029	1,775,000	49,182	1,824,182	51.4	0.0355
15	2030	0	0	-	51.4	-
16	2031	0	0	-	51.4	-
17	2032	0	0	-	51.4	-
18	2033	0	0	-	51.4	-
19	2034	0	0	-	51.4	-
20	2035	0	0	-	51.4	-
21	2036	0	0	-	51.4	-
22	2037	0	0	-	51.4	-
23	2038	0	0	-	51.4	-
24	Total	$ 20,125,000	$ 7,033,083	$ 27,158,083		$ 0.5282
25	NPV 2015	$ 18,220,314	$ 6,577,439	$ 24,797,753		**$ 0.4800**

Table 9 – DWRF 2009

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	DWRF 2009 (7139-01)		**2.500%**			
1	2016	195,000	100,500	$ 295,500	51.4	$ 0.0057
2	2017	195,000	95,625	290,625	51.4	0.0057
3	2018	200,000	90,750	290,750	51.4	0.0057
4	2019	205,000	85,750	290,750	51.4	0.0057
5	2020	215,000	80,625	295,625	51.4	0.0058
6	2021	220,000	105,250	325,250	51.4	0.0063
7	2022	225,000	69,750	294,750	51.4	0.0057
8	2023	230,000	64,125	294,125	51.4	0.0057
9	2024	235,000	58,375	293,375	51.4	0.0057
10	2025	240,000	52,500	292,500	51.4	0.0057
11	2026	245,000	46,500	291,500	51.4	0.0057
12	2027	255,000	40,375	295,375	51.4	0.0057
13	2028	260,000	34,000	294,000	51.4	0.0057
14	2029	265,000	27,500	292,500	51.4	0.0057
15	2030	270,000	20,875	290,875	51.4	0.0057
16	2031	280,000	14,125	294,125	51.4	0.0057
17	2032	285,000	7,125	292,125	51.4	0.0057
18	2033	0	0	-	51.4	-
19	2034	0	0	-	51.4	-
20	2035	0	0	-	51.4	-
21	2036	0	0	-	51.4	-
22	2037	0	0	-	51.4	-
23	2038	0	0	-	51.4	-
24	Total	$ 4,020,000	$ 993,750	$ 5,013,750		$ 0.0976
25	NPV 2015	$ 3,577,805	$ 918,117	$ 4,495,922		**$ 0.0900**

Table 10 – DWRF 2011

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	DWRF 2011 (7325-01)		**2.500%**			
1	2016	25,000	12,832	$ 37,832	51.4	$ 0.0007
2	2017	30,000	12,207	42,207	51.4	0.0008
3	2018	30,000	11,457	41,457	51.4	0.0008
4	2019	30,000	10,707	40,707	51.4	0.0008
5	2020	30,000	9,957	39,957	51.4	0.0008
6	2021	30,000	9,207	39,207	51.4	0.0008
7	2022	30,000	8,457	38,457	51.4	0.0007
8	2023	30,000	7,707	37,707	51.4	0.0007
9	2024	30,000	6,957	36,957	51.4	0.0007
10	2025	30,000	6,207	36,207	51.4	0.0007
11	2026	35,000	5,332	40,332	51.4	0.0008
12	2027	35,000	4,457	39,457	51.4	0.0008
13	2028	35,000	3,582	38,582	51.4	0.0008
14	2029	35,000	2,707	37,707	51.4	0.0007
15	2030	35,000	1,832	36,832	51.4	0.0007
16	2031	38,271	957	39,228	51.4	0.0008
17	2032	0	0	-	51.4	-
18	2033	0	0	-	51.4	-
19	2034	0	0	-	51.4	-
20	2035	0	0	-	51.4	-
21	2036	0	0	-	51.4	-
22	2037	0	0	-	51.4	-
23	2038	0	0	-	51.4	-
24	Total	$ 508,271	$ 114,562	$ 622,833		$ 0.0121
25	NPV 2015	$ 456,047	$ 106,314	$ 562,361		**$ 0.0100**

Table 11 – DWRF 2012

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	DWRF 2012 (7362-01)		**2.500%**	**Pump Station**		
1	2016	344,396	68,059	$ 412,455	51.4	$ 0.0080
2	2017	355,000	59,449	414,449	51.4	0.0081
3	2018	365,000	50,574	415,574	51.4	0.0081
4	2019	375,000	41,449	416,449	51.4	0.0081
5	2020	385,000	32,074	417,074	51.4	0.0081
6	2021	395,000	22,449	417,449	51.4	0.0081
7	2022	400,000	12,574	412,574	51.4	0.0080
8	2023	410,000	156,126	566,126	51.4	0.0110
9	2024	425,000	145,879	570,879	51.4	0.0111
10	2025	435,000	135,250	570,250	51.4	0.0111
11	2026	445,000	124,376	569,376	51.4	0.0111
12	2027	455,000	113,250	568,250	51.4	0.0111
13	2028	465,000	101,876	566,876	51.4	0.0110
14	2029	480,000	90,250	570,250	51.4	0.0111
15	2030	490,000	78,250	568,250	51.4	0.0111
16	2031	500,000	66,000	566,000	51.4	0.0110
17	2032	515,000	53,500	568,500	51.4	0.0111
18	2033	530,000	40,626	570,626	51.4	0.0111
19	2034	540,000	27,376	567,376	51.4	0.0110
20	2035	555,000	13,876	568,876	51.4	0.0111
21	2036	0	0	-	51.4	-
22	2037	0	0	-	51.4	-
23	2038	0	0	-	51.4	-
24	Total	$ 8,864,396	$ 1,433,263	$ 10,297,659		$ 0.2004
25	NPV 2015	$ 7,728,218	$ 1,264,043	$ 8,992,261		**$ 0.1700**

Table 12 – DWRF 2012 – Barton Dam & Water Treatment Plant

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	DWRF 2012 (7333-01)		**2.500%**	**Barton Dam & WTP**		
1	2016	200,000	111,515	$ 311,515	51.4	$ 0.0061
2	2017	205,000	106,515	311,515	51.4	0.0061
3	2018	210,000	51,390	261,390	51.4	0.0051
4	2019	215,000	96,140	311,140	51.4	0.0061
5	2020	220,000	90,765	310,765	51.4	0.0060
6	2021	225,000	85,265	310,265	51.4	0.0060
7	2022	230,000	79,640	309,640	51.4	0.0060
8	2023	235,000	73,890	308,890	51.4	0.0060
9	2024	240,000	68,015	308,015	51.4	0.0060
10	2025	250,000	62,015	312,015	51.4	0.0061
11	2026	255,000	55,765	310,765	51.4	0.0060
12	2027	260,000	49,390	309,390	51.4	0.0060
13	2028	270,000	42,891	312,891	51.4	0.0061
14	2029	275,000	36,140	311,140	51.4	0.0061
15	2030	280,000	29,265	309,265	51.4	0.0060
16	2031	290,000	22,265	312,265	51.4	0.0061
17	2032	295,000	15,015	310,015	51.4	0.0060
18	2033	305,604	7,640	313,244	51.4	0.0061
19	2034	0	0	-	51.4	-
20	2035	0	0	-	51.4	-
21	2036	0	0	-	51.4	-
22	2037	0	0	-	51.4	-
23	2038	0	0	-	51.4	-
24	Total	$ 4,460,604	$ 1,083,521	$ 5,544,125		$ 0.1079
25	NPV 2015	$ 3,942,755	$ 994,385	$ 4,937,140		**$ 0.1000**

Table 13 – Series 2012 (Refinancing)

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2012 (Refinance of Series Z,W,X)			**1.9989%**		
1	2016	1,335,000	185,627	$ 1,520,627	51.4	$ 0.0296
2	2017	1,340,000	158,928	1,498,928	51.4	0.0292
3	2018	1,355,000	132,128	1,487,128	51.4	0.0289
4	2019	660,000	105,028	765,028	51.4	0.0149
5	2020	670,000	91,827	761,827	51.4	0.0148
6	2021	680,000	78,428	758,428	51.4	0.0148
7	2022	675,000	64,828	739,828	51.4	0.0144
8	2023	680,000	49,640	729,640	51.4	0.0142
9	2024	680,000	34,000	714,000	51.4	0.0139
10	2025	680,000	17,000	697,000	51.4	0.0136
11	2026	0	0	-	51.4	-
12	2027	0	0	-	51.4	-
13	2028	0	0	-	51.4	-
14	2029	0	0	-	51.4	-
15	2030	0	0	-	51.4	-
16	2031	0	0	-	51.4	-
17	2032	0	0	-	51.4	-
18	2033	0	0	-	51.4	-
19	2034	0	0	-	51.4	-
20	2035	0	0	-	51.4	-
21	2036	0	0	-	51.4	-
22	2037	0	0	-	51.4	-
23	2038	0	0	-	51.4	-
24	Total	$ 8,755,000	$ 917,434	$ 9,672,434		$ 0.1883
25	NPV 2015	$ 8,266,066	$ 874,749	$ 9,140,815		**$ 0.1800**

Table 14 – DWRF FY 2014

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	DWRF FY 2014 (7375-01)		**2.500%**	**Barton Dam Electrical Upgrades**		
1	2016	0	4,738	$ 4,738	51.4	$ 0.0001
2	2017	125,000	4,738	129,738	51.4	0.0025
3	2018	125,000	2,238	127,238	51.4	0.0025
4	2019	130,000	0	130,000	51.4	0.0025
5	2020	81,360	128,484	209,844	51.4	0.0041
6	2021	81,360	128,484	209,844	51.4	0.0041
7	2022	81,360	128,484	209,844	51.4	0.0041
8	2023	81,360	128,484	209,844	51.4	0.0041
9	2024	81,360	128,484	209,844	51.4	0.0041
10	2025	81,360	128,484	209,844	51.4	0.0041
11	2026	81,360	128,484	209,844	51.4	0.0041
12	2027	81,360	128,484	209,844	51.4	0.0041
13	2028	81,360	128,484	209,844	51.4	0.0041
14	2029	81,360	128,484	209,844	51.4	0.0041
15	2030	81,360	128,484	209,844	51.4	0.0041
16	2031	81,360	128,484	209,844	51.4	0.0041
17	2032	81,360	128,484	209,844	51.4	0.0041
18	2033	81,360	128,484	209,844	51.4	0.0041
19	2034	81,360	128,484	209,844	51.4	0.0041
20	2035	81,360	0	81,360	51.4	0.0016
21	2036	0	0	-	51.4	-
22	2037	0	0	-	51.4	-
23	2038	0	0	-	51.4	-
24	Total	$ 1,681,760	$ 1,938,974	$ 3,620,734		$ 0.0707
25	NPV 2015	$ 1,483,621	$ 1,675,796	$ 3,159,417		**$ 0.0600**

WATER CAPITAL CHARGE CALCULATION

The Buy-In approach yields a total proposed water capital cost recovery charge schedule for the City of Ann Arbor. Tables 15 and 16 present the culmination of steps needed to calculate the charge. Table 15 identifies existing capacity-producing assets by water utility function at the recommended valuation approach of Replacement Cost less Depreciation (RCLD). The net capacity-producing asset value of $280,969,565 is calculated by taking the total RCLD value in Table 6 ($287,066,331) and deducting the RCLD value of vehicles, equipment and land represented in Table 6 ($6,036,766). The net capacity-producing asset value is then divided by the maximum hourly demand of the system to arrive at a gross cost per gallon basis. Outstanding debt on a net present value basis per gallon is then deducted from the system gross cost per gallon to arrive at a net cost per gallon of capacity. This unit cost is then applied to the demand equivalents of each meter size in the fee structure.

In Table 16, assets that support the capacity-producing assets are divided by the total number of connections served by the water system to yield a cost per new connection. Because these are assets do not produce capacity, they are calculated on a per connection basis; thus these assets are allocated uniformly to each connection.

Table 15 – Buy-In Approach Components – Capacity-Generating Assets

Line No.	Description		Replacement Cost less Depreciation Approach
	Buy-In to Existing Assets		
	Water System Assets (Capacity-Generating)		
1	System Asset Value ($)		280,969,565
2	Maximum Hourly Flow Rate Capacity (gal)		51,400,000
3	Existing Asset Cost per Gallon ($)		5.47
4	Less: Outstanding Debt at Net Present Value ($/gallon)		1.10
5	**Net Cost per Gallon of Capacity**	**$**	**4.37**

Table 16 – Buy-In Approach Components – Non-Capacity-Generating Assets

Line No.	Description		Replacement Cost less Depreciation Approach
	Buy-In to Existing Assets		
	Other Assets (Non-Capacity Generating)		
1	Land		5,113,238
2	Equipment		11,507
3	Vehicles		912,021
4	Total Costs ($)		6,036,766
5	Existing Connections		27,487
6	**Asset Cost per Connection**	**$**	**219.62**

Table 17 shows the total proposed charges by meter size. The net cost per gallon of capacity figure from Table 15 is multiplied by the maximum hourly demand associated with the baseline meter size – ¾ inches. Larger meter charges are calculated by multiplying the meter equivalent for each meter by the ¾ inch meter-based charge. The cost per new connection from Table 16 is then added to each metered connection. The sum of these two charges yields the total buy-in charge (water capital cost recovery charge) by meter size.

Table 17 – Proposed Water Capital Cost Recovery Charge Schedule

Line No.	Meter Size (in)	Buy-In Component per Meter Equivalent	Flat Cost per Meter	Capital Cost Recovery Charge
	Displacement Meters			
1	0.62	$5,054	$220	**$5,274**
2	0.75	$5,054	$220	**$5,274**
3	1.00	$8,424	$220	**$8,644**
4	1.50	$16,848	$220	**$17,067**
5	2.00	$26,957	$220	**$27,176**
	Magmeters			
6	0.75	$9,266	$220	**$9,486**
7	1.50	$22,745	$220	**$22,964**
8	2.00	$37,065	$220	**$37,285**
9	2.50	$84,239	$220	**$84,459**
10	3.00	$126,359	$220	**$126,578**
11	4.00	$210,598	$220	**$210,818**
12	6.00	$471,740	$220	**$471,959**
13	8.00	$614,947	$220	**$615,166**
14	10.00	$985,599	$220	**$985,819**
15	12.00	$1,482,611	$220	**$1,482,830**

DEVELOPMENT SCENARIOS AND RECOMMENDED CHARGES

Ann Arbor is subject to a variety of different development projects ranging from annexation of new properties into its water service area, greenfield development whereby once raw land is developed for residential and non-residential uses, and redevelopment of vacant and non-vacant properties that may or may not have paid past capital charges (or related special assessments) to connect to the system sometime in the past. The following section describes two development scenarios whereby considerations are given to private contributions of water system capital assets (namely main extensions) and whereby the City constructs new main extensions to serve a new development project or to service an existing development area that is required to connect to the City's water system.

Private Contribution of Capital Assets – Main Extensions

In some cases, development projects that require extension of water service (usually via pipe 12 inches and smaller in diameter) are required to construct and connect main extensions to serve the project. In these cases, it is usually the developer who pays for, or contributes, the extension. Since the main extension is being contributed to the overall water system asset portfolio, it is not included in the buy-in charge calculation for new connections outside the development project. However, the cost of the extension for a particular project should be recognized in the calculation of the total capital charge collected from the developer of the project. Therefore, the developer, by bearing the cost of the main extension, should receive a credit commensurate with the estimated cost of this new system improvement. This credit is to be applied to the developer's overall capital charge obligation to be paid to the City.

Based on discussions with City staff, it is often difficult to ascertain each developer's actual cost of the main extensions constructed and installed for their particular projects. Therefore, this analysis develops a percentage credit to be applied to the gross capital charge obligation in these development situations. The value of the water system's transmission and distribution assets that are sized 12 inches or smaller compared to the total water system asset value is approximately 51.4 percent ($147.4 million of $287.0 million is 51.4%). Therefore, the credit to be applied to a development project's gross water capital cost recovery charge obligation will be 51.4 percent.

To illustrate the application of this credit, see Table 18 below. In this example, a hypothetical development project will consist of ten ¾ inch water meters. Based on the proposed water capital charges developed in Table 17, ten ¾ inch meters would translate to a gross water capital charge obligation of approximately $52,740. However, in this hypothetical example, the developer is required by the City to construct and install a 12 inch main extension to serve this new development project. Based on the contributed capital analysis described earlier, the developer of this project would receive a 51.4% credit to be applied to the gross capital charge obligation due to the contribution of the 12 inch main extension. Thus, the net capital charge payment to the City related to this development project would be approximately $25,651, as shown in column 6 of this table.

Table 18 – Hypothetical Water Capital Cost Recovery Charge Credit and Net Capital Charge

Meter Size (in) Column (1)	Development Project Meters (2)	Gross Capital Cost Recovery Charges (3)	Contributed Asset Credit (%) (4)	Contributed Asset Credit ($) (5) = (3)*(4)	Net Capital Cost Recovery Charges (6) = (3)-(5)
0.75	10	$52,740	51.4%	$27,089	$25,651
		Total Net Project Capital Charge:			**$25,651**

Notes

(1) Contributed Asset Credit represents the percentage of 12" and smaller water pipes RCLD value compared to total water system RCLD value.

(2) Figures in table are rounded to the nearest dollar and nearest one-tenth of a percent for the credit calculation.

City Construction of New Main Extensions

The City also experiences development scenarios whereby an existing development area that has not been previously served by City water service is now required to connect to the system. In these instances, a new main extension is required to facilitate this connection and would be constructed and installed by the City, rather than by a developer as was the case in the prior example.

In this scenario, the existing properties that are required to connect to the system would be responsible for the cost of the main extension *in addition to* their buy-in charge obligation as described earlier in this report. Table 19 summarizes the estimated main extension cost per property. Based on City documentation, the estimated system improvement cost of serving development projects required to connect to the City water system is $5,829,708. This figure is derived by taking the build-out project cost identified by the City in its 1998 Utility Service Plan and cost forwarded to current dollars by using the ENR-CCI factor of 1.66. According to City staff, City build out for the water system whereby new main extensions would be required equates to 319 additional residential equivalent units (or 319 ¾ inch water meters). Therefore, the estimated cost of the water main extensions per REU (or ¾ inch meter) would be approximately $18,275.

Table 19 – Proposed Water Capital Cost Extension Charge

Build Out Project Cost	# of REUs	Cost/REU
$5,829,708	319	$18,275

Notes
One (1) REU equates to one (1) 3/4" Disp meter.
Project cost and REUs per 1998 Utility Service Plan and City staff.
Project cost inflated to today's dollars from 1998 value (ENR-CCI = 1.66).

This amount would be added to each REU's buy-in charge. If an REU represents a ¾ inch meter, the $18,275 main extension charge would be added to the buy-in charge of $5,274, thus creating a total capital cost recovery charge amount of $23,549 for this new connection.

WATER FIRE LINE LEAD CHARGES

The City currently charges new fire line lead connections for the cost of capacity in the system related to fire flow requirements. The City's water system is designed to accommodate peak flow demands as well as meet fire flow demands should they be needed. Past and existing customers of the system have borne the investment costs related to providing enough capacity to meet these demands. Consequently, the City charges new fire line lead connections for the investment related to this capacity. This is the same principle described earlier related to capacity for peak demands of water connections.

However, unlike the analysis used earlier, not all water system assets are required to meet fire flow capacity needs. The treatment function of a water system is not necessary to provide adequate water flow for fire-related incidents. Transmission and distribution lines are sized to meet both peak customer demands as well as fire flow demands, yet in different amounts. For example, an 8-inch main line needed to meet customer peak demands may be upsized to a larger diameter pipe to accommodate potential fire flow demands. All other water system functions are considered to meet both peak and fire flow demands equally. Consequently, when assigning cost values to the functional assets, not all system investment costs are considered in the fire line lead charge calculation; only those costs related to the functional assets assigned to fire flow capacities are considered.

For this analysis, the RCLD values found in Table 6 were used. Because treatment assets are not required for fire flow capacity, those asset values (roughly $48.3 million) were omitted. Likewise, not all transmission and distribution asset values were included in the fire charge analysis. To calculate the appropriate transmission and distribution asset values to include in the analysis, Black & Veatch analyzed a typical water main installation project within the City of Ann Arbor. For one such representative project, an 8-inch main was required to be installed to meet peak capacity demand from water connections. In order to meet fire flow capacity requirements, the main needed to be upsized to 12 inches. In these situations, it is common for the City to require the developer to install the entire 12-inch line yet only obligate the developer to pay the cost related to installing an 8-inch line. Therefore, the City would pay the cost for the upsizing from 8 inches to 12 inches. Reimbursement for this investment subsequently comes from the imposition of fire line lead capital charges. All other functional asset costs identified in Table 6 were included in this analysis since the functions, in their entirety, are required to meet potential fire flow demand.

Table 20 illustrates the process used to calculate the percentage of asset values that are attributed to meeting fire flow capacity requirements. Lines 1 through 4 include the sample water line upsizing costs. The cost of upsizing the water line from 8 inches to 12 inches is approximately 38.7% of total project costs. Therefore, Black & Veatch included only 38.7% of the total transmission and distribution asset value found in Table 6 (38.7 % of $223.2 million is roughly $86.5 million). This value was added to the other asset values found in Table 6 with the exception of treatment value which was not included in this analysis.

The resulting total of $101.9 million in asset value is the amount then used to compare to the total water system asset value of $287 million in RCLD terms. The resulting percentage is 35.5 percent. Therefore, this analysis indicates that the fire line lead capital charge should equate to 35.5 percent of the total capital charges derived in Table 17. Table 21 presents the recommended fire line lead charges based on this analysis. (Note that utilities throughout the United States vary significantly in their imposition of fire line charges for water systems. Some utilities will charge fire line connections the same charge as they would for other new connections, some will charge a certain percentage of the typical capital charge, while others will not levy any capital charge to new fire line connections. The comparative survey found in Table 41 at the end of this report illustrates this variability.)

Table 20 – Fire Line Lead Calculation

Line No.	Description	Calculation Amounts
	Value of System Related to Fire Flow Requirements	
	Sample Upsize for Fire Flow System Requirements	
1	Sample Project Base Value ($)	12,954
2	Upsize for Fire Flow Requirements ($)	8,192
3	Sample Project Total Cost ($)	21,147
4	Percentage of Project Value Related to Fire Flow Upsize	38.7%
	Fire Line Lead Percentage	
5	Total T&D System Asset Value (RCLD - $)	223,218,300
6	Amount of T&D related to Fire Flow Upsizing ($)	86,476,323
7	Total Water System RCLD Value excluding Treatment & T&D ($)	15,450,246
8	Total Water System RCLD Value for Fire Line Lead Charge Calculation ($)	101,926,569
9	Percentage of Fire Line Lead Value versus Total System Value	35.5%

Table 21 presents the proposed fire line lead charges by meter size. The water capital cost recovery charges identified in Table 17 are reduced to approximately 35.5 percent of their value to arrive at the proposed fire line charges.

Table 21 – Recommended Capital Cost Recovery Charges and Proposed Fire Line Lead Charges for Water System (Compared to Recommended Capital Cost Recovery Charges)

Line No.	Fire Line Pipe Size (in)	Capital Cost Recovery Charge	Fire Line Lead Charge
1	0.75	$9,486	**$3,369**
2	1.50	$22,964	**$8,155**
3	2.00	$37,285	**$13,241**
4	2.50	$84,459	**$29,994**
5	3.00	$126,578	**$44,953**
6	4.00	$210,818	**$74,869**
7	6.00	$471,959	**$167,610**
8	8.00	$615,166	**$218,468**
9	10.00	$985,819	**$350,101**
10	12.00	$1,482,830	**$526,608**

Sanitary Sewer Capital Cost Recovery Charge Analysis

Public utilities assess capital cost recovery charges to help offset costs for tapping into available system capacity and providing for new facilities to support future development. As discussed earlier in the water charge section, capital charges are based on the principle that new connections (and existing connections requiring additional capacity) should pay for required sanitary sewer system capacity. Capital charges represent the current demand requirement of each connection and are not transferable to any other connection or property located within the utility service area.

The cost of providing such capacity in Ann Arbor sanitary sewer system facilities can contribute significantly to the need for capital financing and service rates and/or taxes to support the financing. Collection of sanitary sewer capital cost recovery charges to partially or wholly finance new customer capacity requirements can, over time, significantly reduce the amount of financing and the magnitude of rate increases or taxes that otherwise might be needed. In addition, capital charges could generate additional revenues to meet future expansion requirements so that existing users are not burdened by the costs of expansion caused by growth in system use by new users.

SANITARY SEWER DEMAND AND SERVICE UNITS

Similar to the proposed water charge schedule, proposed sanitary sewer capital cost recovery charges for new Ann Arbor connections are charged on a per meter equivalent basis, with the amount based on the anticipated sewer flow capacity for each meter compared to the baseline meter size for the Ann Arbor sanitary sewer system – the ¾ inch meter (the City customer base does include 5/8 inch meters which are included in the baseline meter count. This meter size category is not considered as the baseline since the City no longer issues this meter size for new connections).

This mechanism differs from the current approach which utilizes sanitary sewer tap size as the charge basis. Table 22 presents the recommended equivalency table, showing the number of existing sanitary sewer accounts by meter size, the capacity of sanitary sewer meters of various sizes, and the equivalency factors based on flow capacity on a gallons per minute basis. The resulting calculations yield the total number of existing sanitary sewer service units by meter size.

Table 22- Sanitary Sewer Service Accounts and Units

Line No.	Meter Size	Meter Capacity	Meter Equivalents	Existing Accounts	Service Units
	(inches)	(gpm)		(accts)	
	Displacement Meters				
1	0.75 & smaller	30	1.00	23,237	23,237
2	1.00	50	1.67	1,679	2,798
3	1.50	100	3.33	828	2,760
4	2.00	160	5.33	594	3,168
5	3.00	440	14.67	5	73
6	4.00	700	23.33	3	70
7		Subtotal Displacement Meters		26,346	32,107
8	**Magmeters**				
9	0.75	55	1.83	2	4
10	1.50	135	4.50	4	18
11	2.00	220	7.33	15	110
12	2.50	500	16.67	1	17
13	3.00	750	25.00	131	3,275
14	4.00	1250	41.67	73	3,042
15	6.00	2800	93.33	25	2,333
16	8.00	3650	121.67	4	487
17	10.00	5850	195.00	2	390
18		Subtotal Magmeters		257	9,675
19		**Total Sewer Service Accounts & Units**		**26,603**	**41,782**

The ratio of maximum demand (daily and hourly) to average day demand is a critical component of sanitary sewer utility planning and operational design. Sanitary sewer facilities are constructed to accommodate maximum customer sewer flow. In calculating the Ann Arbor sanitary sewer capital cost recovery charge, demand is reflected in maximum hour terms since the sanitary sewer utility system was designed to meet that magnitude of peak demand, particularly at treatment plant facilities. Table 23 illustrates the development of the demand factors utilized in this study.

Using City utility master planning documentation, it was possible to determine average day and maximum hourly system demands. By dividing maximum hourly flow rate by the average daily flow rate, the analysis yields a maximum hourly ratio of 2.98. The maximum demand per service unit, in gallons per day, is derived by dividing the total number of sanitary sewer service units from Table 22 by the maximum hourly flow rate. The result is 1,371 gallons per day.

Table 23 - Sanitary Sewer System Maximum Demand Analysis

Line No.	Utility System	Average Daily Flow (gpd)	Maximum Hourly Flow Rate (gal)	Max to Average Ratio	Service Units	Maximum Demand per Service Unit (gpd)
1	Sewer	19,200,000	57,300,000	2.98	41,782	1,371

Notes

(1) Sources: Wastewater Treatment Plant Facilities Master Plan, Service Conditions Assessment Technical Memorandum No. 1, Tables 1-1 & 1-3, May 2003; Water Distribution System Master Plan, Table 0-2, June 2010.

BUY-IN CHARGE METHDOLOGY

A bulk of the proposed sanitary sewer capital charge structure is based on the system buy-in approach (there may be development scenarios which require an additional main extension charge. This analysis will be discussed in a later section of this report). Per discussions with City staff, the current sanitary sewer system assets were oversized, in part, to accommodate future growth anticipated as part of future City build-out. It is widely recognized in the utility industry that major sanitary sewer infrastructure projects typically cannot be built to exact capacity and therefore can accommodate some magnitude of future additional demand.

To facilitate the construction of these facilities, the City sanitary sewer enterprise has used cash or debt financing paid by existing customers through rate revenue, charges for service or previously collected sanitary sewer capital improvement charges and connection fees. Debt service on the financing instruments has been paid through customer rates.

In many cases, future connections to the sanitary sewer system will not have paid for this past system investment (in some cases, past special assessments may have been paid and therefore will receive an appropriate credit) therefore, existing customers and sanitary sewer fund revenues have borne this initial cost of existing facilities, including the excess capacity available in the system which can in turn serve future connections. As such, new connections are obligated to bear their proportional share of the prior capital improvements by paying a capital charge commensurate with this investment. This principle is at the heart of the buy-in charge approach.

Existing Assets and Valuation Approaches

The sanitary sewer system is categorized by several major areas: sanitary sewer treatment and sewer collection. Additional assets support the sanitary sewer system including land, vehicles and related system equipment. To adequately supply sanitary sewer service to new connections, the City also needs non-capacity items such as land, administrative building space, vehicles and equipment. These costs are allocated on a per connection basis since the benefits of these costs are equitably and proportionately accrued per connection (as opposed to capacity on a per service unit basis).

Similar to the valuation of water assets, the first step to determine the sanitary sewer asset valuation is to identify a proper basis for determining the value. To perform this analysis, the City provided its sanitary sewer fixed asset records and inventory lists which were analyzed by Black & Veatch. These records present detailed listings of each sanitary sewer system asset in use by the City's sanitary sewer fund, including asset name, system function, date in service, useful life, original cost, and annual and accumulated depreciation.

From this point, a current valuation of the fixed assets must be determined. Various methods are employed to estimate the value of utility facilities required to furnish service to new users. The two principal methods commonly used to value a utility's properties are original cost and replacement cost, with or without considerations for depreciation of existing assets. Please see the water section for a detailed description of both valuation analyses.

RCLD Method for Ann Arbor Sanitary Sewer Capital Charge Analysis

For this analysis, Black & Veatch recommends the City utilize the RCLD method to value its existing system assets. There are several reasons to choose this approach. First, the sanitary sewer system assets are well-depreciated. Many of the assets have reached at least 50 percent of their useful life, and in several cases are older than 75 years and still in operation. This situation will require the City to renovate or replace many of these assets over the next 5 to 20 years. Furthermore, it is unlikely that all growth projected during this time period will be served by all older, depreciated facilities.

Table 24 shows the RCLD asset values utilized in the City's sanitary sewer capital cost recovery charge analysis. Asset data was provided by the City via its fixed asset records and inventory lists of existing assets The sanitary sewer system assets are grouped into major categories and the replacement cost calculated by taking into account asset useful life and amount of depreciation. This table presents the summary of the original costs and RCLD values for each major sanitary sewer system component.

Table 24 - Sanitary Sewer System Original Cost and Replacement Cost Values

Line No.	Water Asset Category	Estimated Original Cost ($)	Estimated RCLD Value ($)
1	Collection	112,222,658	93,852,046
2	Treatment	222,193,219	225,503,222
3	Construction-in-Progress	12,360,000	12,520,355
4	Land	345,577	2,614,798
5	Equipment	215,217	130,565
6	Vehicles	1,113,373	444,150
7	**Total**	**348,450,043**	**335,065,136**

Debt Service and Credits

Adhering to rational nexus criteria, this capital charge analysis considers credits for remaining debt because connections associated with new development (new and upsized connections to the sanitary sewer system), after they pay their respective capital charges and receive service, will contribute to this cost through utility rates applied to debt. In Ann Arbor, sanitary sewer system capital improvements have been partly financed through the issuance of debt (revenue bonds and low-interest state revolving fund loans). Customer utility rates help retire the outstanding principal and interest of this debt. Since new connections will be helping to retire outstanding debt that was issued to create existing capacity, capital cost recovery charges are reduced by the present value of the share of future rates that will be used to retire the outstanding debt.

For this analysis, Black & Veatch utilizes a net present value approach using a real interest rate (nominal rate less inflation) as the discount rate rather than a nominal interest rate. The sanitary sewer utility debt service schedules are presented on the next several pages in Tables 25 through 35. These tables illustrate the outstanding sanitary sewer system debt obligations related to capacity-providing sanitary sewer assets and their associated principal and interest payments. The tables also show the sum of the gross debt costs per gallon for each loan (gallons used reflect maximum hour demand in the sanitary sewer system), and the net present value of the sum of these gross debt costs on a per gallon basis. The sum of the net present value amounts is approximately $0.99 per gallon. The capacity figure used in this analysis is 57.3 million gallons per day (mgd) which represents the typical system maximum hourly demand and is consistent with the sanitary sewer system maximum demand shown in Table 23.

Table 25 – Series 2008A

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2008A		**4.44077%**			
1	2016	725,000	948,125	$ 1,673,125	57.3	$ 0.0292
2	2017	750,000	923,219	1,673,219	57.3	0.0292
3	2018	800,000	896,094	1,696,094	57.3	0.0296
4	2019	850,000	865,094	1,715,094	57.3	0.0299
5	2020	900,000	830,094	1,730,094	57.3	0.0302
6	2021	925,000	793,594	1,718,594	57.3	0.0300
7	2022	975,000	755,594	1,730,594	57.3	0.0302
8	2023	1,000,000	716,094	1,716,094	57.3	0.0299
9	2024	1,050,000	674,438	1,724,438	57.3	0.0301
10	2025	1,125,000	629,578	1,754,578	57.3	0.0306
11	2026	1,200,000	580,875	1,780,875	57.3	0.0311
12	2027	1,250,000	526,469	1,776,469	57.3	0.0310
13	2028	1,300,000	466,688	1,766,688	57.3	0.0308
14	2029	1,350,000	403,750	1,753,750	57.3	0.0306
15	2030	1,450,000	337,250	1,787,250	57.3	0.0312
16	2031	1,500,000	267,188	1,767,188	57.3	0.0308
17	2032	1,550,000	194,750	1,744,750	57.3	0.0304
18	2033	1,625,000	119,344	1,744,344	57.3	0.0304
19	2034	1,625,000	0	1,625,000	57.3	0.0284
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 21,950,000	$ 10,928,238	$ 32,878,238		$ 0.5736
25	NPV 2015	$ 18,672,464	$ 9,844,837	$ 28,517,301		**$ 0.5000**

Table 26 – Series 2009A SRF/SQWIF

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2009A SRF/SQWIF		**2.50%**			
1	2016	60,000	26,000	$ 86,000	57.3	$ 0.0015
2	2017	60,000	24,500	84,500	57.3	0.0015
3	2018	60,000	23,000	83,000	57.3	0.0014
4	2019	65,000	21,500	86,500	57.3	0.0015
5	2020	65,000	19,876	84,876	57.3	0.0015
6	2021	65,000	18,250	83,250	57.3	0.0015
7	2022	65,000	16,626	81,626	57.3	0.0014
8	2023	70,000	15,000	85,000	57.3	0.0015
9	2024	70,000	13,250	83,250	57.3	0.0015
10	2025	75,000	11,500	86,500	57.3	0.0015
11	2026	75,000	9,626	84,626	57.3	0.0015
12	2027	75,000	7,750	82,750	57.3	0.0014
13	2028	80,000	5,786	85,786	57.3	0.0015
14	2029	80,000	3,876	83,876	57.3	0.0015
15	2030	75,000	1,876	76,876	57.3	0.0013
16	2031	0	0	-	57.3	-
17	2032	0	0	-	57.3	-
18	2033	0	0	-	57.3	-
19	2034	0	0	-	57.3	-
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 1,040,000	$ 218,416	$ 1,258,416		$ 0.0220
25	NPV 2015	$ 922,676	$ 201,119	$ 1,123,795		**$ 0.0200**

Table 27 – Series 2010 SRF/SQWIF

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2010 SRF/SQWIF		**2.50%**			
1	2016	55,000	27,626	$ 82,626	57.3	$ 0.0014
2	2017	60,000	26,250	86,250	57.3	0.0015
3	2018	60,000	24,750	84,750	57.3	0.0015
4	2019	60,000	23,250	83,250	57.3	0.0015
5	2020	65,000	21,750	86,750	57.3	0.0015
6	2021	65,000	20,126	85,126	57.3	0.0015
7	2022	65,000	18,500	83,500	57.3	0.0015
8	2023	70,000	16,876	86,876	57.3	0.0015
9	2024	70,000	15,126	85,126	57.3	0.0015
10	2025	70,000	13,376	83,376	57.3	0.0015
11	2026	75,000	11,626	86,626	57.3	0.0015
12	2027	75,000	9,750	84,750	57.3	0.0015
13	2028	75,000	7,876	82,876	57.3	0.0014
14	2029	80,000	6,000	86,000	57.3	0.0015
15	2030	80,000	4,000	84,000	57.3	0.0015
16	2031	80,000	2,000	82,000	57.3	0.0014
17	2032	0	0	-	57.3	-
18	2033	0	0	-	57.3	-
19	2034	0	0	-	57.3	-
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 1,105,000	$ 248,882	$ 1,353,882		$ 0.0237
25	NPV 2015	$ 972,047	$ 227,996	$ 1,200,043		**$ 0.0200**

Table 28 – Series 2011 SRF/SQWIF

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2011 SRF/SQWIF		**2.50%**			
1	2016	55,000	31,369	$ 86,369	57.3	$ 0.0015
2	2017	60,000	29,994	89,994	57.3	0.0016
3	2018	60,000	28,494	88,494	57.3	0.0015
4	2019	60,000	26,994	86,994	57.3	0.0015
5	2020	60,000	25,494	85,494	57.3	0.0015
6	2021	65,000	23,994	88,994	57.3	0.0016
7	2022	65,000	22,369	87,369	57.3	0.0015
8	2023	65,000	20,744	85,744	57.3	0.0015
9	2024	70,000	19,119	89,119	57.3	0.0016
10	2025	70,000	17,369	87,369	57.3	0.0015
11	2026	70,000	15,619	85,619	57.3	0.0015
12	2027	75,000	13,869	88,869	57.3	0.0016
13	2028	75,000	11,994	86,994	57.3	0.0015
14	2029	80,000	10,119	90,119	57.3	0.0016
15	2030	80,000	8,119	88,119	57.3	0.0015
16	2031	80,000	6,119	86,119	57.3	0.0015
17	2032	80,000	4,119	84,119	57.3	0.0015
18	2033	84,760	2,119	86,879	57.3	0.0015
19	2034	0	0	-	57.3	-
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 1,254,760	$ 318,017	$ 1,572,777		$ 0.0275
25	NPV 2015	$ 1,086,549	$ 288,450	$ 1,374,999		**$ 0.0200**

Table 29 – Series 2012 SRF/SQWIF

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2012 SRF/SQWIF		**2.50%**			
1	2016	55,000	24,073	$ 79,073	57.3	$ 0.0014
2	2017	55,000	19,327	74,327	57.3	0.0013
3	2018	60,000	17,952	77,952	57.3	0.0014
4	2019	60,000	16,452	76,452	57.3	0.0013
5	2020	60,000	14,952	74,952	57.3	0.0013
6	2021	65,000	13,452	78,452	57.3	0.0014
7	2022	65,000	11,827	76,827	57.3	0.0013
8	2023	65,000	10,202	75,202	57.3	0.0013
9	2024	70,000	8,577	78,577	57.3	0.0014
10	2025	70,000	6,827	76,827	57.3	0.0013
11	2026	70,000	5,077	75,077	57.3	0.0013
12	2027	75,000	3,327	78,327	57.3	0.0014
13	2028	75,000	1,452	76,452	57.3	0.0013
14	2029	75,000	0	75,000	57.3	0.0013
15	2030	80,000	0	80,000	57.3	0.0014
16	2031	80,000	0	80,000	57.3	0.0014
17	2032	85,000	0	85,000	57.3	0.0015
18	2033	85,000	0	85,000	57.3	0.0015
19	2034	85,000	0	85,000	57.3	0.0015
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 1,335,000	$ 153,497	$ 1,488,497		$ 0.0260
25	NPV 2015	$ 1,146,267	$ 142,999	$ 1,289,266		**$ 0.0200**

Table 30 – Series 2004 SRF/SQWIF

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2004 SRF/SQWIF 3002-01			**1.625%**		
1	2016	45,000	7,713	$ 52,713	57.3	$ 0.0009
2	2017	45,000	6,982	51,982	57.3	0.0009
3	2018	45,000	6,251	51,251	57.3	0.0009
4	2019	45,000	5,520	50,520	57.3	0.0009
5	2020	45,000	4,788	49,788	57.3	0.0009
6	2021	50,000	4,057	54,057	57.3	0.0009
7	2022	50,000	3,245	53,245	57.3	0.0009
8	2023	50,000	2,432	52,432	57.3	0.0009
9	2024	50,000	1,619	51,619	57.3	0.0009
10	2025	49,672	807	50,479	57.3	0.0009
11	2026	0	0	-	57.3	-
12	2027	0	0	-	57.3	-
13	2028	0	0	-	57.3	-
14	2029	0	0	-	57.3	-
15	2030	0	0	-	57.3	-
16	2031	0	0	-	57.3	-
17	2032	0	0	-	57.3	-
18	2033	0	0	-	57.3	-
19	2034	0	0	-	57.3	-
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 474,672	$ 43,414	$ 518,086		$ 0.0090
25	NPV 2015	$ 437,913	$ 40,971	$ 478,884		**$ 0.0090**

Table 31 – Series 2004 SRF/SQWIF

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2004 SRF/SQWIF 3002-02			**1.625%**		
1	2016	45,000	8,440	$ 53,440	57.3	$ 0.0009
2	2017	45,000	7,709	52,709	57.3	0.0009
3	2018	45,000	6,977	51,977	57.3	0.0009
4	2019	45,000	6,246	51,246	57.3	0.0009
5	2020	45,000	5,515	50,515	57.3	0.0009
6	2021	45,000	4,784	49,784	57.3	0.0009
7	2022	50,000	4,052	54,052	57.3	0.0009
8	2023	50,000	3,240	53,240	57.3	0.0009
9	2024	50,000	2,427	52,427	57.3	0.0009
10	2025	50,000	1,615	51,615	57.3	0.0009
11	2026	49,382	802	50,184	57.3	0.0009
12	2027	0	0	-	57.3	-
13	2028	0	0	-	57.3	-
14	2029	0	0	-	57.3	-
15	2030	0	0	-	57.3	-
16	2031	0	0	-	57.3	-
17	2032	0	0	-	57.3	-
18	2033	0	0	-	57.3	-
19	2034	0	0	-	57.3	-
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 519,382	$ 51,807	$ 571,189		$ 0.0099
25	NPV 2015	$ 475,727	$ 48,658	$ 524,385		**$ 0.0099**

Table 32 – Series 2004 SRF/SQWIF

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2004 SRF/SQWIF 3002-03			**1.625%**		
1	2016	45,000	9,261	$ 54,261	57.3	$ 0.0009
2	2017	45,000	8,530	53,530	57.3	0.0009
3	2018	45,000	7,798	52,798	57.3	0.0009
4	2019	45,000	7,067	52,067	57.3	0.0009
5	2020	45,000	6,336	51,336	57.3	0.0009
6	2021	45,000	5,605	50,605	57.3	0.0009
7	2022	50,000	4,873	54,873	57.3	0.0010
8	2023	50,000	4,061	54,061	57.3	0.0009
9	2024	50,000	3,248	53,248	57.3	0.0009
10	2025	50,000	2,436	52,436	57.3	0.0009
11	2026	50,000	1,623	51,623	57.3	0.0009
12	2027	49,903	811	50,714	57.3	0.0009
13	2028	0	0	-	57.3	-
14	2029	0	0	-	57.3	-
15	2030	0	0	-	57.3	-
16	2031	0	0	-	57.3	-
17	2032	0	0	-	57.3	-
18	2033	0	0	-	57.3	-
19	2034	0	0	-	57.3	-
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 569,903	$ 61,649	$ 631,552		$ 0.0109
25	NPV 2015	$ 518,200	$ 57,628	$ 575,828		**$ 0.0100**

Table 33 – Series 2004 SRF/SQWIF

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2004 SRF/SQWIF 3002-04			**1.625%**		
1	2016	45,000	10,725	$ 55,725	57.3	$ 0.0010
2	2017	45,000	9,993	54,993	57.3	0.0010
3	2018	50,000	9,262	59,262	57.3	0.0010
4	2019	50,000	8,450	58,450	57.3	0.0010
5	2020	50,000	7,637	57,637	57.3	0.0010
6	2021	50,000	6,825	56,825	57.3	0.0010
7	2022	50,000	6,012	56,012	57.3	0.0010
8	2023	50,000	5,200	55,200	57.3	0.0010
9	2024	50,000	4,387	54,387	57.3	0.0009
10	2025	55,000	3,575	58,575	57.3	0.0010
11	2026	55,000	2,681	57,681	57.3	0.0010
12	2027	55,000	1,787	56,787	57.3	0.0010
13	2028	55,000	893	55,893	57.3	0.0010
14	2029	0	0	-	57.3	-
15	2030	0	0	-	57.3	-
16	2031	0	0	-	57.3	-
17	2032	0	0	-	57.3	-
18	2033	0	0	-	57.3	-
19	2034	0	0	-	57.3	-
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 660,000	$ 77,427	$ 737,427		$ 0.0129
25	NPV 2015	$ 595,383	$ 72,020	$ 667,403		**$ 0.0100**

Table 34 – Series 2004 SRF/SQWIF

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series 2004 SRF/SQWIF 3002-05			**1.625%**		
1	2016	40,000	16,875	$ 56,875	57.3	$ 0.0010
2	2017	40,000	15,875	55,875	57.3	0.0010
3	2018	45,000	14,875	59,875	57.3	0.0010
4	2019	45,000	13,750	58,750	57.3	0.0010
5	2020	45,000	12,625	57,625	57.3	0.0010
6	2021	45,000	11,500	56,500	57.3	0.0010
7	2022	50,000	10,375	60,375	57.3	0.0011
8	2023	50,000	9,125	59,125	57.3	0.0010
9	2024	50,000	7,875	57,875	57.3	0.0010
10	2025	50,000	6,625	56,625	57.3	0.0010
11	2026	55,000	5,375	60,375	57.3	0.0011
12	2027	55,000	4,000	59,000	57.3	0.0010
13	2028	55,000	2,625	57,625	57.3	0.0010
14	2029	50,000	1,250	51,250	57.3	0.0009
15	2030	0	0	-	57.3	-
16	2031	0	0	-	57.3	-
17	2032	0	0	-	57.3	-
18	2033	0	0	-	57.3	-
19	2034	0	0	-	57.3	-
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 675,000	$ 132,750	$ 807,750		$ 0.0141
25	NPV 2015	$ 603,359	$ 122,851	$ 726,210		**$ 0.0100**

Table 35 – Series XVI, XVIII, XIX & XX

Line No.	Fiscal Year Ending	Outstanding Principal	Outstanding Interest	Annual Payment	Hourly Peak Flow Capacity (mgd)	Debt Service per Gallon
	Series XVI, XVIII, XIX & XX		**2.39346%**			
1	2016	1,500,000	753,731	$ 2,253,731	57.3	$ 0.0393
2	2017	1,550,000	700,356	2,250,356	57.3	0.0393
3	2018	1,600,000	644,231	2,244,231	57.3	0.0392
4	2019	1,650,000	584,294	2,234,294	57.3	0.0390
5	2020	1,700,000	520,631	2,220,631	57.3	0.0388
6	2021	1,775,000	452,406	2,227,406	57.3	0.0389
7	2022	1,850,000	379,906	2,229,906	57.3	0.0389
8	2023	1,925,000	303,203	2,228,203	57.3	0.0389
9	2024	2,000,000	221,000	2,221,000	57.3	0.0388
10	2025	2,075,000	134,406	2,209,406	57.3	0.0386
11	2026	0	0	-	57.3	-
12	2027	0	0	-	57.3	-
13	2028	0	0	-	57.3	-
14	2029	0	0	-	57.3	-
15	2030	0	0	-	57.3	-
16	2031	0	0	-	57.3	-
17	2032	0	0	-	57.3	-
18	2033	0	0	-	57.3	-
19	2034	0	0	-	57.3	-
20	2035	0	0	-	57.3	-
21	2036	0	0	-	57.3	-
22	2037	0	0	-	57.3	-
23	2038	0	0	-	57.3	-
24	Total	$ 17,625,000	$ 4,694,164	$ 22,319,164		$ 0.3897
25	NPV 2015	$ 16,219,502	$ 4,414,274	$ 20,633,776		**$ 0.3600**

SANITARY SEWER CAPITAL CHARGE CALCULATION

The Buy-In approach yields a total proposed sanitary sewer capital cost recovery charge schedule for the City of Ann Arbor. Tables 36 and 37 present the culmination of steps needed to calculate the charge. Table 36 identifies existing capacity-producing assets by sanitary sewer utility function at the recommended valuation approach of Replacement Cost less Depreciation (RCLD). The net capacity-producing asset value of $331,875,623 is calculated by taking the total RCLD value in Table 24 ($335,065,136) and deducting the RCLD value of vehicles, equipment and land represented in Table 24 ($3,189,513). The net capacity-producing asset value is then divided by the maximum hourly demand of the system to arrive at a gross cost per gallon basis. Outstanding debt on a net present value basis per gallon is then deducted from the system gross cost per gallon to arrive at a net cost per gallon of capacity. This unit cost is then applied to the demand equivalents of each meter size in the fee structure.

In Table 37, assets that support the capacity-producing assets are divided by the total number of connections served by the sanitary sewer system to yield a cost per new connection. Because these are assets do not produce capacity, they are calculated on a per connection basis; thus these assets are allocated uniformly to each connection.

Table 36 – Buy-In Approach Components – Capacity-Generating Assets

Line No.	Description		Replacement Cost less Depreciation Approach
	Buy-In to Existing Assets		
	Sewer System Assets (Capacity-Generating)		
1	System Asset Value ($)		331,875,623
2	Maximum Hourly Flow Capacity (gpd)		57,300,000
3	Existing Asset Cost per Gallon ($)		5.79
4	Less: Outstanding Debt at Net Present Value ($/gallon)		0.99
5	**Net Cost per Gallon of Capacity**	**$**	**4.80**

Table 37 – Buy-In Approach Components – Non-Capacity-Generating Assets

Line No.	Description		Replacement Cost less Depreciation Approach
	Buy-In to Existing Assets		
	Other Assets (Non-Capacity Generating)		
1	Land		2,614,798
2	Equipment		130,565
3	Vehicles		444,150
4	Total Costs ($)		3,189,513
5	Existing Connections		26,603
6	**Asset Cost per Connection**	**$**	**119.89**

Table 38 shows the total proposed charges by meter size. The net cost per gallon of capacity figure from Table 36 is multiplied by the maximum hourly demand associated with the baseline meter size – ¾ inches. Larger meter charges are calculated by multiplying the meter equivalent for each meter by the ¾ inch meter-based charge. The cost per new connection from Table 37 is then added to each metered connection. The sum of these two charges yields the total buy-in charge (sanitary sewer capital cost recovery charge) by meter size.

Table 38 – Proposed Sanitary Sewer Capital Cost Recovery Charge Schedule

Line No.	Meter Size (in)	Buy-In Component per Meter Equivalent	Flat Cost per Meter	Capital Cost Recovery Charge
	Displacement Meters			
1	0.62	$6,587	$120	**$6,707**
2	0.75	$6,587	$120	**$6,707**
3	1.00	$10,978	$120	**$11,098**
4	1.50	$21,956	$120	**$22,076**
5	2.00	$35,130	$120	**$35,250**
6	3.00	$96,608	$120	**$96,728**
7	4.00	$153,694	$120	**$153,814**
	Magmeters			
8	0.75	$12,076	$120	**$12,196**
9	1.50	$29,641	$120	**$29,761**
10	2.00	$48,304	$120	**$48,424**
11	2.50	$109,782	$120	**$109,902**
12	3.00	$164,672	$120	**$164,792**
13	4.00	$274,454	$120	**$274,574**
14	6.00	$614,777	$120	**$614,897**
15	8.00	$801,406	$120	**$801,526**
16	10.00	$1,284,445	$120	**$1,284,565**

DEVELOPMENT SCENARIOS AND RECOMMENDED CHARGES

Ann Arbor is subject to a variety of different development projects ranging from annexation of new properties into its sanitary sewer service area, greenfield development whereby once raw land is developed for residential and non-residential uses, and redevelopment of vacant and non-vacant properties that may or may not have paid past capital charges (or related special assessments) to connect to the system sometime in the past. The following section describes two development scenarios whereby considerations are given to private contributions of sanitary sewer system capital assets (namely main extensions) and whereby the City constructs new sanitary sewer main extensions to serve a new development project or to service an existing development area that is required to connect to the City's sanitary sewer system.

Private Contribution of Capital Assets – Main Extensions

In some cases, development projects that require extension of sanitary sewer service (usually via pipe 8 inches in diameter) are required to construct and connect main extensions to serve the project. In these cases, it is usually the developer who pays for, or contributes, the extension. Since the main extension is being contributed to the overall sanitary sewer system asset portfolio, it is not included in the buy-in charge calculation for new connections outside the development project. However, the cost of the extension for a particular project should be recognized in the calculation of the total capital charge collected from the developer of the project. Therefore, the developer, by bearing the cost of the main extension, should receive a credit commensurate with the estimated cost of this new system improvement. This credit is to be applied to the developer's overall capital charge obligation to be paid to the City.

Based on discussions with City staff, it is often difficult to ascertain each developer's actual cost of the main extensions constructed and installed for their particular projects. Therefore, this analysis develops an estimated percentage credit to be applied to the gross capital charge obligation in these development situations. The value of the sanitary sewer system's transmission and distribution assets that are sized 8 inches or smaller compared to the total sanitary sewer system asset value is approximately 11.0 percent ($36.9 million of $335.0 million is 11.0%). This percentage is considerably smaller than the water system analysis showed. The reason for this disparity is that the value of the sewer system's treatment plant assets and sewer pipes greater than 8 inch in size represent a much larger share of the overall sewer system value compared to similar assets for the water system. Therefore, the credit to be applied to a development project's gross sanitary sewer capital cost recovery charge obligation will be 11.0 percent.

To illustrate the application of this credit, see Table 39. In this example, a hypothetical development project will consist of ten ¾ inch sanitary sewer meters. Based on the proposed sanitary sewer capital charges developed in Table 38, ten ¾ inch meters would translate to a gross sanitary sewer capital charge obligation of approximately $67,068. However, in this hypothetical example, the developer is required by the City to construct and install an 8 inch main extension to serve this new development project. Based on the contributed capital analysis described earlier, the developer of this project would receive a 11.0% credit to be applied to the gross capital charge obligation due to the contribution of the 8 inch main extension. Thus, the net capital charge payment to the City related to this development project would be approximately $59,690, as shown in column 6 of this table.

Table 39 – Hypothetical Sanitary Sewer Capital Cost Credit and Net Capital Charge

Meter Size (in) Column (1)	Development Project Meters (2)	Gross Capital Cost Recovery Charges (3)	Contributed Asset Credit (%) (4)	Contributed Asset Credit ($) (5) = (3)*(4)	Net Capital Cost Recovery Charges (6) = (3)-(5)
Displacement Meters					
0.75	10	$67,068	11.0%	$7,378	$59,690
		Total Project Capital Charge:			**$59,690**

Notes

(1) Contributed Capital Credit represents the percentage of 8" and smaller sewer pipes RCLD value compared to total water system RCLD value.

(2) Figures in table are rounded to the nearest dollar and nearest one-tenth of a percent for the credit calculation.

City Construction of New Main Extensions

The City also experiences development scenarios whereby an existing development area that has not been previously served by City sanitary sewer service is now required to connect to the system. In these instances, a new main extension is required to facilitate this connection and would be constructed and installed by the City, rather than by a developer as was the case in the prior example.

In this scenario, the existing properties that are required to connect to the system would be responsible for the cost of the main extension *in addition to* their buy-in charge obligation as described earlier in this report. Table 40 summarizes the estimated main extension cost per property. Based on City documentation, the estimated system improvement cost of serving development projects required to connect to the City sanitary sewer system is $4,593,539. This figure is derived by taking the build-out project cost identified by the City in its 1998 Utility Service Plan and cost forwarded to current dollars by using the ENR-CCI factor of 1.66. According to City staff, City build out for the sanitary sewer system whereby new main extensions would be required equates to 230 additional residential equivalent units (or 230 ¾ inch sanitary sewer meters). Therefore, the estimated cost of the sanitary sewer main extensions per REU (or ¾ inch meter) would be approximately $19,972.

Table 40 – Proposed Sanitary Sewer Capital Cost Extension Charge

Build Out Project Cost	# of REUs	Cost/REU
$4,593,539	230	$19,972

Notes
One (1) REU equates to one (1) 3/4" Disp meter.
Project cost and REUs per 1998 Utility Service Plan and City staff.
Project cost inflated to today's dollars from 1998 value (ENR-CCI = 1.66).

This amount would be added to each REU's buy-in charge. If an REU represents a ¾ inch meter, the $19,972 main extension charge would be added to the buy-in charge of $6,707, thus creating a total capital cost recovery charge amount of $26,679 for this new connection.

FIRE LINE LEAD CHARGES – SANITARY SEWER CONNECTIONS

The City current charges a capital charge for the sewer system on any new fire line lead connections. Based on Black & Veatch's experience with fire line lead charges and industry experience, few if any public agencies charge a fire line lead capital charge related to a sanitary sewer system. Our agency comparative survey results also indicate that none of the surveyed agencies exact a similar charge for fire leads related to sewer. Therefore, Black & Veatch recommends that the City discontinue the levying of capital charges on fire line leads related to the sanitary sewer system.

Capital Charge Comparative Analysis

A comparative analysis, or benchmarking, for public agencies is a process of comparing one agency's processes and/or fees to best practices within an industry or to other agency processes and/or fees. Such an analysis also includes an internal comparison of current charges to proposed charges for difference development scenarios within the City's service area or sphere of influence. For purposes of this report, the City asked Black & Veatch to compare the City's proposed charges to current charges for different types of development as well as to compare the City's proposed water and sanitary sewer capital cost recovery charges to like agency charges (other cities that exact similar types of capital charges). While there are obvious benefits to making such inter-agency comparisons, there are also several caveats that should be considered during this process.

Fee surveys are reliant on the availability of other agency fee data. In many cases, the city data collected as part of this benchmarking effort were found on agency web sites. Where data did not exist, Black & Veatch placed telephone calls with the agencies to obtain data. In many of these cases, the municipalities simply did not charge a capital fee for a particular utility. One agency simply did not respond to our survey request despite numerous requests.

Another caveat is that many agencies will not charge the maximum cost-based fee, choosing instead to subsidize capital investment through other sources, most often customer utility rates. The primary reason that agencies do not implement full cost-based charges is concern about the impact that high capital charges will have on economic development with their communities. Contrary to popular opinion, there is little empirical analysis that demonstrates a causal effect between the amount of capital charges collected and the level of economic development activity. Yet, many agencies continue to support the notion that lower charges will stimulate growth in their communities.

A final consideration in drawing capital charge comparisons with other communities is that the cost bases for Ann Arbor may be much different than those of the other agencies. Other agency capital assets may be older or newer on average compared to Ann Arbor. Also, other agencies may employ different methodologies and approaches in calculating fees and/or existing asset values. One or a combination of these considerations can have a significant effect on the level of capital charges an agency decides to implement and collect from its new connections. All of these caveats should be kept in mind when reviewing the proposed Ann Arbor fees with those of other agencies.

Tables 41 and 42 present the comparison of proposed Ann Arbor water and sanitary sewer capital cost recovery charges with those of several agencies. The agencies selected fit a profile of being well-established communities that have a major university situated within its utility service area. Also, Black & Veatch attempted to keep the agencies centered within the Midwestern to Eastern part of the United States whereby these communities are not experiencing or have not experienced a significantly high rate of growth. Growth-oriented communities tend to have a high level of capital expansion requirements that can skew charge level comparisons.

Table 43 is the intra-agency charge comparison. This chart presents nine different development scenarios and relates current charges (improvement and connection) with the proposed charges detailed in this report. The combined total charges include both water and sanitary sewer charges.

Finally, we included in Table 44 a national survey of utility capital charges that was conducted in 2012 by Duncan and Associates, a professional consulting firm located in the State of Texas. It is the most comprehensive survey of its kind and includes hundreds of agencies from many of the states throughout the country. The water and sewer charges listed in the survey are representative of single-family residential connections, presumably with 5/8 inch or ¾ inch meters. For purposes of this report, Black and Veatch lists the highest and lowest water and sewer capital charges within each state to give the reader an idea of the range of charges found throughout the U.S. While the survey was conducted three years ago, many agencies do not update or increase capital charges on a regular basis, therefore the data are likely still relevant for comparison purposes.

Table 41 – Comparison of Proposed Ann Arbor Water Capital Charges to Other Agencies

Meter Size (in)	Proposed Ann Arbor	Grand Rapids, MI		Lansing, MI	Columbus, OH	Cincinnati, OH	Bloomington, IN	Ft. Wayne, IN	Madison, WI	Charleston, SC	Columbia, SC	Fort Worth, TX	Lawrence, KS
Displacement Meters													
0.75	$2,565 - $5,274	$2,992	plus $76/foot to $108/foot of front footage for distribution system	$1,000	$1,345 - $2,018	$4,690	No capital charge for capacity	$749	Information not available from City	$2,590	$2,512	$704	$1,580
1.00	$4,204 - $8,644	$4,880	plus $76/foot to $108/foot of front footage for distribution system	$1,000	$2,245 - $3,363	$4,922	No capital charge for capacity	$1,129	Information not available from City	$4,050	$3,468	$1,173	$3,940
1.50	$8,301 - $17,067	$9,730	plus $76/foot to $108/foot of front footage for distribution system	$2,194	$4,483 - $ 6,725	$8,178	No capital charge for capacity	$1,570	Information not available from City	$7,380	$4,350	$2,435	$7,880
2.00	$13,217 - $27,176	$15,574	plus $76/foot to $108/foot of front footage for distribution system	$3,900	$7,174 - $10,760	$12,861	No capital charge for capacity	$2,953	Information not available from City	$11,600	$8,490	$3,752	$12,600
Fire Line Leads													
	Ranges from $3,369 to 12" fire line connection @ $526,608			Information not available from City	50% of capacity charge	Information not available from City	None	Information not available from City	None	None	4-inch line w/ 1.5-inch meter: $3,161; 6-inch line w/1.5-inch meter: $4,210; 8-inch line w/2-inch meter: $5,967; 10-inch line w/2-inch meter: $8,279	None	None

Table 42 – Comparison of Proposed Ann Arbor Sewer Capital Charges to Other Agencies

Meter Size (in)	Proposed Ann Arbor	Grand Rapids, MI		Lansing, MI	Columbus, OH	Cincinnati, OH	Bloomington, IN	Ft. Wayne, IN	Madison, WI	Charleston, SC	Columbia, SC	Fort Worth, TX	Lawrence, KS
Displacement Meters													
0.75	$5,969 - $6,707	$2,992	plus $85/foot to $107/foot of front footage for distribution system	Information not available from City	$3,044	$3,700	$1,000	Information not available from City	Information not available from City	$2,940 per ERU	$3,940 per ERU	$678	$2,050 - $4,280
1.00	$9,877 - $11,098	$4,880	plus $85/foot to $107/foot of front footage for distribution system	Information not available from City	$5,074	$6,710	$4,000	Information not available from City	Information not available from City	$2,940 per ERU	$3,940 per ERU	$1,129	$2,050 - $10,690
1.50	$19,648 - $22,076	$9,730	plus $85/foot to $107/foot of front footage for distribution system	Information not available from City	$10,147	$15,340	$10,000	Information not available from City	Information not available from City	$2,940 per ERU	$3,940 per ERU	$2,258	$2,050 - $21,380
2.00	$31,372 - $35,250	$15,574	plus $85/foot to $107/foot of front footage for distribution system	Information not available from City	$16,236	$27,620	$19,000	Information not available from City	Information not available from City	$2,940 per ERU	$3,940 per ERU	$3,612	$2,050 - $34,200
3.00	$86,087 - $96,728	$34,100	plus $85/foot to $107/foot of front footage for distribution system	Information not available from City	$32,472	$62,630	$26,000	Information not available from City	Information not available from City	$2,940 per ERU	$3,940 per ERU	$9,820	$64,130 Commercial Only
4.00	$136,894 - $153,814	$61,362	plus $85/foot to $107/foot of front footage for distribution system	Information not available from City	$50,737	$111,850	$58,000	Information not available from City	Information not available from City	$2,940 per ERU	$3,940 per ERU	$16,932	$106,880 Commercial Only
Fire Line Leads													
	$0			Information not available from City	None	None	None	Information not available from City	Information not available from City	None	None	None	None

Table 43 – Intra-Agency Comparison of Proposed Capital Charges under Varied Development Scenarios

Line No.	Development Scenario	Year of Utility Construction		Current Charges [1]			Proposed Charges		
		Sanitary	Water	Sanitary	Water	Total	Sanitary	Water	Total
1	A - City extends sanitary/water in the future to unserved areas	New	New	$26,900	$18,172	$45,072	$26,679	$23,549	$50,228
2	B - Vacant lot within City limits which paid a historic special assessment in the 1960s and is now being developed	1962	1962	$11,661	$7,466	$19,127	$5,969	$2,584	$8,553
3	C - Vacant lot within City limits which paid a historic special assessment in the 1930s/1960s and is now being developed	1962	1931	$11,661	$10,761	$22,422	$5,969	$2,584	$8,553
4	D - Vacant lot within City limits which did not pay a historic special assessment since the sanitary construction occurred in 2004 under the "Fixed IC" rules	2004	1965	$26,900	$7,466	$34,366	$6,707	$2,584	$9,291
5	E - Site Plan Development - Developer constructs roads/utilities (next Foxfire Subdivision)	New	New	$2,235	$2,620	$4,855	$5,969	$2,584	$8,553
6	F - Downtown re-development site [2]			$44,700	$136,240	$180,940	$151,378	$58,732	$210,110
7	G - Downtown re-development site [3]			$143,040	$167,680	$310,720	$239,324	$402,026	$641,350
8	H - Downtown re-development site [4]			$143,040	$167,680	$310,720	$135,567	$336,318	$471,885
9	I - Downtown re-development site [5]			$44,700	$136,240	$180,940	$139,958	$138,846	$278,804

Notes:

1. Includes current improvement charges and connection fees.
2. Assumes 4" domestic lead (assumed 3" mag meter) and 6" fire lead; developer upsized water main from 6" to 12"; credit for 5/8" meter, 3/4" meter, 4" fire lead.
3. Assumes a 8" Fire Lead, 6" Domestic Lead (4" mag meter); credit 2" meter.
4. Assumes 8" Fire, 6" Domestic (3" mag meter), 1" meter credit; developer extended sanitary sewer.
5. Assumes 6" Fire, 4" Domestic (assume 3" mag meter), developer upsized water main to 12", 3/4" meter credit.
6. Fire line calculations were based on 35.5% of the total capital charge.

Table 44 – National Survey – Water and Sewer Capital Charges

State	Water (High / Low)	Sewer (High / Low)	Notes
Arkansas	$1,366	$1,117	
	$971	$872	
Arizona	$10,334	$7,529	
	$726	$480	
California	$17,750	$14,231	
	$1,382	$3,099	
Colorado	$15,542	$4,136	
	$975	$1,520	
Delaware	N/A	$8,164	Only 1 agency responded
Florida	$3,205	$5,213	
	$352	$1,233	
Georgia	$2,000	$2,600	Only 1 agency responded
Idaho	$2,212	$5,917	Only 1 agency responded
Indiana	N/A	$2,715	Only 1 agency responded
		$2,400	
Kansas	$4,030	$4,360	Only 1 agency responded

State	Water (High / Low)	Sewer (High / Low)	Notes
Louisiana	N/A	$2,150	Only 1 agency responded
Maryland	$6,300	$7,600	
	$2,240	$2,850	
Montana	$3,850	$3,437	Only 1 agency responded
North Carolina	$3,500	$3,499	
	$1,471	$915	
Nebraska	$1,261	$624	Only 1 agency responded
New Mexico	$5,765	$2,298	
	$898	$735	
Nevada	N/A	$2,020	Only 1 agency responded
Ohio	$5,650	$5,385	Only 1 agency responded
Oklahoma	N/A	$700	Only 1 agency responded
Oregon	$8,775	$6,600	
	$205	$2,129	

State	Water (High / Low)	Sewer (High / Low)	Notes
Pennsylvania	N/A	$1,711	Only 1 agency responded
South Carolina	$2,400	$4,500	
	$2,000	$3,040	
Tennessee	$2,089	$3,544	
	$500	$1,850	
Texas	$3,700	$1,730	
	$480	$185	
Utah	$4,320	$2,831	
	$258	$935	
Virginia	$6,900	$7,292	
	$4,683	$3,500	
Washington	$9,133	$7,428	
	$2,800	$1,632	
Wisconsin	$1,640	$3,429	
	$877	$365	

Source: 2012 National Fee Survey, Duncan & Associates.