Executive Summary

Master Plan Update Purpose and Objectives

In order to address current and future needs of the water distribution and sanitary sewer collection systems in a proactive and economical manner, the City of Manhattan contracted with Camp Dresser & McKee Inc. to develop this Master Plan Update. CDM teamed with BG Consultants, Inc. of Manhattan to complete vital portions of the project, including all necessary fieldwork and system surveys and assessments. This report documents the assumptions made, criteria used, methods employed, evaluations made with project results obtained and culminates with a long-range capital improvements program for both utilities through the year 2030.

Hydraulic modeling analysis tools, in the form of easy-to-use and readily adaptable software models, are provided to the City so that this Master Plan Update will truly be a living document. The tools will enable staff to readily assess development impacts on current utility infrastructure so that the City can maintain quality drinking water and wastewater utility services for customers.

Project Definition

A contract was signed with Camp Dresser & McKee Inc. on November 20, 2001 to complete the distribution and collection system analysis. The agreement required examination of the distribution system including pumping stations, tanks and water lines. Raw water supply and drinking water treatment needs are not included in this project as the City examined them as part of an earlier study.

Additionally, the sanitary sewer collection system including lift stations, sewer lines and forcemains were to be analyzed and improvements identified for reinforcement of the existing system and for expanding services to new locations throughout Manhattan. Hydraulic modeling was contractually limited to one collection system basin with system-wide needs extrapolated from information provided by City staff. Wastewater treatment and biosolids management issues are not included in this project as the City previously studied them as part of a facilities planning effort completed by others in 2001.

The following Agreement tasks were completed for the distribution and collection systems during the course of the project by the Camp Dresser & McKee Inc. and BG Consultants, Inc. team:

- Task 1 – Data Collection and System Surveys
- Task 2 – System Assessments
- Task 3 – Utility Operations Evaluations
- Task 4 – Maintenance Management Planning
- Task 5 – Systems Modeling and Alternatives Development
- Task 6 – Capital Improvements Program Development
- Task 7 – Master Plan Update Preparation

Population and Growth

Growth and development in a community drive the need for utility service improvements and the scope of infrastructure needs for new customers. Growth rates and patterns used in this Master Plan Update were taken from the *Manhattan Urban Area Comprehensive Plan* completed on behalf of the City in 2002 by Clarion Associates.

Comprehensive Plan Projections

The *Manhattan Urban Area Comprehensive Plan* reviewed the growth rate projections of two organizations, the Housing Element of the Manhattan Urban Area Comprehensive Plan and the Kansas Water Office, comparing them to Manhattan's historic growth over several decades. At the conclusion of the comprehensive planning effort, the Kansas Water Office population growth rate of 1.31 percent per year was selected by the comprehensive plan steering committee as the most appropriate planning projection for the Manhattan urban area. This growth rate was used as the basis for population projections, and subsequently water demand and wastewater flow projections, for this Master Plan Update.

City of Manhattan Projections

The City's population was 46,722 in 2002 according to the City of Manhattan Community Development Department. Future population is projected to be 67,265 within the existing urban service area boundary and using a 1.31 percent annual growth rate. Figure ES-1 shows the population growth projected for Manhattan over the next 27 years at the various rates examined in the comprehensive plan.

It is highly probable that the City will expand over time and the net result will be the addition of new customers to the City's service area already residing in the urban area. To account for these annexed customers, potential future service area boundaries were established in consultation with Public Works and Community Development Department staff through 2030. Figure ES-2 displays the *Manhattan Urban Area Comprehensive Plan* study area outlined in red, Manhattan's current city limits outlined in blue and the Master Plan Update study area delineated in green. It is projected that the City will serve 2,096 existing urban area residents by year 2030 should service areas expand as expected. Assuming an expanded service will be realized, the resultant 2030 population used in this Master Plan Update is 69,361. (2030 projected population for the City of Manhattan of 67,265 plus an existing population of 2,096 through annexation.)

Utility Usage Projections

Historical records maintained by the Public Works Department and land use and population growth rates as defined in the *Manhattan Urban Area Comprehensive Plan* define the parameters necessary to determine future water demands and sanitary sewage flows. All of these components went into the usage projections derived for the City. Usage projections are summarized below for each utility.

Water Demands

Manhattan's average water consumption for the years 2000 and 2001 was 7.25 and 6.78 million gallons per day, respectively. Average water consumption is defined as the total water sold during a one-year period divided by the 365 days in the period. Using a combination of land use designations from the comprehensive plan to determine projected commercial, institutional, governmental and industrial water usage and population growth rates to define projected residential usage, the 2030 average daily demand is expected to be approximately 11.1 million gallons per day. This represents an increase of roughly 61 percent over the next 27 years. The corresponding maximum daily demand and peak hour demands are expected to be about 24 and 34 million gallons per day, respectively, at the end of the planning period, which is significantly higher than the current maximum daily demand of approximately 15 and peak hourly demand of approximately 21. Water demand projections are shown on Figure ES-3.

It should be noted that water demand projections presented in this Master Plan Update do not include wholesale water sales to other communities or water districts. The City should expect future inquiries from surrounding communities about buying drinking water from Manhattan. Drinking water regulations are getting stricter each year and many utilities are opting to purchase water from regional suppliers rather than construct, maintain and operate treatment facilities that come at a substantial price tag. It is suggested herein that wholesale water sales requests be handled on a case-by-case basis. Each request can be evaluated rapidly with the distribution system modeling tools provided to determine infrastructure requirements and costs in support of a request for water.

Sanitary Sewage Flows

Manhattan's average sewage flow for the year 2000 was 5.55 million gallons per day or an average of 120 gallons per person per day. Average sewage flow is defined as the total sewage flow metered at the influent to the wastewater treatment plant during a one-year period divided by the 365 days in the period. At a population growth of 1.31 percent per year (obtained from the *Manhattan Urban Area Comprehensive Plan* for the City's core area) and population growth expected through annexation as previously discussed, sewage flows were computed through 2030. The average daily flow to the wastewater treatment plant is expected to be approximately 8.3 million gallons per day in 2030. This represents an increase of roughly 50 percent over the next 27 years. The corresponding peak monthly and peak hourly flows are expected to be about 11.7 and 20.8 million gallons per day, respectively, at the end of the planning period. The current average daily flow is approximately 5.7 mgd and the peak monthly flows are around 8.0 mgd. Wastewater flow projections are shown on Figure ES-5. Sewage flows in the Wildcat Creek Basin, the focus of this planning effort, were measured at 1.4 million gallons per day during the 2002 flow-metering program. Average daily flows in the Wildcat Creek Basin are expected to grow to 2.9 million gallons per day by 2030. Peak monthly flows in this basin are expected to be 4.1 million gallons per day by 2030.

Water Distribution System Evaluation and Findings

Water Distribution System Background

The City currently supplies water within the boundaries of the City and to adjacent residential areas. Water is not currently sold on a wholesale basis, but may in the future. The Manhattan Water Treatment Plant produces softened drinking water and is designed to provide a maximum daily output of 20 million gallons per day. Wellfield and raw water transmission mains feeding the plant currently limit output to around 17.5 million gallons per day. The City is the process of upgrading the wellfield and raw water transmission mains to fully realize the plant's production capacity.

Water demand projections completed for this Master Plan Update indicate the City's treatment plant will need to be expanded by approximately 2015, as maximum daily water demand will approach plant capacity. Should the plant be expanded to 25 million gallons per day as suggested in the *Water and Wastewater Facilities Plan and Cost of Services Study: Evaluation of Water Treatment Plant Siting Alternatives* report of 2001, Master Plan Update demand estimates indicate Manhattan will not need additional treatment capacity until 2025 at the earliest and potentially as late as 2030.

Low and high service pumping stations distribute water from the treatment plant to the distribution system via 230 miles of water mains and lines. Four booster stations located throughout the system provide pressure increases for customers located in the five different pressure zones (High, Low, Northwest, Southwest and Stagg Hill). Six storage tanks located strategically across the City store additional supplies to account for fluctuations in demand and for fire fighting. Figure ES-5 shows schematically the components of Manhattans current and future distribution system.

Existing Water Distribution System Hydraulic Evaluation

A detailed hydraulic analysis of Manhattan's water distribution system was performed hereunder for the first time using a computer-based modeling program. The program evaluated and selected by the City is WaterCAD 5.0®, which will be provided to City staff at project completion. Historical operating data for 2000 and 2001 was used to calibrate the model to actual field conditions. Once calibration was achieved, several operating scenarios were examined to identify where distribution system capacity is currently limited under peak hourly demand and maximum daily demand plus fire flow. Distribution system improvements are identified and discussed in Section 4.

Modeling of the existing system indicated:

- The City's six existing pumping stations are sufficient to supply current maximum daily demands plus fire flows and peak hourly demands.
- The 6-½ million gallons of water storage tanks is adequate. System storage represents about 90 percent of average daily demands, which is roughly equal to

the Ten State Standards suggested design criteria of 100 percent of average daily flow.

- The City's five pressure zones should be physically isolated from one another to make distribution system operation more efficient. Pressure relief valves should be installed between zones enabling delivery of water across zone boundaries in the event of an emergency. For example, a fire in the High Pressure Zone would draw water from within that zone at high rates thereby reducing pressures. With pressure relief valves in place at connections to the Stagg Hill and Northwest Pressure Zones, water from those other two areas could automatically be diverted to the High Pressure Zone to supplement fire-fighting needs.
- Under current conditions, achieving an optimum fire flow of 1,500 gallons per minute at major piping nodes will require the installation of about 11 ½ miles of either new water lines or parallel water lines ranging in size from 6 to 16 inches. This represents a 5-percent increase in the size of the distribution system piping network.

Expanded Water Distribution System Hydraulic Evaluation

Like the modeling completed for existing conditions, WaterCAD 5.0® was used to examine water system requirements through the year 2030. Population growth and service area expansion will place additional stresses on the City's existing water infrastructure as demand increases. Several operating scenarios were examined to determine existing distribution system reinforcements necessary and to size service extensions providing the necessary peak hour and maximum day capacities. Distribution system reinforcement and extensions are identified and discussed in Section 4. Implementing the suggested improvements and possible extensions will provide the necessary distribution system capacity and water pressure throughout the service area through 2030. Service extensions through the year 2030 are shown on Figure ES-6. Modeling of the possible future expanded system (existing system improvements assumed to have been completed) indicated:

- If service is extended to the Gateway Corridor area, service area expansion may necessitate the addition of a sixth pressure zone – the Gateway Pressure Zone to be located in the southeast quadrant of the metropolitan area.
- If service is extended to the Gateway area, a new booster pumping station will be needed to supply water at the desired pressure from the Low Pressure Zone to the possible new Gateway Pressure Zone.
- The low service pumping station at the water plant will need to be upgraded so that it has a firm pumping capacity of approximately 14.2 million gallons per day by the year 2030.
- If service is extended to the Gateway and Highway 24 Corridors, two new water storage tanks may be needed for the expanded service area; one each for the Gateway and Highway 24 Corridors. Storage would be especially critical in these

locations as only one main is suggested to extend water service across the Blue and Kansas Rivers.

- Extending water service to the potential new growth and development areas, as defined by the Public Works and Community Development Departments in maps provided to CDM, will require the installation of about 23 ½ miles of additional water mains by the year 2030 ranging in size from 8 to 24 inches. This represents almost a 10-percent increase in the size of the distribution system piping network.

Water Distribution System Conditional Assessment

Physical inspections of major distribution system facilities, including pumping stations, water storage tanks and the water lines, were completed under Task 2 of the Agreement. BG Consultants, Inc. conducted field inspections during the summer of 2002 at each major facility. Conditions observed indicate equipment, systems and facilities are generally well maintained and in good condition. The majority of the pumping stations and storage tanks have been constructed within the last 10 to 15 years so they are considered relatively new by industry standards. Distribution system items that should be addressed include:

- **Water Lines** – Continue a water line rehabilitation and replacement program in the Lee School and Northview areas. These two areas of the community have the highest occurrence of water main breaks and are composed of older cast iron pipe.
- **Sunset Tank** – Repaint the tank and install a new valve pit.
- **Miller Ranch Tower** – Repair the cracked floor slab and provide a drainage pipe at the valve pit.
- **Bluemont Tank** – Repaint the tank and repair the broken foundation anchor.
- **Booster Pumping Stations** – All booster stations are in very good condition.

Sanitary Sewer Collection System Evaluation and Findings

Sanitary Sewer Collection System Background

The City currently accepts sewage from within the boundaries of the City and from adjacent residential areas. The Manhattan Wastewater Treatment Plant uses advanced biological treatment processes to clarify sewage received from the City's customers before being released as treated effluent to the Kansas River. The facility is designed to accept a peak monthly flow of about 8.7 million gallons per day. The City has initiated several recent wastewater treatment plant projects to address short-term needs and is currently planning a plant expansion in the next few years.

Wastewater flow projections completed for this Master Plan Update, which were derived from population projections that assumed lower growth rates than were utilized in the facility plan report, indicate the treatment plant will need to be expanded and fully operational before 2009, as peak monthly flows are expected to reach plant capacity at that time. Should the plant be expanded to 12.7 million gallons

per day as suggested in the *Water and Wastewater Facilities Plan and Cost of Services Study* report of 2001, Master Plan Update demand estimates indicate Manhattan will not need additional wastewater treatment capacity until well after 2030.

The wastewater treatment plant accepts flow from 192 miles of gravity line and 9.5 miles of forcemain. The City's collection system is composed of five sanitary sewer basins or sewersheds. Nine lift stations operate within the collection system to serve outlying area or those sewersheds where gravity interceptors have yet to be extended. Figure ES-7 shows schematically the components of Manhattan's current and future sanitary sewer collection system through 2030. Improvements identified include those modeled in this study as well as those identified by City staff.

Existing Sanitary Sewer System Hydraulic Evaluation

A detailed hydraulic analysis of the Wildcat Creek Basin was performed for the first time using a computer-based modeling program. The program evaluated and selected by the City is *SewerCAD5.0®*, which will be provided to City staff at project completion. A flow-monitoring program conducted by BG Consultants, Inc. during the spring of 2002 was used to calibrate the model to actual field conditions under both dry and wet weather flows. Once existing system model calibration was achieved, several scenarios were examined to identify where the Wildcat Creek Basin's capacity is currently limited under peak wet weather flow events. As is generally the case for municipal collection systems, the Wildcat Creek Basin's collection system has more than sufficient capacity to convey dry weather sewage flows. However, capacity limitations were identified when the facilities were subjected to significant 10-year storm events. Collection system improvements are identified and discussed in Section 5 to alleviate these wet weather capacity issues. Implementing the suggested improvements will increase the collection system and Wildcat Lift Station capacity thereby reducing the risk of sanitary sewer overflows or basement backups in the lower elevations of the sewershed.

Modeling of the existing Wildcat Creek Basin indicated:

- The Wildcat Lift Station's firm capacity needs to be expanded now from 7.8 to 13.2 million gallons per day in order to transport existing wet weather sewage flows to the Central Basin from a 10-year storm event.
- A new 3,000-foot Wildcat Lift Station forcemain is needed from the Wildcat Lift Station to the Central Basin before wet weather capacity improvements are implemented upstream. The forcemain will run from the Wildcat Lift Station under Wildcat Creek to a downstream manhole in the Central Basin where sewage flows by gravity to the wastewater treatment plant.
- Achieving adequate wet weather conveyance capacity in the Wildcat Creek Basin will require the installation of approximately 8,300 feet or 1.6 miles of relief sewers and forcemains ranging in size from 8 to 18 inches.

Expanded Sanitary Sewer Collection System Hydraulic Evaluation

Like the modeling completed for existing conditions in the Wildcat Creek Basin, *SewerCAD5.0®* was used to examine sewage flows through the year 2030 in the Wildcat Creek Basin. Population growth and service area expansion will place additional loads on the City's existing sanitary sewer infrastructure as the service area expands and sewer connections are added. Several scenarios were examined hereunder to determine existing collection system reinforcements necessary, if any, and to size service extensions for growth while providing the necessary dry and wet weather capacities. Collection system extensions are identified and discussed in Section 5. Implementing the suggested improvements and extensions will provide the necessary collection system capacity in the Wildcat Creek Basin through 2030. Service extensions for the entire collection system are shown on Figure ES-8.

Modeling of the future expanded system indicated:

- The Wildcat Lift Station's firm capacity will need to be expanded up to 15 million gallons per day in order to transport wet weather sewage flows from an expanded service area to the Central Basin from a 10-year, 24-hour storm event.
- Extending sewer service to the new growth and development areas, as defined by the Public Works and Community Development Departments, will require the installation of about 3-1/2 miles of additional major sewer lines in the Wildcat Creek Basin by the year 2030. The sizes are estimated to range between 8 and 15 inches.

Additional collections system needs, as identified by City staff, covering the entire service area through the year 2030 include the following:

- Rehabilitation or replacement of eight prepackaged wastewater lift stations throughout the City.
- If service is extended to the Gateway and Highway 24 Corridors, service area expansion may necessitate the addition of three sewersheds to the City's collection system - the Gateway Basin, the School Creek Basin and the Elbo Creek Basin. These new basins would be located in the northeast and southeast quadrants of the metropolitan area.
- **North Airport Basin** – No improvements identified at this time.
- **South Airport Basin** - Extension of sewer service to the southwest for approximately 6,700 feet.
- **Wildcat Creek Basin** - A new forcemain from the Stagg Hill Lift Station to the Wildcat Creek Basin with a length of approximately 12,000 feet.

- **North Basin**
  - Installation of approximately 14,700 feet of gravity sewer lines largely concentrated in the East Knox Village area ranging in size from 10 to 15 inch. Of that amount, 7,500 feet of sewer line is needed to extend service from Casement Road to new customers in the area north of Marlatt Avenue and east of Tuttle Creek Boulevard.
  - Abandoning the Northfield Lift Station after extension of appropriate gravity sewer lines to convey sewage flows to the wastewater treatment plant.
- **Central Basin**
  - Replacement of about 7,600 feet of gravity sewers in the downtown area due to age and condition and installation of a new swimming pool drain line.
  - Installation of a parallel or replacement interceptor from the wastewater treatment plant to the Wildcat Lift Station. This line is approximately 20,000 feet in length and ranges in size from 54 to 24 inch.
- **Gateway and School Creek Basins**

  If service is extended to the area:
  - Construction of a new School Creek Lift Station and installation of 14,900 feet of sewer lines and forcemains.
  - Installation of about 17,400 feet of gravity interceptor from the Gateway Basin under the Kansas River and to the City's wastewater treatment plant.
- **Elbo Creek Basin**

  If service is extended to the area:
  - Construction of a new Elbo Creek Lift Station.
  - Installation of 6,200 feet of interceptor sewers and construction of 15,600-foot forcemain to provide service in this new area.

Sanitary Sewer Collection System Conditional Assessment

The physical condition of the sanitary sewer collection system was documented by BG Consultants, Inc. under Task 2 of the Agreement during the summer and fall of 2002. Manhole, sewer line and lift station inspections were completed. As is the case for most utilities, Manhattan's collection system needs repair/rehabilitation work to reduce the amount of infiltration and inflow getting into the system. Reducing infiltration and inflow will be beneficial to Manhattan as treatment of these extraneous flows is expensive, and its reduction will lessen the City's risk of sanitary sewer overflows and basement backups. Lift stations, on the other hand, are generally

well maintained and in good working order considering their age. However, some issues affecting operation and performance were seen.

The following list summarizes the collection system items of concern and provides recommendations for improvement.

- **Odor Control** – The Wildcat Lift Station and the siphon near HB Stereo should be further evaluated as to the cause and corrective action necessary to control excessive odors. Implementing odor mitigation measures will substantially reduce neighborhood complaints.
- **Sewer Main Rehabilitation** – A line rehabilitation program is in place and should be continued. The effort, however, should be increased so that sewer lines in the Northview and downtown areas are fully rehabilitated over the next 10 years.
- **Manholes** – Manhole rehabilitation will provide the most benefit as to infiltration and inflow reduction. This program should be increased in scope so that all brick manholes can be rehabilitated in the next 10 years.
- **Wildcat Lift Station** – An odor control system should be considered for this facility as well as new bar screen room ventilation.
- **Job Corps Lift Station** – A bar screen should be evaluated for this facility to remove sewage debris that continuously clogs the pumps.
- **Corporate Technology Park Lift Station** - The telemetry should be repaired and the concrete slab should be repaired.
- **Northview Lift Station** – Install gravity sewer lines to this location so the lift station can be mothballed. The City has insufficient response time at present to prevent basement backups when power fails at the station.
- **Airport Lift Station** – Install an alarm horn and telemetry to the wastewater plant.
- **Miller Ranch Lift Station** – Repair the wetwell leak before placing this station into operation.

Utilities Operation Evaluation

Field observations, coupled with a review of utility records, indicate that the Public Works Department does most things very well. A review of the water distribution and metering divisions, as well as the collection system division, was completed to determine if the units are efficiently operated and managed and if they are using resources efficiently. The divisions were compared against other utilities of similar size in order to characterize the performance of the City's utility.

The following items are recommended for enhanced utility performance.

well maintained and in good working order considering their age. However, some issues affecting operation and performance were seen.

The following list summarizes the collection system items of concern and provides recommendations for improvement.

- **Odor Control** – The Wildcat Lift Station and the siphon near HB Stereo should be further evaluated as to the cause and corrective action necessary to control excessive odors. Implementing odor mitigation measures will substantially reduce neighborhood complaints.
- **Sewer Main Rehabilitation** – A line rehabilitation program is in place and should be continued. The effort, however, should be increased so that sewer lines in the Northview and downtown areas are fully rehabilitated over the next 10 years.
- **Manholes** – Manhole rehabilitation will provide the most benefit as to infiltration and inflow reduction. This program should be increased in scope so that all brick manholes can be rehabilitated in the next 10 years.
- **Wildcat Lift Station** – An odor control system should be considered for this facility as well as new bar screen room ventilation.
- **Job Corps Lift Station** – A bar screen should be evaluated for this facility to remove sewage debris that continuously clogs the pumps.
- **Corporate Technology Park Lift Station** - The telemetry should be repaired and the concrete slab should be repaired.
- **Northview Lift Station** – Install gravity sewer lines to this location so the lift station can be mothballed. The City has insufficient response time at present to prevent basement backups when power fails at the station.
- **Airport Lift Station** – Install an alarm horn and telemetry to the wastewater plant.
- **Miller Ranch Lift Station** – Repair the wetwell leak before placing this station into operation.

Utilities Operation Evaluation

Field observations, coupled with a review of utility records, indicate that the Public Works Department does most things very well. A review of the water distribution and metering divisions, as well as the collection system division, was completed to determine if the units are efficiently operated and managed and if they are using resources efficiently. The divisions were compared against other utilities of similar size in order to characterize the performance of the City's utility.

The following items are recommended for enhanced utility performance.

- **Training** - The Public Works Department should develop and implement a training plan to ensure that current employees, as well as new hires, are thoroughly trained on all aspects of their job.
- **Safety** - A safety committee should be formed for the collection and distribution divisions and an ongoing safety-training program should be implemented to help reduce accidents.
- **Standard Operating Procedures** – Written Standard Operating Procedures (SOPs) should be developed that thoroughly document procedures and practices employed by the Public Works Department.
- **Communication** - The Public Works Department should consider expanding the use of the interoffice computer systems and provide training to supervisors to enhance interdepartmental communication.
- **Performance-Based Compensation** - Implement employee incentive programs as recognition for high performance.
- **Manpower Optimization** - The Public Works Department should consider expanding its cross-training program to include training between the collection and distribution divisions. This would increase the number of people available to complete water line flushing or valve exercising programs, which are not routinely done.
- **Distribution and Collection Division** - Specific Recommendations

  Collection Division - The Public Works Department should consider implementing a routine collection system-cleaning program. As an initial program, the Public Works Department should consider adopting a 10-year cleaning cycle. In order to implement a routine cleaning program, equipment needs must be identified and purchase plans developed.

  Distribution Division - The division should initiate a water main flushing program prior to starting the new disinfection program. Regular flushing will improve water quality in the distribution system and reduce customer complaints.

  Water Service Division - The Public Works Department should consider hiring one or more summer workers to relieve division staff in order to install replacement water meters. New meters provide faster reads reducing labor costs. Additionally, they are far more accurate than older models meaning the City gets a better accounting of actual water use.

Maintenance Management Planning Evaluation

The purpose of the maintenance management planning evaluation task was to determine needs and provide recommendations for maintenance management. These

recommendations should enable the Public Works Department to develop a consistent, proactive approach to system maintenance.

A review of the water distribution, water metering and collection system divisions' operation and maintenance practices was completed to determine how maintenance activities are currently planned, scheduled and executed. Work data was reviewed to identify the types of tasks currently done by the divisions. Tasks that are normally outsourced at other utilities were also identified. Budget records were reviewed to determine significant cost components.

In general, both the collection and water distribution divisions' maintenance programs are reactive in nature. Both divisions could benefit from a more planned approach to addressing day-to-day workload.

The following items are recommended for enhanced maintenance management.

- **Reporting** - In order to develop measures to adequately plan work, a monthly report should be developed to summarize the significant activities of each division.
- **Water Main Flushing / Valve Exercising Program** - The water division should implement a water main flushing program so that the change to a chloramination disinfection program is successful. A unidirectional flushing program should be developed and implemented to maximize effectiveness in cleaning water lines.
- **Computerized Maintenance Management System (CMMS)** - Once the monthly reporting program has been developed and implemented, the Public Works Department should explore the use of a CMMS to schedule and track maintenance tasks, especially as they relate to preventive maintenance.
- **Automated Meter Readers** - The Public Works Department should consider hiring one or more summer workers to relieve full-time personnel for more rapid installation of new water meters. It is recommended as meter-reader productivity increases with the application of newer technology the readers be used to support the distribution divisions' water main flushing program.

Capital Improvements Program

The outcome of the previous work elements was the development of a long-term capital improvements program whereby the City can proactively plan for the funding and completion of capital improvements projects in its distribution and collection systems. Details of the capital improvements program are presented in Section 8. Table ES-1 lists the suggested capital improvements investment through the year 2030.

Total anticipated project expenditures over the life of the capital improvement program are shown below for each utility. The estimated expenditures are in May 2003 dollars. Figure ES-9 shows annual budget amounts.

Table ES-1
Capital Improvements Program Summary

System Improvement Description	Total Program Cost (Today's Dollars)
Water Distribution System	
Existing System Improvements Total	$6,833,000
Future System Enhancements Total	$13,376,000
Grand Total Water System Improvements	$20,209,000
Sanitary Sewer Collection System	
Existing System Improvements Total	$5,000,000
Future System Enhancements Total	$18,773,000
Grand Total Collection System Improvements	$23,773,000

Figure ES-9 shows the estimated fiscal year budget amounts required to fully fund the capital improvements program suggested in this Master Plan Update. Annual budget amounts are shown for the years 2004 through 2009 and annual average amounts are shown for the periods that follow (2010 to 2015 and 2016 to 2030). The annual average budget amounts account for yearly inflation at a rate of 3 percentage points per year. Capital improvements program details are included in Section 8.

Conclusion

Like all other growing communities across the U.S., the City of Manhattan will need to invest significantly in its water distribution and sanitary sewer collection systems in order to provide utility services to a larger population and an expanded service area. Growth and development will require funds be invested in utility infrastructure to extend water and sewer services to new areas. The City's long-term capital program should be positioned to accomplish the following:

- Reinforce the existing water distribution system to provide an optimal 1,500-gpm fire flow at all major piping nodes (those nodes in the system with 8-inch and larger intersecting pipes) within the existing system,

- Proactively plan for water utility service area expansion incorporating funding needs in the long-term budgeting process so that when growth occurs the Public Works Department will be ready and able to provide quality service to new customers,

- Increase the conveyance capacity of the existing sanitary sewer collection system to eliminate system surcharging, basement backups and sanitary sewer overflows due to wet-weather flow events and

- Proactively plan for sanitary sewer collection system service area expansion incorporating funding needs in the long-term budgeting process so that when growth occurs the Public Works Department will be ready and able to provide quality service to new customers.

Follow-Up Activities

Described previously are the recommended projects that will improve and enhance existing system condition and operation and extend services to new areas. Suggested follow-up activities for the Public Works Department after review and acceptance of this Master Plan Update are as follows:

- Update the cost-of-services study incorporating the impacts of this Master Plan Update's capital improvements program identifying potential impacts to utility rates and examining possible funding mechanisms,

- Complete field surveys of manholes and hydraulic modeling of the collection system's four remaining basins to better define needed wet-weather capacity improvements that will mitigate the impact of wet-weather flows and substantially reduce the likelihood of sanitary sewer overflows and basement backups,

- Maintain and regularly update the distribution and collection system software models to incorporate completed infrastructure projects from the previous year and, lastly,

- Revisit the capital improvements program annually adjusting project sequencing and cost estimates to reflect changes in priorities, which are driven by variable growth rates and development patterns.