ES.1 EXECUTIVE SUMMARY

The mission of the Washington Suburban Sanitary Commission (WSSC) is to provide safe and reliable water to its customers, and return clean water to the environment, all in a financially responsible manner. As its systems age, WSSC's challenge is to continue to accommodate growth, while meeting ever more stringent drinking water and wastewater disposal standards, as well as planning for the timely repair, rehabilitation or replacement of its existing assets.

ES.2 PURPOSE

The objective of the WSSC Utility-Wide Master Plan is to provide input to the 10-year fiscal plan and prepare a 30-year capital investment projection based on the following requirements: regulatory, capacity, maintenance, rehabilitation/replacement, process control, energy conservation, and reliability. The Utility-Wide Master Plan will be completed in phases. This report presents the results of Phase 1A, a high level assessment of WSSC's assets completed in an accelerated time frame to have input into both the Fiscal Year 2009 capital planning process and the WSSC Budget Group's 10-Year Fiscal Plan. Additional outcomes of Phase 1A include: Development of asset summary profiles for each of the major asset groups; Identification of key strategic drivers, trends and levels of service; and Recommendations for subsequent phases of the Utility-Wide Master Plan. This project is based on the core principles of asset management, which were used in the aggregation, data capture, and analysis of WSSC's assets.

ES.3 ASSET MANAGEMENT

Asset management provides for the systematic planning, acquisition, deployment, utilization, control, and decommissioning of capital assets. It integrates strategic-level, mid-level, and operational-level management decisions to maximize the value of the assets per dollar invested.

For the WSSC Utility-Wide Master Plan, enterprise-wide asset management (EAM) is defined as a management paradigm and a body of integrated management practices applied to the entire portfolio of infrastructure assets. EAM seeks to minimize the total investment in acquiring,

maintaining, operating, and renewing assets while continuously delivering the service levels customers/stakeholders desire and regulators require. Based upon this knowledge, the Utility operates at a level of risk which the community and the organization are willing to accept.

Failure to adequately manage the life cycle of assets can lead to: Under-investment in mission critical assets; Over-investment in non-mission critical assets; Imbalance among acquisition, maintenance, operation, and renewal investments; Revenue loss and dissatisfied customers and regulators due to performance failures; and other monetary and non-monetary impacts.

At its highest level, asset management is a *business model*. It drives *What* to do, and *Why, How* and *When* to do it. It determines *Where* to invest, *What* the costs will be, and *What* the return is.

Millions of dollars are at stake in WSSC's management of its assets. Misdirected appropriations – investments made too early or too late in the life cycle or for the wrong solutions – are costly to WSSC and its ratepayers. Such misdirection is inefficient, and can erode credibility over time. Asset management finds the mix of investments in maintenance, operations, and capital infrastructure that sustains organizational performance over time at the lowest life-cycle cost. It builds confidence in decision-making, investing in the right projects, at the right time.

A data collection and analysis tool called TeamInfo, which stands for Total Enterprise Asset Management Information, was created for this project. It is a web-based data collection and evaluation system designed specifically for WSSC and the Utility-Wide Master Plan.

Business Risk Exposure (BRE)

The development of the Business Risk Exposure of an organization requires an understanding of the failure mode plus the probability and consequence of failure mode for the asset. It also requires knowing the current state of an asset, the required level of service (LOS), and future investment requirements. Some of the key terms used in the development of the BRE are:

"Triple Bottom Line:" Includes the traditional focus on finances as well as the organization's commitment to social and environmental issues.

Consequence of Failure: The impact due to failure of an asset, including direct consequences such as the cost of repairs, legal fees and fines, and indirect consequences such as environmental cleanup costs or loss of business revenue to the community. Specific definitions for the consequences of failure were developed for all of the asset groups.

Probability of Failure: Includes Time to Failure and the Level of Redundancy in an asset.

Failure Modes: The way in which an asset can fail. There are four primary failure modes of an asset: physical mortality; capacity; financial efficiency; and level of service.

Phase 1A Approach

For the Phase 1A evaluation, WSSC's assets were divided into 11 major asset groups. Each of these groups was broken down into major process areas, or components, and data for the assets was captured from existing WSSC sources. This process was followed by "Delphi" workshops for each asset group. These workshops extracted information on key issues from WSSC staff most knowledgeable about them, and identified those issues needing additional evaluation. Using the TeamInfo tool, the installation date, maximum potential life, expected economic life, refurbishment and replacement cost, imminent failure mode, and remaining useful life of each asset was estimated.

Analysis of this data was conducted using TeamInfo, which calculated the BRE for the assets being evaluated, and created the 30-year financial Nessie curve based on the required investment to sustain each asset throughout its life cycle. The BRE scores developed in Phase 1A are not directly comparable between multiple assets (e.g. buried piping and appurtenances) and facility assets. Subsequent phases will develop BRE scores at the asset level (e.g. individual piping units, pipe segments, etc.) and will be comparable for all assets across the organization. The BRE scores from Phase 1A will be useful in comparing assets within the defined asset groups.

The high level evaluation of Phase 1A will not determine individual component life cycle costs; however, it does begin to clarify issues surrounding organization-wide funding requirements over the next 30 years.

ES.4 AREAS OF FOCUS

Each group of assets was evaluated with respect to the following:

- Compliance with existing regulatory requirements
- Providing adequate system capacity for current and future customers
- Adequately maintaining, rehabilitating and replacing the existing systems
- Incorporating energy conservation and reliability measures at existing facilities
- Providing process control systems that allow for optimization of the systems

ES.5 EVALUATION RESULTS

In general, the aboveground assets are in good condition, with a few exceptions. The process upgrades that are necessary to comply with existing regulations are programmed in the CIP for both the water and wastewater treatment plants. Additional attention, however, is required on general (non-process) rehabilitations at the plants, as well as for pumping stations and water storage tanks. The renewal of buried assets is WSSC's most immediate challenge. Approximately 85% of the buried water distribution system piping will reach or exceed its useful life by 2020. Renewal of the collection system piping is driven by compliance with a Consent Decree signed in 2005 to reduce sanitary sewer overflows (SSOs). Most of the collection system still has substantial remaining useful life, with proper renewal and rehabilitation; however, cast iron (CI), non-reinforced concrete pipe (PCCS) and precast concrete cylinder pipe (PCCP) are in poor condition, with several drainage basins requiring significant attention over the next 30 years. Increases in the water and wastewater reconstruction efforts will require strengthening of WSSC's program and project management capabilities. The communications and the buildings and grounds assets were generally found to be in good condition.

ES.5.1 WASTEWATER SYSTEM

WSSC's Wastewater System consists of a Collection System, Pumping Stations, Treatment Plants, and Inter-Agency Assets in which WSSC has purchased capacity. The major results of the Phase 1A evaluation follow.

Collection System: There are approximately 5,300 miles of pipeline in 24 sewered basins, with sizes ranged from less than 3" to 108" in diameter, and ten different types of material. An outcome of the evaluation is the identification of the economic effective life (EEL) consumed for collection system piping. EEL is the total effective life of an asset before it begins to "fail" and require rehabilitation. Figure ES.5.1-1 shows the total length of piping in the WSSC collection system as a percentage of the EEL consumed. 25% of the collection system has 80-90 percent of its EEL consumed. Except for cast iron and non-reinforced concrete pipe, the collection system has a substantial amount of remaining useful life, with appropriate and timely rehabilitation.

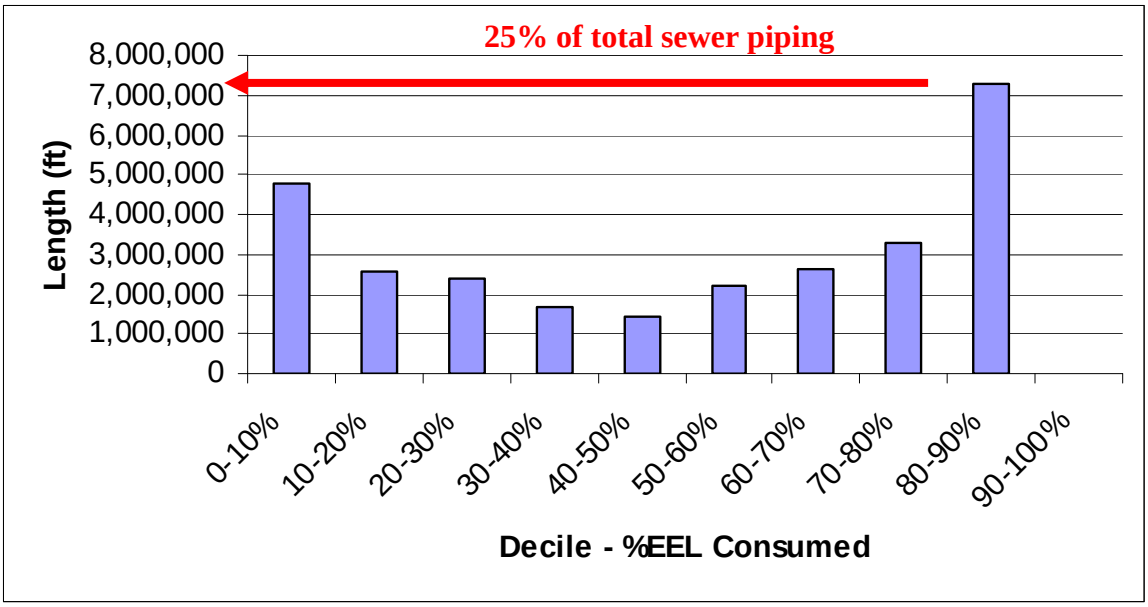

Figure ES.5.1-1: Length of Piping per % EEL Consumed as Deciles

Major replacement of system piping is not expected until approximately 2060, assuming that the rehabilitation of the pipe segments with expired EELs is made and the rehabilitated pipe segments maintain the required LOS for another 60 years. Approximately 50 miles of collection piping per year needs to be programmed for renewal.

Wastewater Pumping Stations: With few exceptions, the pumping stations are in good condition. Anacostia Valley #2 and Broad Creek are in need of major rehabilitations, and the Damascus Center WWPS requires immediate replacement. The latter two projects are already programmed in the CIP. Maintenance and repair of the force mains associated with pumping stations have usually been reactive, rather than proactive.

Wastewater Treatment Plants: WSSC owns and operates seven wastewater treatment plants (WWTPs). For Phase 1A, the five larger plants – Piscataway, Western Branch, Seneca, Damascus, and Parkway - were divided into nine distinct groups of assets. Two smaller plants - Hyattstown and Marlboro Meadows - were each considered as single assets. WSSC has purchased capacity in three wastewater plants - Blue Plains, Poolesville and Mattawoman. Through agreements with the owners of these plants, WSSC is responsible for a portion of the capital cost of upgrades that are made to these plants, based on its allocated share of capacity.

WSSC wastewater plants are generally in good condition and have capacities greater than, or just below, their 30-year flow projections. The exception is the 20 mgd Seneca WWTP, which needs to be expanded to 26 mgd. ENR upgrades are required by 2011 for all five major WWTPs, and these projects are programmed in the CIP, as is the expansion of Seneca. Decommissioning of the Marlboro Meadows WWTP, also in the CIP, is required as the flow to this plant is to be pumped to Western Branch to avoid upgrading to ENR standards. Funding for influent pump station and solids handling upgrades at Western Branch is also included in the CIP. Currently non-programmed projects with high BRE scores include the Piscataway secondary and tertiary process equipment and influent pumping station upgrade, and the Parkway solids handling upgrade and expansion.

Inter-Agency Wastewater Assets: The Anacostia Force Main received a high BRE score as it has been identified as being subject to imminent failure. Several of the Blue Plains asset groups had high BRE scores due to the lack of bypass redundancy in their processes. Flow meters received high BRE scores as they are essential to proper and accurate billing and there are no redundant metering methods.

Existing Programs/Initiatives

There are currently four programs of importance to the wastewater system - Enhanced Nutrient Removal (ENR), Biosolids Management in Prince George's County, the Consent Decree, and the Sewer Reconstruction Program. While these programs address major wastewater issues, there is no program to address general rehabilitation of the treatment plants and pumping stations. Also, the Sewer Reconstruction Program will need expansion and additional investment to address aging infrastructure while also meeting the requirements of the Consent Decree.

ES.5.2 WATER SYSTEM

WSSC's water system consists of Raw Water Supply, Treatment, Pumping, Finished Water Storage, and Transmission and Distribution piping, including metering and service connections. The major results from the Phase 1A evaluation are:

Dams and Reservoirs: The T. Howard Duckett Dam requires improvements to conform to Dam Safety Regulations, giving it a higher BRE than Brighton or Little Seneca Dams. An on-going CIP project is evaluating options for the Duckett Dam, which could result in significant capital expense.

Water Filtration Plants: Major on-going CIP projects are addressing process improvements to the Potomac and Patuxent Plants to meet current and near term water treatment regulations. At Potomac, non-programmed needs include rehabilitation of the raw water pumping stations, raw water lines and isolation valves. At the Patuxent Plant, the penstock from the dam to Rocky Gorge Pumping Station has no redundancy, and solids handling improvements will likely be needed, either at the plant, or at Parkway WWTP where its residuals are currently handled.

Water Storage Facilities: There are fifty nine water storage facilities in seventeen pressure zones. Four zones have storage deficits. A new tank is planned in the Montgomery 760 zone, while other deficits are being examined in on-going studies. Seven storage facilities were rated as having water quality issues, due to excess capacity in the facility or in under or over-sized

mains near the facility. Some of these issues will be resolved by projects already programmed in the CIP. Numerous storage facilities are due or overdue for recoating and other rehabilitation work such as safety upgrades or work on antennas mounted on the facilities.

Water Pumping Stations: Of the thirteen pumping stations in the system, Central Avenue was identified as a critical system asset in need of expansion, since the firm capacity to the 317 zone is less than the 2030 projected demand. Additionally, the station needs significant rehabilitation. The Neelsville, Cedar Heights and Brink WPSs are critical to WSSC's ability to provide water to the Damascus area, as there are no other ways to supply water to the 960 zone; however, these stations had no specific issues identified in the workshops.

Water Distribution and Transmission System: Approximately 5,300 miles of pipelines ranging in size from one (1) to ninety-six (96) inches in diameter comprise the transmission and distribution systems. Service lines, including meters to measure and record usage for billing, connect the distribution piping to the customer's plumbing system.

Unlined cast iron pipe 8 to 10 inches in size had the highest BRE score in this asset group due to the large number of miles in the system, a significant break rate, and a higher consequence of failure than smaller pipes. Also, the condition of this pipe size was generally rated as poor. Cast iron mains larger than 16 inches have a low break rate, but high consequence of failure due to the catastrophic nature of failure, and a poor condition rating, resulting in a high BRE score.

The consequence of failure of electric PRV's is greater than the non-electric valves, but their lower numbers result in similar BRE scores. A number of non-electric valves are located in busy roadways and pose a significant safety hazard to WSSC workers.

Small meters have a large BRE because of their large numbers and a high "failure rate"; however, the consequence of failure is low, as the meters are inexpensive and replacement can be done quickly. The consequence of failure of 3 inches and greater cast iron services is high, due to the catastrophic nature of the failure. Tuberculation of unlined cast iron and ductile iron services is also a concern. The WSSC Executive Steering Board (ESB) asked that consideration

be given to implementing a program to replace the private portion of the service lines at the same time as the public portion.

Existing Programs/Initiatives

There are currently five programs that pertain to the water system - Raw Water Supply Initiatives, Water Filtration Plant Planning Programs, Water Storage Facilities Planning Programs, Water Pumping Station Planning Programs, and the Water Reconstruction Program. While these programs address many of the major issues in the water system, a noted deficiency is the lack of a program to address general rehabilitation of the water treatment plants, pumping stations and storage tanks. Also, the Water Reconstruction Program is not as comprehensive as needed, and may result in insufficient replacement/rehabilitation cycles. The current target of 33 miles per year of water pipe replacement greatly understates the systems' needs.

ES.5.3 BUILDINGS AND GROUNDS

WSSC operates five Service Centers - Anacostia, Gaithersburg, Laurel, Lyttonsville and Temple Hills - that support its maintenance activities. In addition, the Richard G. Hocevar (RGH) Building houses all administrative, management, customer service and engineering functions and the Consolidated Laboratory provides centralized services for the analysis of water and wastewater. To evaluate these facilities, they were divided into four major asset categories - buildings, site and civil improvements, miscellaneous structures, and land. The major issues that were identified during the evaluations of these assets include:

- Service Centers were in various states of disrepair which ranged from a need for total rehabilitation to nearing potential failure mode. Many of the buildings have a remaining life of 15 years or less.
- Facilities experience inefficient utilization of space for document storage, administrative functions, and warehousing.
- HVAC, elevators at the RGH, asphalt paving, security systems, and roofing are nearing failure mode and require immediate attention.

- Land capacity issues may exist given new Montgomery and Prince George's County Landscape Manual "Buffer Yard" requirements, environmental regulations, and storm water management laws for vehicle maintenance facilities.
- At the lab, the steam boiler needs replacement and there is a need for back-up power generation for the chiller and boiler.
- The lab has been asked to perform tests for outside agencies in recent years, such as lead testing for Montgomery, Prince George's and DC schools. These outside tests may require additional staff and equipment if this trend continues.
- New testing resulting from more stringent regulations will require 24/7 testing capacity at the lab. This would require more space, equipment, and special features such as explosion-proof areas. The original building was designed to allow construction of a future wing, which may be necessary if significant testing requirements are to be added.

Existing WSSC Programs

The programs that address buildings and grounds include the Capital Improvement Program (CIP), Engineering Support Program (ESP), and Energy Performance Program. The ESP will be the primary funding mechanism for buildings and grounds programs beginning in FY 2009.

ES.5.4 COMMUNICATIONS SYSTEMS

The communications assets that were evaluated during this project included the Data Network, Dictaphone/NICE message recording system, Land Mobile Radio (LMR) system, microwave network, paging system, SCADA system, security services and the Voice/PBX (Telephone) Systems. Note that computers, servers, and application software were not included. The major results from the Phase 1A evaluation are:

Data Network: The Data Network has a high BRE score due to its critical function and the need for major replacement, which it is currently undergoing. New capabilities and increased performance will continue the demand for additional bandwidth. Network equipment generally has a seven year replacement cycle.

Dictaphone/NICE Message Recording System: The system records telephone and LMR conversations for supervisory personnel. This equipment is at the end of its economic life. A newer model with newer media, factory support, and capability to back up the network is recommended. This equipment has a ten year life cycle.

Land Mobile Radio System: The LMR is a mobile system that provides independent voice communications. Radio equipment is located in vehicles and at various remote sites and provides two-way communication with the RGH Building. The LMR has many components beyond their expected life. The equipment is currently replaced only after failure. All equipment should be replaced over a 5 year period every 15 years and rehabilitated as necessary.

Microwave Network: The Microwave Network has the highest BRE, as several other systems such as SCADA, Security, Data Network, and Telephone rely on the system as a communications backbone. This is mostly DS3 microwave network with a few low capacity radios, centrally located in the RGH Building and connecting to 30 sites in Montgomery and Prince George's counties. Some components are at the end of their economic life, with a plan to replace radio equipment in 2008, 2009, 2012 and 2022. Fiber optics and external service providers need to be considered in the future.

Paging System: The system, located in the RGH Building, is dependent on a paging terminal owned by Prince George's County. The Paging System, which provides notifications to approximately 175 people, received the lowest BRE score as its use and criticality have diminished significantly with the increasing use of cell phones.

SCADA System: The system is located at the RGH Building and interfaces with 130 remote sites in Montgomery and Prince George's counties. It is used to monitor and control various processes at Wastewater Treatment and Water Filtration Plants, pumping stations and other remote sites. There is adequate capacity for the foreseeable future. The Network has a high BRE due to its critical function and the need for major replacements. Radio components have a 15 year life and network components have a 7 year life, which determines replacement timing.

Security Services: This service monitors 24 sites in real time in Montgomery and Prince George's counties, and is located in the Security Command Center at the RGH Building. Capacity appears adequate, but with increasing emphasis on security, increased demand is likely. This Service has a low BRE as the system is new and not currently in need of rehabilitation.

Voice/PBX (Telephone) Systems: The telephone system, with an expected life of 15 years, has adequate capacity, although there have been rare occurrences of not being able to place an outgoing call. The technology and equipment are aging and the cable infrastructure is old at remote facilities. Newer features such as caller ID and telecommuter support are desired. Beginning in 2009, the equipment and wiring at remote facilities is in need of replacement.

Existing WSSC Programs/Initiatives

Communications Systems include assets that are funded by the Engineering Support Program (ESP) as well as the Operations & Maintenance (O&M) Program. Assets with an expected life of 7 years or less are assumed to be funded by the O&M Program, with all others in the ESP.

ES.6 RECOMMENDED PROGRAMS/INITIATIVES

A summary of the asset specific recommended programs and initiatives is presented in Table ES.6-1 beginning on the next page. The implementation of these programs and initiatives was recommended to address the issues identified in the previous section in addition to other issues identified during Phase 1A. Included in the table is a ranking of the programs as determined by the ESB, who were asked to rank the priority of these programs as high, medium or low. Numerical values were assigned on a scale of "3" for a program with a high priority to "1" for a program with a low priority. Rankings were received from six ESB members and therefore, the highest and lowest numerical ranking that a program could receive was 18 and 6, respectively. A priority of high, medium or low was assigned to each program based upon the combined rankings with a high priority having a ranking of 18 to 15, a medium priority ranking from 14 to 11 and a low priority ranking from 10 to 6. The rankings can be used to focus WSSC's efforts on programs or initiatives that are of the highest priority to the agency.

Table ES.6-1: Summary and Ranking of Recommended Programs/Initiatives

SYSTEM	PROGRAM/ INITIATIVE	DESCRIPTION	PAGE NUMBER	PRIORITY
Water	Water Distribution and Transmission System	The PCCP inspection program was said to have lagged in recent years, and was felt by the Delphi workshop group to have been beneficial in identifying issues before failure of the pipe. It is recommended that WSSC reinvest in this program, since the consequence of failure of large diameter transmission mains is very high.	3-53	High
General	Strengthen Asset Management (AM) Program	Develop a "state of the practice" knowledge-base for refurbishment technology built around best practices	7-41	High
General	EAMS Strategy	Implement an Enterprise Wide Asset Management System (EAMS) is to take advantage of the lessons learned from this initial phase and to conduct a detailed assessment of the organization with the aim of developing an asset management implementation strategy. This strategy would focus on defining specific projects that can be implemented within WSSC. An EAMS will allow for the efficient and effective investment of capital, operations and maintenance programs, and the creation of linkages between these programs and levels of service, and customer/stakeholder ability to fund them. The EAMS will comprise information systems, data and knowledge, organization support structure, appropriate levels of resourcing and repeatable decision making processes. Costs to implement this program were included in the Nessie curve in an amount of $5 million per year for five years, beginning in 2009.	7-41	High
General	Strengthen AM Program	Strengthen pipe maintenance strategies; increase maintenance	7-41	High
Water	Water Distribution and Transmission System	Replacement of large unlined cast iron and ductile iron services, as well as the older Hersey FM and DC meters, should be given priority due to the potential liability they present to WSSC. If either a meter or a service prevent sufficient flow from reaching a customer's property, or prevent adequate fire fighting capacity from being available, the liability to WSSC could be great.	3-53	High
Wastewater	Strengthen Sewer Reconstruction Program	WSSC needs to continue the development of the SSES reports, which is useful in identifying potential areas of concern. It is also recommended that WSSC focus on sewer rehabilitation. WSSC should develop a "state of the practice" knowledge-base for refurbishment technology built around best practices. They should also investigate cost effective rehabilitation technologies by pipe type as these new technologies are becoming increasingly relevant. A program should also be developed to identify and address line blockages such as root intrusion, FOG and other major causes of pipe failure. More immediately, a more detailed evaluation of the data needs will occur during the next phase of the project. Data will be mined from the MMIS and CMIS systems at a more detailed level and evaluated on a per pipe basis, which will result in a better assessment of the condition of the existing assets. This condition coding process – and subsequent determination of residual life - will be increasingly key to effective renewal investment timing.	2-119	High
General	Strengthen AM Program	Implement an "optimized renewal" investment program	7-41	High
Communications	Disaster Recovery Plan	Disaster Recovery capability is needed for all communications systems and should be considered a near term priority.	5-17	High

SYSTEM	PROGRAM/ INITIATIVE	DESCRIPTION	PAGE NUMBER	PRIORITY
Communications	Staffing	A staffing plan needs to be developed that addresses concerns about insufficient staff, budget cuts / staff reductions that have already occurred, succession planning, and knowledge transfer for critical skills.	5-18	High
Water	Water Distribution and Transmission System	External cathodic protection of cast iron and ductile iron mains by use of sacrificial anodes may help preserve the pipe wall thickness that remains and should be considered for thicker wall cast and ductile iron mains that are internally lined and therefore not subject to internal corrosion.	3-53	Med.
Water	Water Distribution and Transmission System	A number of non-electric pressure reducing and pressure relief valve vaults are located in areas that are hazardous to WSSC personnel who must maintain them. The Delphi workshop team estimated that 21 such vaults should be given priority for relocation to safer areas. A number of electric PRV vaults should be converted to flow control valves vaults according to the workshop team. WSSC should develop a prioritization for this work, and program its completion into the ESP.	3-53	Med.
Wastewater	Facility Master Plans	Complete and/or update Facility Master Plans for all the wastewater treatment plants and pumping stations. Creating facility master plans and updating existing plans will allow WSSC to better prepare for the general rehabilitation and replacement that is required over the next 30 years. These plans will evaluate the condition of the existing equipment and provide explicit recommendations for the time frame and extent of the rehabilitation or replacement efforts.	2-115	Med.
Wastewater	Force Main Program	Currently, the force mains that are associated with the wastewater pumping stations are managed in a reactive manner. It is recommended that WSSC create a program that allows for proactive management of the force mains. The program should include the performance of an evaluation to determine the remaining life of the piping as well as an assessment of its available capacity.	2-117	Med.
Wastewater	Strengthen FOG Program	Strengthen existing programs to include more operating procedures for pumping stations and more stringent enforcement of FOG dischargers. A protocol should be developed to focus the enforcement efforts into specific geographical areas.	2-118	Med.
General	Strengthen AM Program	Drill down asset management program to asset level across organization starting with pipe	7-41	Med.
General	Strengthen AM Program	Develop post-failure management programs for high BRE assets with focus on water side	7-41	Med.
Water	Water Distribution and Transmission System	The replacement of small diameter water mains (1 to 6 inch) that are subject to internal tuberculation should be a priority for WSSC. Replacing the amount of piping in this size range in the system (370 miles), even over a period of 10 years, would lead to expenditures of over $75 million per year, well in excess of the proposed level for the Water Reconstruction Program as a whole (the proposed FY 2009-2014 program includes a total of $58.446 million per year for all water reconstruction program activities). Given the customer service implications associated with failure of these small diameter mains, WSSC needs to acknowledge the increased expenditures required by an increased level of commitment to this work. Areas where water mains will be replaced should be carefully selected based on data available regarding system operation and maintenance work order history to optimize whatever funds are committed to this function.	3-52	Med.

SYSTEM	PROGRAM/ INITIATIVE	DESCRIPTION	PAGE NUMBER	PRIORITY
Water	Water Distribution and Transmission System	Water mains that are 8 to 10 inches in diameter are also candidates for replacement. This asset category contains an estimated 1,310 miles of pipe. A number of the breaks experienced in the April-May 2007 time period in Bethesda occurred in 8 to 10 inch diameter cast iron mains (data indicated 9 of 20 breaks occurred in 8 to 10 inch diameter *CIP*), which appears consistent with the high Business Risk Exposure (BRE) of this class of pipe. The level of investment required to replace all of this type of pipe necessitates that careful decisions be made regarding specific areas where replacement will be done, especially if there are funding limitations that require prioritization of the replacement efforts.	3-52	Med.
Water	Water Distribution and Transmission System	Other non-capital programs, such as leak detection programs, monitoring cathodic protection system function, and locating and exercising valves, would provide valuable information to the Commission that would likely assist in prioritizing major capital work such as pipeline replacement projects. Costs for these programs have not been included in capital projections, but were documented in the Annual Action Item #12 team report and the Annual Targets Summary report.	3-53	Med.
Wastewater	Inter-Agency Project Review Initiative	An immediate need that has been identified is a formal review of the proposed Anacostia No. 2 Force Main project. WSSC has not had the chance to evaluate the real need for this project as it was just recently brought to the attention of the Commission.	2-118	Med.
Wastewater	Biosolids Management Plan	Implement a Biosolids Management Program and develop a Biosolids Management Plan that addresses all of the existing biosolids facilities as well as the new biosolids regulations. The current plan, which was revised in 2005, only addresses the management of the biosolids facilities that are located Prince George's County.	2-116	Med.
Water	Water Production Projections	Update the 2006 Water Production Projections. These updates should be done whenever new growth data becomes available from the counties, or when there have been significant, documented changes in either unit consumption or the ratio between average and maximum day, based on actual consumption data. These projections should be utilized in conjunction with the Facility Master Plans to provide input in the evaluation of the major process assets and prioritization of future capital expenditures.	3-51	Med.
Water	Water Storage Facilities	Take steps to complete the recoating and rehabilitation of tanks and reservoirs that are due for such work. Review all of the storage facilities that received level of service scores associated with water quality issues to determine if additional action is necessary	3-51	Med.
Water	Facility Master Plans	Update and expand the scope of the Facility Master Plans for the water filtration plants. There are existing facility master plans for both the Potomac and the Patuxent Water Filtration Plants that were developed in the 2000 time frame; however they seem to be focused on water quality/treatment aspects and do not address the physical mortality of major process assets. Updating and expanding the scope of the existing plans will allow WSSC to better prepare for the general rehabilitation and replacement of assets that is required over the next 30 years.	3-50	Med.
Water	Water Pumping Stations	It is recommended that a thorough assessment of the needs at the Central Avenue WPS be completed and an appropriate project programmed into the CIP. Operational responses to the loss of any one of the pumping stations (Neelsville, Brink and Cedar Heights) that are critical to providing water to the Damascus area should be planned and documented so that there are written guidelines to follow in the event of a failure of one of these stations or their connecting pipelines.	3-51	Med.

SYSTEM	PROGRAM/ INITIATIVE	DESCRIPTION	PAGE NUMBER	PRIORITY
Communications	Systems Development	Top level systems architecture should be developed that identifies all voice and data systems and their relationship to the Communications Systems.	5-17	Med.
Water	Water Distribution and Transmission System	Cleaning and lining select water mains may help prolong the life of the mains while higher priority mains are replaced. The selection of sections of mains to be cleaned and lined must also be made carefully based on system operation and maintenance information.	3-53	Med.
Communications	Asset Management	An Asset Management plan needs to be developed for each Communication System component and a budget established for each plan. The funding source should be identified. These plans should be reviewed on a periodic basis.	5-17	Med.
Buildings and Grounds	Emergency Generator	There is an apparent need for an emergency generator at each service center or provision of a mobile generator within 4 hours of a major power outage. Also, generators should have the capacity to run boilers and chillers.	4-15	Med.
Wastewater	Paving Replacement	Most of the collection system lies in the public rights of way under paved streets or roads maintained by the County in which the pipe is located. The replacement of sewers as part of the Sewer Reconstruction Program will certainly have impacts on County streets and roadways. WSSC staff tries to coordinate with County staff so as to replace sewers in advance of new or repaving operations; however, this does not always occur, resulting in road cuts in newly installed paving. WSSC's Standard Details for Construction requires repairing roadways for the width of the pipe trench only, although County roadway permits often require WSSC to include considerably more repaving than that. The WSSC ESB has asked that the cost of full lane width repaving be identified so that it can potentially be included in the costs associated with the replacement of water and sewer pipelines.	2-119	Low
Wastewater	Wastewater Treatment Plant Capacity Evaluation	The current review of the capacities of the existing wastewater treatment plants has identified the need for the expansion of only one of the plants, the Seneca WWTP, by 2029. Three other wastewater treatment plants were identified as potentially exceeding their current treatment capacity by 2039. While this is over 30 years away, it is recommended that a study be performed during the mid-term time period to re-evaluate the need for these expected expansions. At this time, the study should also evaluate the other wastewater treatment plants to determine if an expansion of these facilities may also be necessary. It is necessary to perform this study at this time because while continued growth in the WSSC service area is expected, population centers may shift to areas that had not previously been identified.	2-120	Low
Communications	Systems Responsibility	For each component of the Communications System, the organization within WSSC that is responsible for it needs to be clarified, and major stakeholders should be identified.	5-17	Low
Buildings and Grounds	Large Equipment Replacement	WSSC staff had discussed elevator replacements at the RGH COB and chiller replacements at various Service Centers locations where these systems have reached or will reach their maximum potential life within the next 10 years.	4-18	Low

SYSTEM	PROGRAM/ INITIATIVE	DESCRIPTION	PAGE NUMBER	PRIORITY
Buildings and Grounds	Disaster Recovery Plan	A short-term disaster preparedness plan and a post disaster mitigation plan will provide a loss management strategy for the service centers; however, the plan can be modified to accommodate other WSSC facilities such as buildings at treatment plants pumping stations, laboratories, and offices.	4-16	Low
Buildings and Grounds	Building Rehabilitation	According to WSSC staff at the Delphi Workshop, funding for Buildings and Grounds priorities will be include in the Engineering Support Program asset funding allocation for rehabilitation beginning Fiscal Year 2009. There is an expected $1,000,000 funding allocation per year to cover replacement costs for HVAC secondary components, and rehabilitation of elevators, chillers, boilers, and asphalt repair. The short-term plan is also expected to include roof replacement costs. Security systems were indicated to be totally replaced under a separate funding program.	4-18	Low
Wastewater	Sewer Service Pipeline Replacement	One of the main initiatives that has been identified as a priority during this time period is the replacement of the sewer pipes that run from a collection system lateral to a residential customer. Typically, the cost of replacing this line is paid for by the homeowner, usually when a line breaks or becomes clogged and a replacement of this line is required. WSSC has indicated that they may be interested in developing and funding a program that would provide for the replacement of these sewer pipes to provide financial relief for customers that may not otherwise be able to afford this work.	2-121	Low
Buildings and Grounds	Facility Utilization	Better document and space management practices will improve facility utilization. Also, there is a need to review furniture and space utilization to increase occupancy. It is recommended to use Phase 1B of the Utility-Wide Master Plan for further study of capacity, space utilization, needs assessments, and operational efficiencies.	4-15	Low
Buildings and Grounds	Consolidated Lab	Within the next 10 years, WSSC staff has indicated that expansion of the Consolidated Laboratory may be necessary to accommodate additional testing requirements. Around 2020, a facility upgrade that involves the upgrade of counters, cabinets, built-in equipment such as fume hoods, related plumbing and ventilation upgrades to most recent code requirements may be necessary. A study to evaluate the necessity of this addition is recommended in this timeframe.	4-18	Low
Buildings and Grounds	Land Capacity	Land capacity for each service center must be studied during phase 1B to determine the useful life and extended production of the Depots as well as other WSSC facilities.	4-15	Low

ES.7 30-YEAR INFRASTRUCTURE CAPITAL INVESTMENT – NESSIE CURVE

A 30-year infrastructure capital investment projection, also known as a Nessie curve, was developed. The curve is based on: The Staff Draft FY 2009-2014 CIP; input from WSSC staff during the Delphi workshops; input from the ESB and County representatives; evaluation of system renewal and rehabilitation requirements; requirements from strategic drivers and changes in levels of service; and growth and capacity requirements.

Overall 30-Year Nessie Curve

The overall 30-year Nessie curve, which is presented in Figure ES.7-1, depicts a projection of capital investment requirements on an annual basis from 2009 through 2038. All investments/costs are shown in FY 2009 dollars. The overall Nessie curve includes investments in six distinct categories. The following three components are included, showing items already programmed in the Staff Draft FY 2009 to 2014 CIP, as well as non-programmed investment requirements.

a. System Renewal – Investment required to rehabilitate and renew legacy and new assets.
b. Growth – Investment required to accommodate growth in the WSSC service area.
c. Environmental/Regulatory – Investment required to address changes in environmental and/or regulatory levels of service.

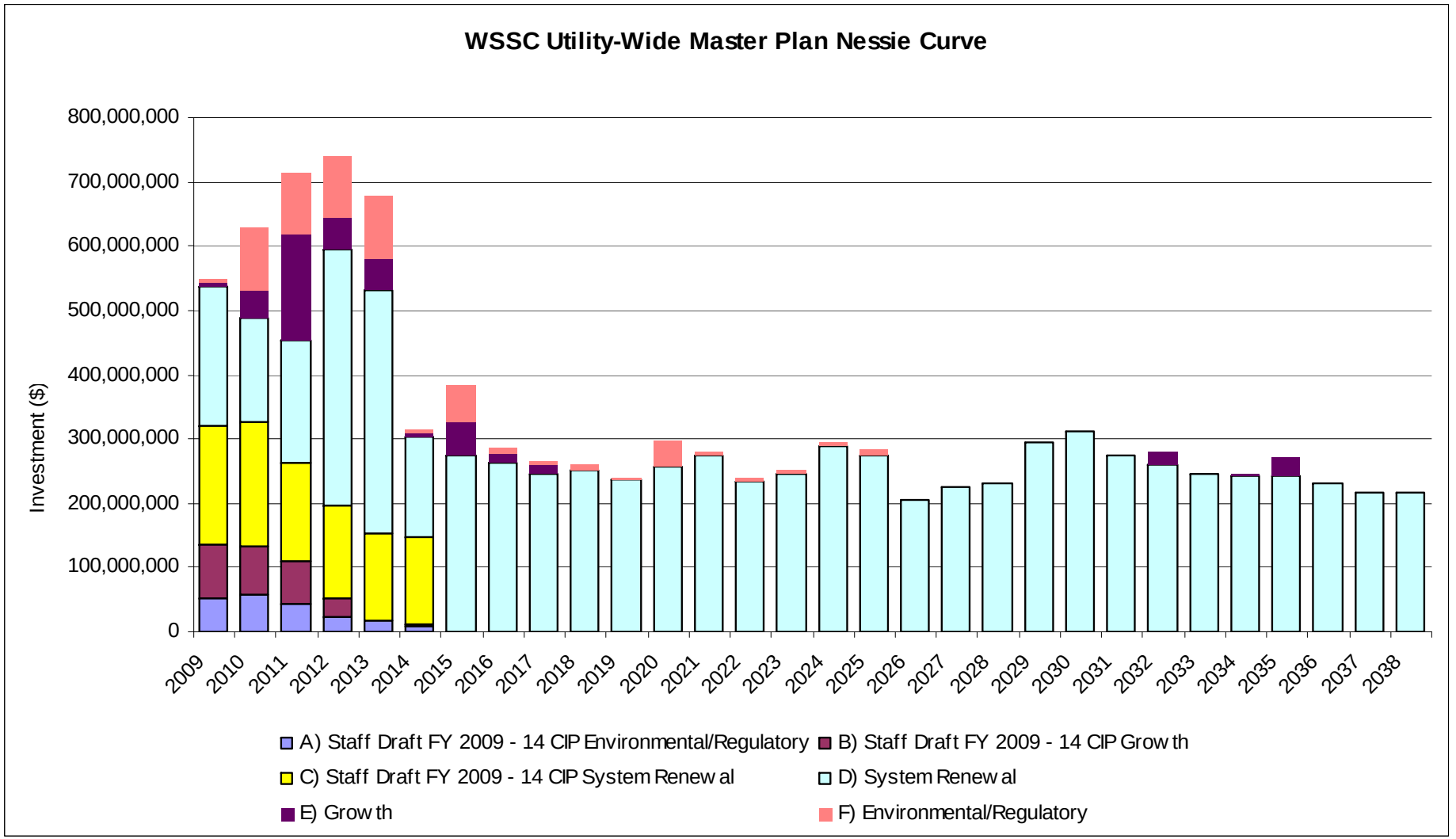

Figure ES.7-1: WSSC Utility-Wide Master Plan Overall 30-Year Nessie Curve

Other 30-Year Nessie Curves

The report also contains various other versions of the Nessie Curve that show different views or sorts of the investment requirements. Curves depicting future investment requirements for the Major Asset Groups - Water Systems, Wastewater Systems, Communications Systems, and Buildings and Grounds - are included. Additional curves are also presented to show the impact of key strategic drivers, such as Automatic Meter Reading, ENR compliance, BioSolids Management, Full Width Paving requirements, Trihalomethane (DBP Rule) compliance, Enterprise Wide Asset Management implementation, and Rehabilitation/Renewal of the Collection and Distribution Systems. These curves are contained in Section 6.0 of this report.

Other curves, which differentiate between projects that impact rates and those that do not, and options for "leveling" the curves to reduce spikes in funding requirements, are included in Section 7.0. The curves in this section resulted from the charge made to the project team of leveling the Nessie curve over a ten year period and a fifteen year period. A set of strategic steps was defined prior to the leveling exercise that detailed the methodology that would be used to level the curve. The steps were as follows:

1. To determine the amount of capital investment that would be leveled, those proposed investments that will not have an impact on rates were removed.
2. Of the remaining investments, those which are categorized as RCO and will impact rates were identified. These projects were included in leveling exercise but the investments themselves were not leveled.
3. Using the redistribution approach to leveling, the investments associated with the water and sewer reconstruction programs were reviewed and leveled as needed.
4. The curve was further leveled by using the BRE scores to redistribute or defer the investments related to the facility assets. As part of this step, six projects with high BRE scores and capital investments were leveled over three years and all investments associated with projects that received a BRE score of 60 or less were deferred for five years.

5. The results of all the asset group specific leveling exercises were combined together to form curve that depicts the rate-impact projects leveled over a ten and fifteen year period. These curves are presented in Figures ES.7-2 and ES.7-3, respectively.
6. The non-rate impacted investments were added back into the Nessie curve. The original Nessie curve and the ten year and the fifteen year leveled Nessie curves are presented for comparison purposes in Figure ES.7-4.

During the review of the original Nessie curve, it is apparent that there is a large amount of rehabilitation that has been deferred in the sewer collection system and the older facility assets, which results in the peaks at the beginning of the Nessie curves. There are also several major pending investment commitments for WSSC that are classified as RCO projects. The leveling exercise resulted in a more evenly distributed investment profile over the first ten to fifteen years of the leveled Nessie curves. The curves presented in Figures ES.7-2 and ES.7-3 represent the amount of capital investment that WSSC must pay for and the goal for these curves was to level them as much as possible to more evenly allocate the capital investments that were identified as part of the Delphi workshop process. When the non-rate impacted projects are added back to the Nessie curve as shown in Figure ES.7-4, it can be observed that the magnitude of the hump does not change. This is due to the amount of capital investment that has been identified for projects that are funded by outside sources, such as MDE grants or developer contributions. However, the leveling exercise reduced the duration of the hump from three years (2011 to 2013) to one year (2011). This means that a significant amount of the capital investments identified in 2012 and 2013 were able to be leveled by redistributing the investments or deferring them for a few years. Leveling the proposed capital investments allows WSSC to more evenly manage the capital investment program and eliminate extreme swings in workload for the WSSC staff.

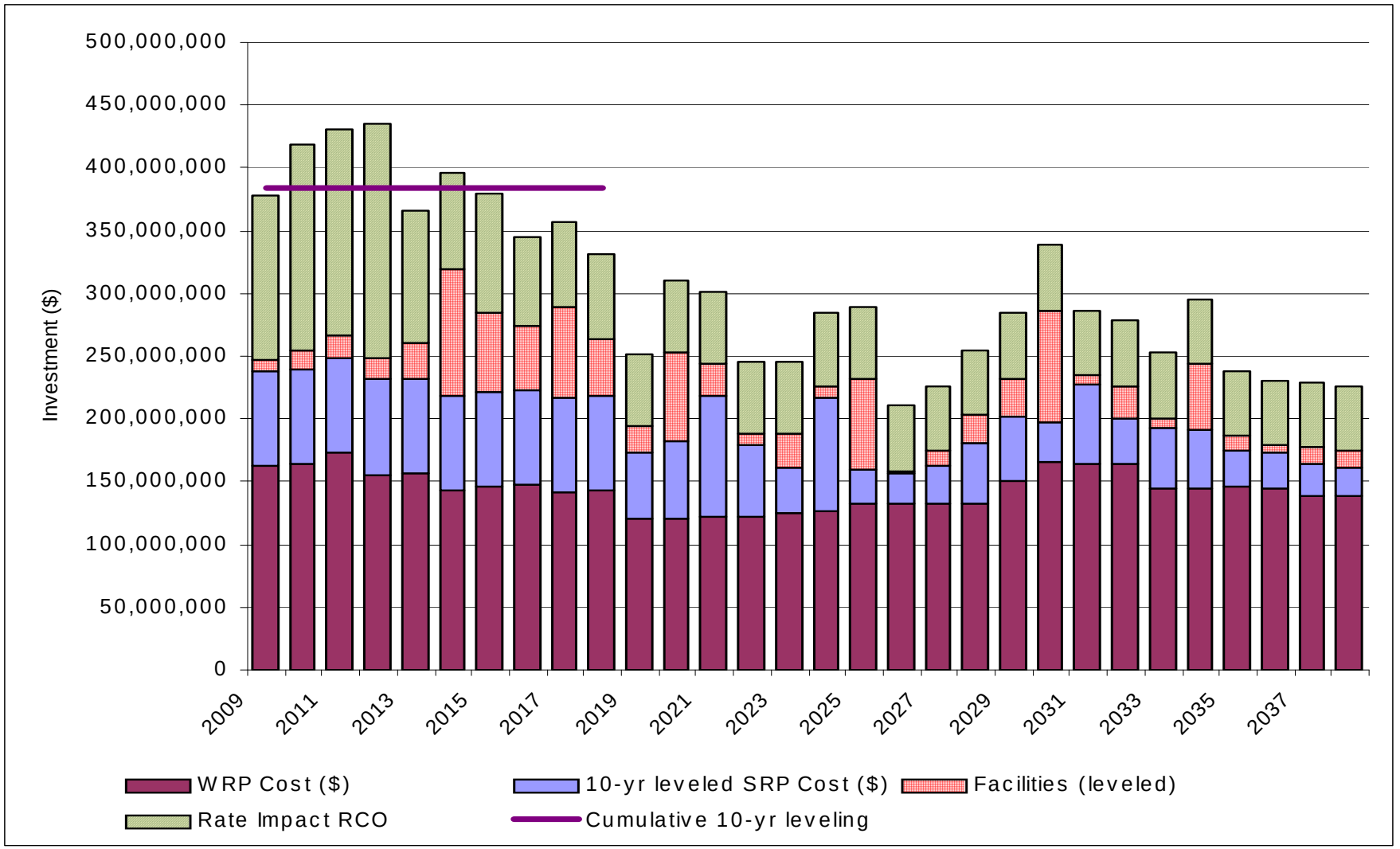

Figure ES.7-2: 10-Year Leveled Nessie Curve (Excluding Non-Rate Impacted Investments)

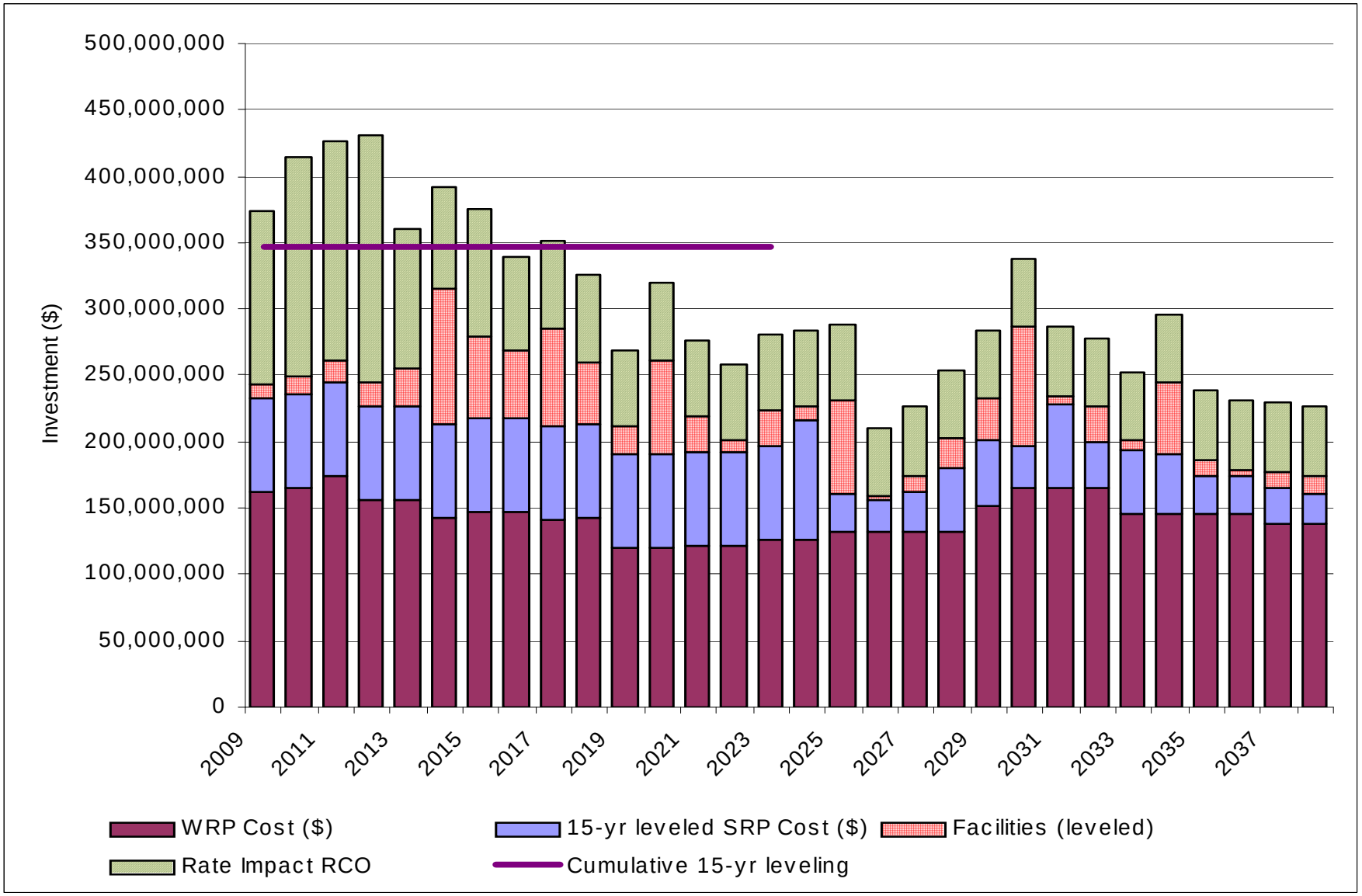

Figure ES.7-3: 15-Year Leveled Nessie Curve (Excluding Non-Rate Impacted Investments)

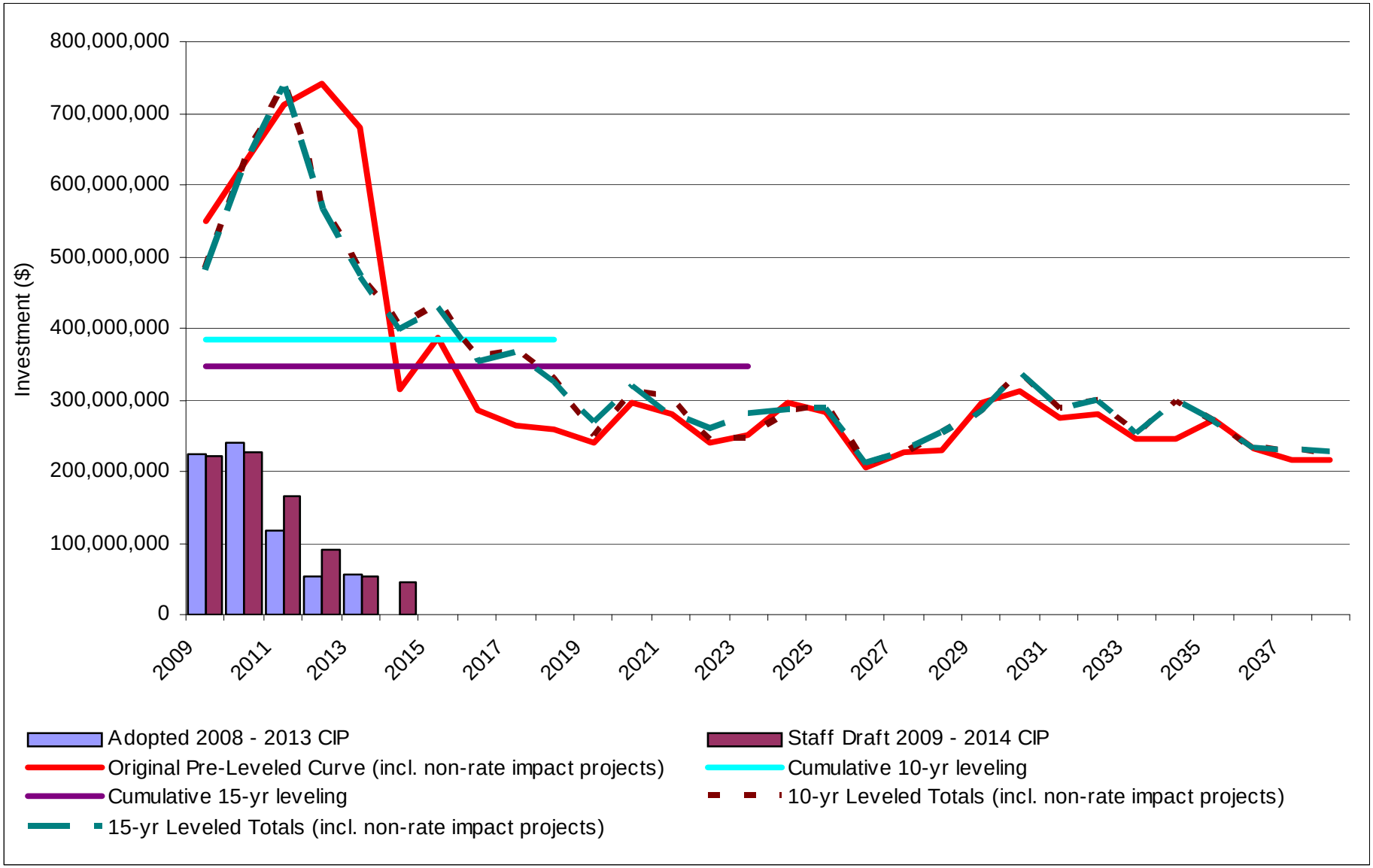

Figure ES.7-4: Comparison of Original Nessie Curve and the Curves Developed as Part of the Leveling Exercise

ES.8 SUMMARY

To address the concerns and issues previously presented, it is recommended that WSSC continue to strengthen the agency's asset management program, with the focus of the program being on renewal of the assets, especially the underground piping. Other items that should be considered while strengthening this program include:

- Isolate "root causes" of failures to effectively focus investment
- Refine failure/survival curves for key asset types
- Develop a "state of the practice" knowledge-base for refurbishment technology built around best practices
- Develop comprehensive and uniform condition assessment/residual life protocols
- Implement an "optimized renewal" investment program
- Strengthen pipe maintenance strategies; increase maintenance
- Develop post-failure management programs for high BRE assets with focus on water side
- Drill down AM program to asset level across organization starting with pipe

The agency should also strengthen the staff capital improvement program and project management capabilities to allow for more involvement of the staff in the management of the agency's assets.

A number of improvement areas have been identified during the first phase of this project, which would be required for WSSC to move to a higher level of investment decision-making. These areas include information systems, the quality and structure of the data held within them, and the processes of the organization.

The next step in achieving the goal of an Enterprise Wide Asset Management System (EAMS) is to utilize the lessons learned from this initial phase and conduct a detailed assessment of the organization with the aim of developing an asset management implementation strategy. This strategy would focus on defining specific projects that can be implemented within WSSC.

An EAMS will allow for the efficient and effective investment in capital, operations and maintenance programs, and the creation of linkages between these programs and levels of service, as well as the customers' and stakeholders' ability to fund them. The EAMS will comprise information systems, data and knowledge, organization support structures, appropriate levels of resourcing and repeatable decision making processes.