State of the Municipal Infrastructure

Summary Status Through End of Year 2009

City of Shreveport

Department of Operational Services

H. M. Strong, Director

March, 2010

UNDERLYING ASSUMPTIONS RELATED TO INFRASTRUCTURE ASSETS VALUATION AND CONDITION

This report represents a summary of the current methodology and approach used by the Department of Operational Services to provide a basic level of infrastructure asset management. This asset management program involves development and analyses of data related to infrastructure assets inventory, condition, and valuation parameters.

Over time these parameters change due to inflation, construction cost increases, deteriorating physical assets, etc. Since it is not possible with existing programs and tools to monitor and adjust all the parameters due to these changes, the information reflected in this report should be viewed as the best available data resulting from a reasonable amount of data development and analysis.

This year annual renewal rates for water, wastewater and roadways were adjusted. These increases can be seen as the sharp spikes in the annual renewal amounts on the graphs in the report. The majority of the adjustments were in water and wastewater as these renewal costs have not been increased since the inception of this report in 1997 while roadways and drainage were added to the report in 2003. These increases are substantial and reflect not only thirteen years of increases in construction costs and the increase in physical size of the infrastructure, but also a more accurate representation of the true renewal and life cycle costs of the different types of infrastructure in the City.

Renewal costs for water and wastewater in previous reports had been estimated based on the size of our infrastructure at the time of the original 1997 report as well as a 50 year design life regardless of the type of infrastructure. While this is adequate for basic structures and pipelines, it does not accurately reflect the life cycle of mechanical and electrical equipment which more are accurately represented as a 20 year design life. They were also based solely on treatment plants and pipelines and did not include a detailed analysis of costs for sewer pumping stations, water booster stations and water storage facilities. The revisions for the 2009 End of Year report have been reviewed by an outside consultant to ensure that acceptable costs and applications of those costs were followed.

The revisions in this document seek to provide a more accurate representation of these costs and are based on a combination of 20 and 50 year life cycle costs as well as renewal costs for sewer pumping stations, water booster stations and water storage facilities.

The data provided in this document should be considered as representative of trends in infrastructure assets renewal and expenditures.

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PROJECTS OF SPECIAL CONCERN

The following are special or high priority infrastructure projects or concerns which are identified here to highlight their unique characteristics and to emphasize the importance in timing for addressing these projects.

While these specific projects are identified as high priority, other projects identified by the Department of Operational Services (DOS) must also be addressed as scheduled to prevent deterioration of the infrastructure categories to levels which will affect the City's ability to meet customer expectations.

WASTEWATER COLLECTION SYSTEM UPGRADE AND REHABILITATION

The current state of our wastewater collection system is not adequate to convey the flows into the system to the wastewater treatment facilities. This is evident in the monthly documentation of sanitary sewer overflows as well as significant increase in flows to the treatment facilities during wet weather events. This inadequacy results in sewer overflows into neighborhoods and stresses our lift stations and treatment plants. The 'fix' for this problem lies not only in repairing defective pipes and rehabilitating lift stations, but in committing to an overall evaluation of our system.

Unlike our water distribution system where it is relatively easy to install a pipe and the water will flow through it, the sewer collects from one point to another, where it is then combined with other flows from other places and then continues on. In essence, changes in one place effect what happens further downstream and if these changes are not accounted for system-wide, it results in capacity issues. While City Staff has identified $180 to $200 million in collection system projects, this does not account for capacity issues. This type of capacity planning is accomplished through a Master Plan. The last Master Plan for the City's collection system was completed in 1984. This is in dire need of updating so that money spent on the collection system is spent effectively.

The City has been notified by the Environmental Protection Agency (EPA) that they have submitted us to the U.S. Department of Justice (DOJ) for litigation over past and on-going sanitary sewer overflows (SSO's). This action by EPA will either force the City into a consent decree that will mandate a minimum level of repairs and rehabilitation to the sewer system within a set time-frame or the City may opt to go through the court system for actual litigation. City staff has participated in two conference calls with EPA and DOJ and has submitted information about past, current and future work on the sanitary sewer system as well as the City's request to the Department of Environmental Quality (DEQ) for a $50,000,000 State Revolving Fund loan.

We had requested that the recently submitted information be reviewed and that the City be allowed to negotiate rehabilitation work and a schedule directly with EPA that would exclude immediate action by the DOJ. EPA responded to our request and has advised that the DOJ would be involved in all negotiations.

FUNDING OF EMERGENCY WATER AND SEWER PROJECTS

The City continues to have needs to repair parts of our system. These needs are not lumped in with planned projects, but rather emergency situations related to complete collapses of sewer mains, loss of backup transformers at both the water and wastewater plants and loss of critical pump station equipment. The total cost of our current emergency list is over $1,000,000. At this time there is little to no funding available for these projects or other emergencies.

COMPREHENSIVE CITY-WIDE GIS AND ASSET MANAGEMENT SYSTEM

Since 1997 DOS has utilized a general form of infrastructure asset management for water and wastewater and added roadway and drainage infrastructure in 2003. The City's Geographical Information System (GIS) project was started back in 1996 and has not yet acquired the funding or personnel needed to bring this system of maps and data up to current levels. While the generalized asset management reporting that has been done does not need a current GIS to provide information for the report, it is obvious that a GIS that includes all of the City's assets rather than just some of its assets would be much more useful and provide a more accurate report. Although DOS has been able to develop trends of renewal expenditures by infrastructure asset category based on a general form of asset management and incomplete GIS data, it has not allowed for detailed development of inventory tracking, asset valuation, condition assessments, maintenance work order systems, and budget management. Until the City's GIS is updated and a comprehensive program is implemented, infrastructure asset planning activities will continue to indicate a range of needed expenditures rather than allowing for more efficient management and spending.

A comprehensive city-wide infrastructure asset management program and GIS upgrade are long term projects that will require careful planning and development. Critical asset systems would be addressed first and over time, all asset categories would be included and mapped for a complete system. A project of this magnitude will take several years and $15 to $20 million dollars to implement. While this seems like a large amount of capital to spend, the savings from the application of these types of programs for asset renewal projects will ultimately pay for the project many times over.

INCREASED WATER TREATMENT CAPACITY

The T. L. Amiss Water Treatment Facility (WTF), originally built in the early 1930's, is aging and requires significant investment to maintain its original treatment capacity of 90 million gallons per day (MGD). This plant takes water from Cross Lake and is the City's primary source of drinking water.

The T. L. Amiss WTF provides an average of 38 MGD of drinking water on a daily basis. The plant, as currently in place, can treat 78 MGD based on the most current design parameters and regulations. While the plant was originally designed for 90 MGD, this capacity has been reduced over the years due to more stringent regulations. The 78 MGD treatment capacity is also the total treatment capacity of the plant. This means that if one of the redundant treatment processes are out of service for cleaning or repair, this total capacity is likewise reduced. While it appears on average that there is adequate capacity to provide drinking water to the citizens of Shreveport, this capacity is stretched considerably during the summer months when the demands can, and have, risen to the total capacity of the plant. Last summer for a period of 7 days, the plant operated between 60 and 65 MGD with hourly peaks between 75 and 85 MGD. During the month of July the plant operated at 63 MGD on average, just 15 MGD less than the total treatment capacity of the plant. If one of the main treatment processes had failed during this time, the City might not have been able to provide the customers with all of their drinking water needs.

Discussed in a section below are projects currently underway to provide additional water pressure to Southeast Shreveport. When these projects are complete this summer, this will allow more water use and ultimately more demand on our already strained water treatment plant.

One alternative for assuring that the City has adequate water treatment capacity for the next 20 to 50 years would be to construct additional water treatment capacity of between 30 MGD and 60 MGD. The intent would be to construct this additional capacity in two locations, one near southeast Shreveport on the Red River, north of the Lucas Wastewater Treatment Facility, and a second one near the Red River, just south of I-220. By constructing one or both of these water treatment plants the City could provide not only additional needed capacity and redundancy but also a redundant raw water source with the Red River should there be an issue with the water from Cross Lake. These two plants are estimated to cost approximately $168 million each to construct.

Alternative water treatment pilot testing will need to be conducted to provide data for use in optimizing the capacity; source raw water; and physical location of a second water treatment plant. The estimated cost of this preliminary pilot testing of water treatment technologies and associated engineering analysis is $1,200,000.

CROSS LAKE

Cross Lake was built back in the late 1920's for the purpose of supplying water to the City of Shreveport. The T. L. Amiss Water Treatment Facility was built on the shores of the lake and designed for a capacity of 8 MGD. Since that time the City has expanded and grown and development around the lake has increased. The lake now serves the dual purpose of water supply and recreation. There are two areas of concern for the lake, one is the slow silting in from creeks, streams and surface runoff which reduces the depth and water supply capacity and the other is non-native vegetation which not only speeds up the silting in process and reduces recreation, but also contributes to water treatment issues including taste and odor.

The cost to dredge the lake back to the original depth and capacity is approximately $200 million. The costs for reducing the non-native vegetation are smaller at $1 million, but require yearly expenditures of a few hundred thousand dollars to maintain.

CROSS LAKE DAM

The Cross Lake Dam was built in the late 1920's. At the time the dam was built, the existing embankment was used as a railroad bridge over Cross Bayou. The spillway was constructed in 1928 to replace this embankment structure and form Cross Lake. The combined usage of the Cross Lake Dam as both a containment structure for raw water supply to the City of Shreveport's only water treatment facility and as structural support for two existing rail lines for Kansas City Southern Railroad provide an unusual situation requiring a unique balance of responsibilities and accountability related to caretaking of the dam structure and surrounding area.

Studies have recently been conducted to determine maintenance, repair and replacement costs of various parts of the dam and spillway. The cost for providing additional structural support for the dam is approximately $3 million. As discussed above, the spillway, or gate portion of the dam, was constructed over 80 years ago and is in need of replacement. Parts of the spillway are gates that are operated to provide for flood control when rains substantially increase the lake levels. This equipment is past it's design life and replacement parts are not available and repairs are expensive. Replacement of the spillway structure is $10 to $15 million.

INTELLIGENT TRAFFIC SYSTEM

Early in 2009, the main-frame computer that managed the Traffic Signal System in Shreveport took heavy damage from a fire. This thirty year old central system is now completely off line and has no option for repair. Unfortunately, the back up system for this equipment is even older. Signals within the city are now operating on equipment that is, in some cases, over sixty years old.

This turn of events is causing congestion, increased driver frustration, and an overall drop in motorist's safety throughout the City. Small projects, such as Youree Drive and the signals along I-20 have updated roughly fifteen percent of the system utilizing the seven million dollars in federal grant monies obtained from 2001-2005. To completely utilize the capabilities these improvements represent, more work is needed. In addition, the estimated total cost to rehabilitate the entire system is approximately sixty million dollars. The first phase of this work for $25 million is included in the upcoming bond issue.

SOUTHEAST REGION WATER PRESSURE AND SUPPLY PROBLEMS

Low water pressure in Southeast Shreveport is due to a combination of inadequate water transmission capacity to specific zones of the water distribution system and inadequate pumping/pressuring capacity for specific elevation differentials in some of these zones. The City is currently in construction of facilities totaling $32 million to address these issues. The projects include the Southern Loop Water Distribution Mains (Linwood Avenue, Southern Loop and Wallace Lake Road), the 36" Water Transmission Main (Meriwether to Mt. Zion along St. Vincent to Bert Kouns), the Inner Loop Ground Storage and Pump Station at Mt. Zion and St. Vincent, and the 60" Water Main from the Amiss Water Treatment Facility to West College. With the exception of the Inner Loop Ground Storage and Pump Station facility, these projects are substantially complete and will be operational by the end of March 2010. The Inner Loop Ground Storage and Pump Station facility will be complete by the end of May 2010. Since these projects are new facilities and the construction costs are not for renewal or replacement of existing facilities, the expenditures on these projects are not included in the expenditures included in this report.

While the City has expended considerable funds to rectify pressure issues in Southeast Shreveport, city-wide issues of aged and undersized water mains remain. These issues present the City with continual repairs when these mains fail. This was highlighted with the recent cold weather event that left portions of the City temporarily without water as crews worked tirelessly to repair over 150 water main breaks in a week. Not only do water main breaks provide an inconvenience to customers, but they cost the City millions per year in emergency repairs as well as lost water. DOS has estimated that approximately $530 million is needed to bring the water distribution system up to current standards and levels of reliable service.

EXECUTIVE SUMMARY

The state of our infrastructure is a very important issue that has a significant impact on our citizen's daily lives. As a City government, it is our business to design, construct, operate and maintain the infrastructure (roads, bridges, pipes and pumps, etc.) to facilitate the development of our City. As a practical matter, all of the facilities we install have a life cycle. Within that life cycle it is implied that resources for the expected maintenance and the eventual replacement are required. Some facilities have different life expectancies and different maintenance requirements.

For planning purposes, we have to take into account the capital cost of a project, its life expectancy and the years between preventive maintenance and replacement. The problem is when our aging facilities were designed and built; an implied covenant was made to expend the capital to provide for preventive maintenance and replacement when the service life comes to an end. What we are witnessing today symptomatically is the advanced and sometimes premature decay of our infrastructure and the breaking of that implied covenant made many years ago.

With issues today that include water management, energy efficiency, funding and environmental concerns, infrastructure should be viewed in a different manner. As a result, the new buzzword is "sustainability". This includes not only the physical asset and how it is installed, but the affect of that asset on its surrounding environment. Elements of sustainability include conservation and efficiency, energy management, security, environmental stewardship, public outreach and information, funding transparency and realistic life-cycle costing, and regulatory optimization.[1] With all of these issues comes a cost of not only money but time, both of which are in short supply.

Historically municipalities have lagged in infrastructure spending as compared to the needs. An example is the 2002 US Environmental Protection Agency report, The Clean Water and Drinking Water Infrastructure Gap Analysis. This report concluded that the current national spending "gap" for water and wastewater capital needs is $225 billion. This is the amount needed above current spending. This does not include the Operations and Maintenance spending gap of over $300 billion.

Nationally the current spending for water and wastewater infrastructure is $30 billion.[2] The majority of these funds are derived from local sources as minimal federal monies are typically available to municipalities other than through the State Revolving Loan programs. As the name suggests, these are loans and not grants, and local revenues must ultimately pay back principal and interest on these loans.

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[1] American Water Works Association, Sustainable Water Systems, Opflow February 2010.

[2] 2009 Congressional Budget Office.

The emphasis on infrastructure sustainability is being driven by the widely accepted fact that cities historically have managed their infrastructure poorly. This has resulted in a national concern for municipal infrastructure which is in poor condition and is continuing to deteriorate to the point of negatively impacting the economic strength of cities, as well as health concerns of citizens. [3] [4]

Minimization of expenditures on municipal infrastructure is not the least cost alternative to infrastructure management—it only defers needed expenditures until infrastructure assets' failure require their replacement—always at a much greater cost due to parts, labor, method of repair and collateral damages. These increased costs are often hidden but are real costs that unnecessarily increase the amount that citizens pay and can negatively affect the quality of services provided.

The Department of Operational Services has utilized a general form of infrastructure asset management which dates back to 1997. [5] Since that time, numerous reports on the status of the water and sewer infrastructure have been produced for the U. S. Environmental Protection Agency (EPA) and the Louisiana Department of Environmental Quality (DEQ), and for internal City use.

In 2003, the Infrastructure Committee of the City Council requested that streets and drainage be added to the monitoring of infrastructure status. It is one of the Department of Operational Services' highest priorities to implement a comprehensive infrastructure asset management program for water, sewer, streets, and drainage infrastructure that will build on what was initiated in 1997.

As detailed in the annual report "Capital Projects and Proposed Infrastructure Improvement Programs" the City has total infrastructure needs of almost $1.5 billion dollars. Those needs as compared to the actual annual spending provided in this report show that the City's spending gap is comparable to that of other municipalities around the country. While the City has expended $320 million since 2000 for capital improvements, this has not been enough to keep up with the infrastructure needs.

This document summarizes the general asset management approach used by the Department of Operational Services to report the current infrastructure expenditures and estimated renewal rates for the City's municipal infrastructure and to make recommendations about the most cost effective actions which will continue to improve that infrastructure.

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[3] Report Card for America's Infrastructure, 2003 Progress Report: An Update to the 2001 Report Card, American Society of Civil Engineers.

[4] Report Card for America's Infrastructure, 2005 Progress Report. An update to the 2003 Report Card, American Society of Civil Engineers.

[5] 'State of the Water and Sewer Infrastructure Report: City of Shreveport, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008'.

STATE OF THE MUNICIPAL INFRASTRUCTURE

The following sections summarize the status of investment in the water, sewer, streets, and stormwater drainage infrastructure in the City of Shreveport. The information has been updated through the end of 2009. As indicated previously in this report, annual renewal costs were revised from previous reports for water, wastewater and roadways.

TOTAL MUNICIPAL INFRASTRUCTURE

For the purposes of this report, the total municipal infrastructure consists of (1) water and sewer infrastructure assets; (2) roadways infrastructure assets; and (3) stormwater drainage infrastructure assets.

The following are brief discussions and explanations of these specific assets with graphs comparing actual annual capital expenditures vs. target annual investment expenditures or asset renewal rates.

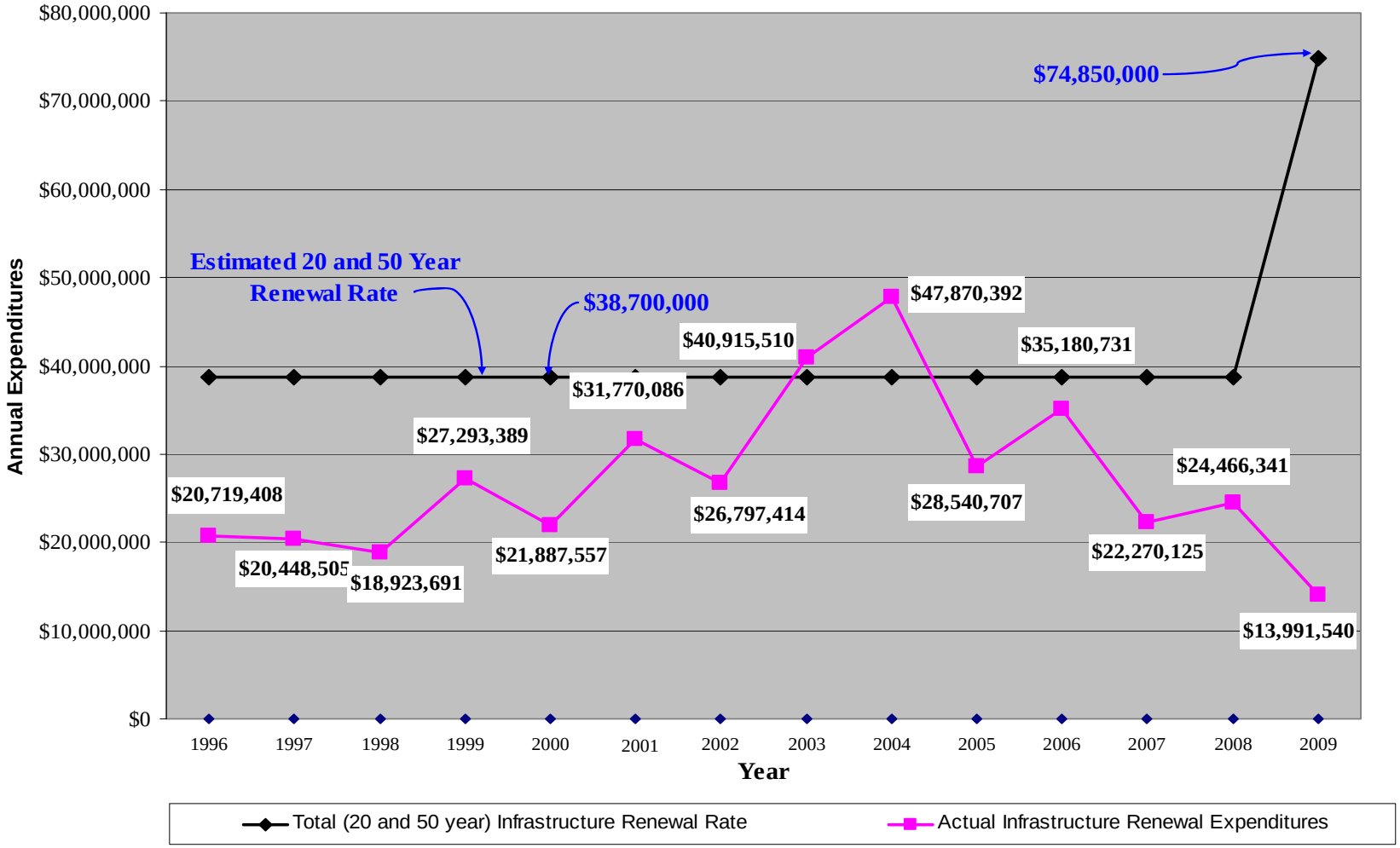
The information described below was utilized to develop the recommended annual investment or annual renewal requirement amounts shown on the graphs:

1) The annual infrastructure asset renewal rate is intended to represent a best estimate of the percentage of infrastructure assets which will become inoperable or unusable each year and therefore will need to be replaced. For most assets, an economic life is typically 50 years. For assets that include equipment, an economic life of 20 years is utilized. A 50 year economic life corresponds to an estimated infrastructure asset annual renewal rate of 2% (50/100) and 20 years corresponds to a renewal rate of 5% (20/100). This means that the City should budget for replacing between 2% or 5% of its infrastructure every year.

2) Conservative replacement values have been used to calculate an estimated annual replacement rate of $74,850,000 for the total municipal infrastructure. These costs are based on a total infrastructure value of $3.2 billion. The value of the infrastructure is based on current construction costs for each type of infrastructure whether that is an asphalt roadway, a 12-inch water main or a concrete drainage channel.

As stated above, the total estimated value of the City's infrastructure is $3.2 billion. This is a very rough estimation based on miles of pipe and roadway, pumping and treatment facilities, inlets and channels. Some infrastructure is less expensive to replace than another of the exact same size. For instance, a 12-inch sewer line is less expensive to replace when located in the middle of a road right of way with no other conflicting utilities than a 12-inch sewer main located in the middle of a road.

Being able to accurately assess the value (and condition) of existing infrastructure allows for better planning and utilization of capital infrastructure funding. The better the infrastructure asset management system implemented by the City, the more realistic the annual renewal expenditure the City will be able to use while improving and sustaining its infrastructure at planned operability levels. A more detailed, comprehensive asset management system coupled with an accurate, up-to-date GIS would allow for less interpretation and estimation of data and would rely more heavily on actual values of existing infrastructure. This will result in more accurate estimations of infrastructure renewal rates which in turn will provide for realistic budgeting of capital improvements as well as future financing plans.



TOTAL MUNICIPAL ANNUAL INFRASTRUCTURE RENEWAL

WATER AND SEWER INFRASTRUCTURE

Water and sewer infrastructure assets are physical structures with related equipment, piping, and appurtenances which treat and transport water and wastewater.

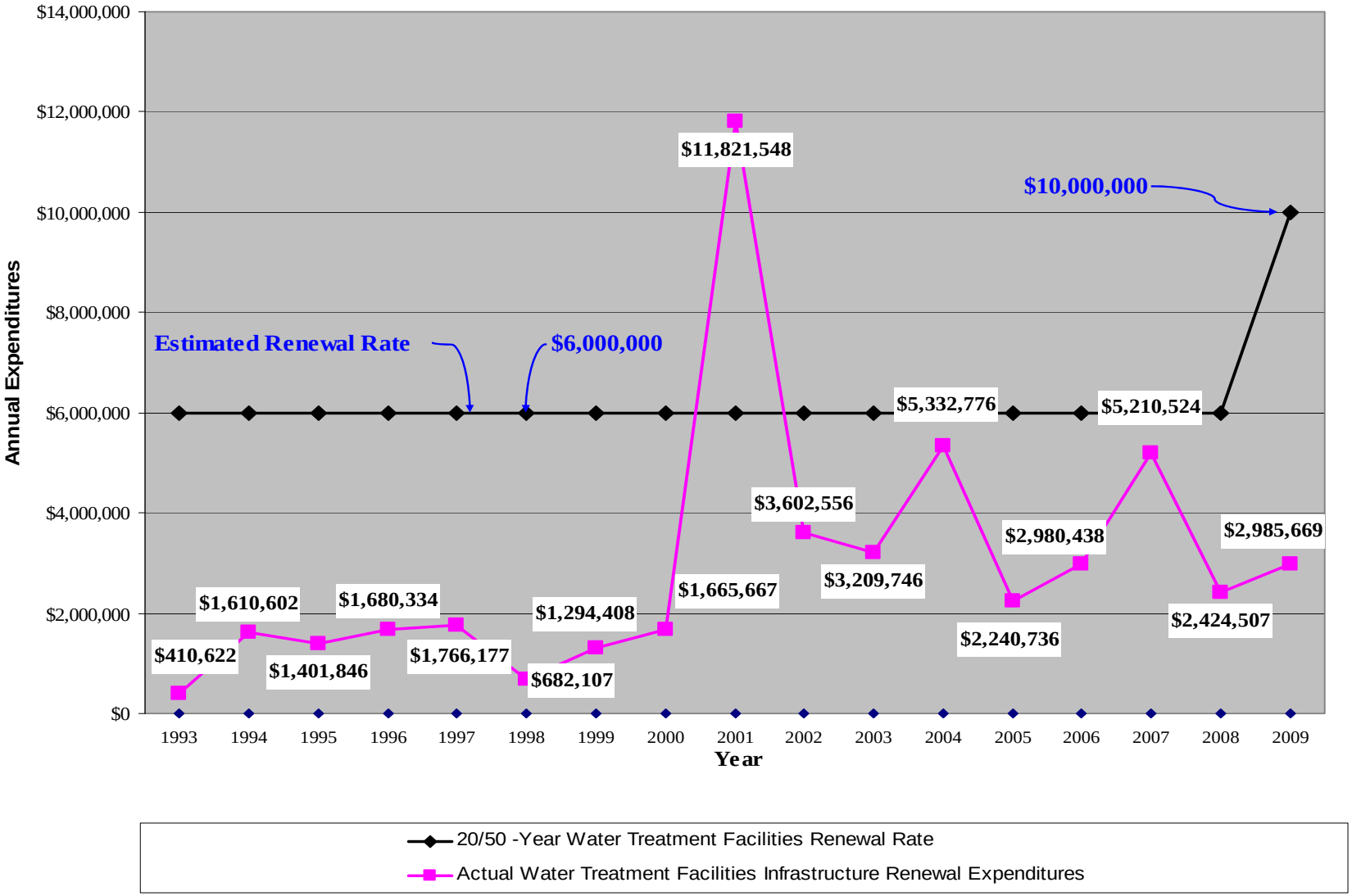
The level of water and sewer service is highly dependent upon the condition and functional capability of the water and sewer infrastructure assets.

Categories of Water and Sewer Infrastructure Assets

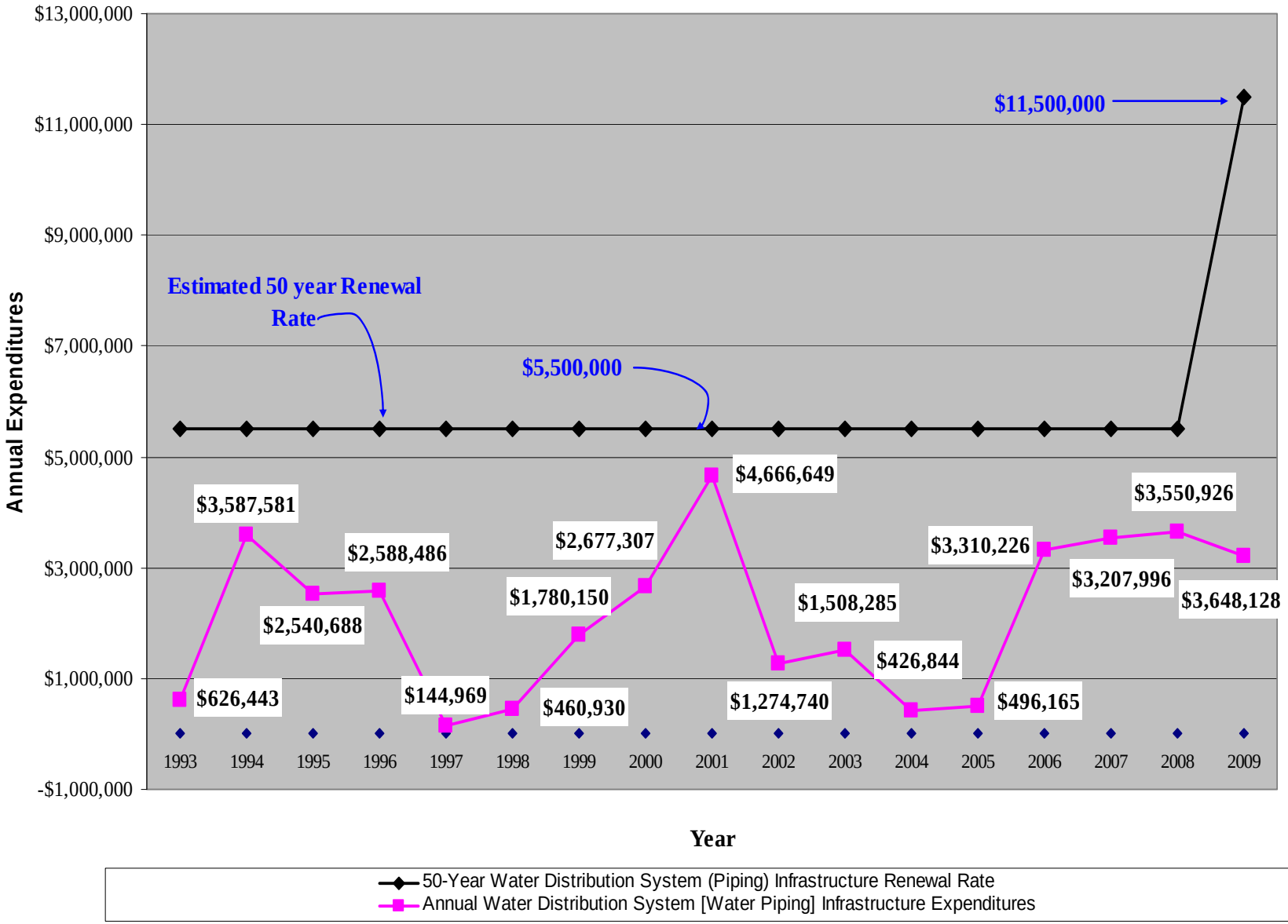
The four major categories of water and wastewater infrastructure assets are:

1) Water Supply, Treatment and Pumping Facilities.
2) Water Distribution System (Piping).
3) Wastewater Treatment and Pumping Facilities.
4) Wastewater Collection System (Piping).

The following graphs indicate the historical investment in infrastructure for each of the above water and wastewater infrastructure asset categories.

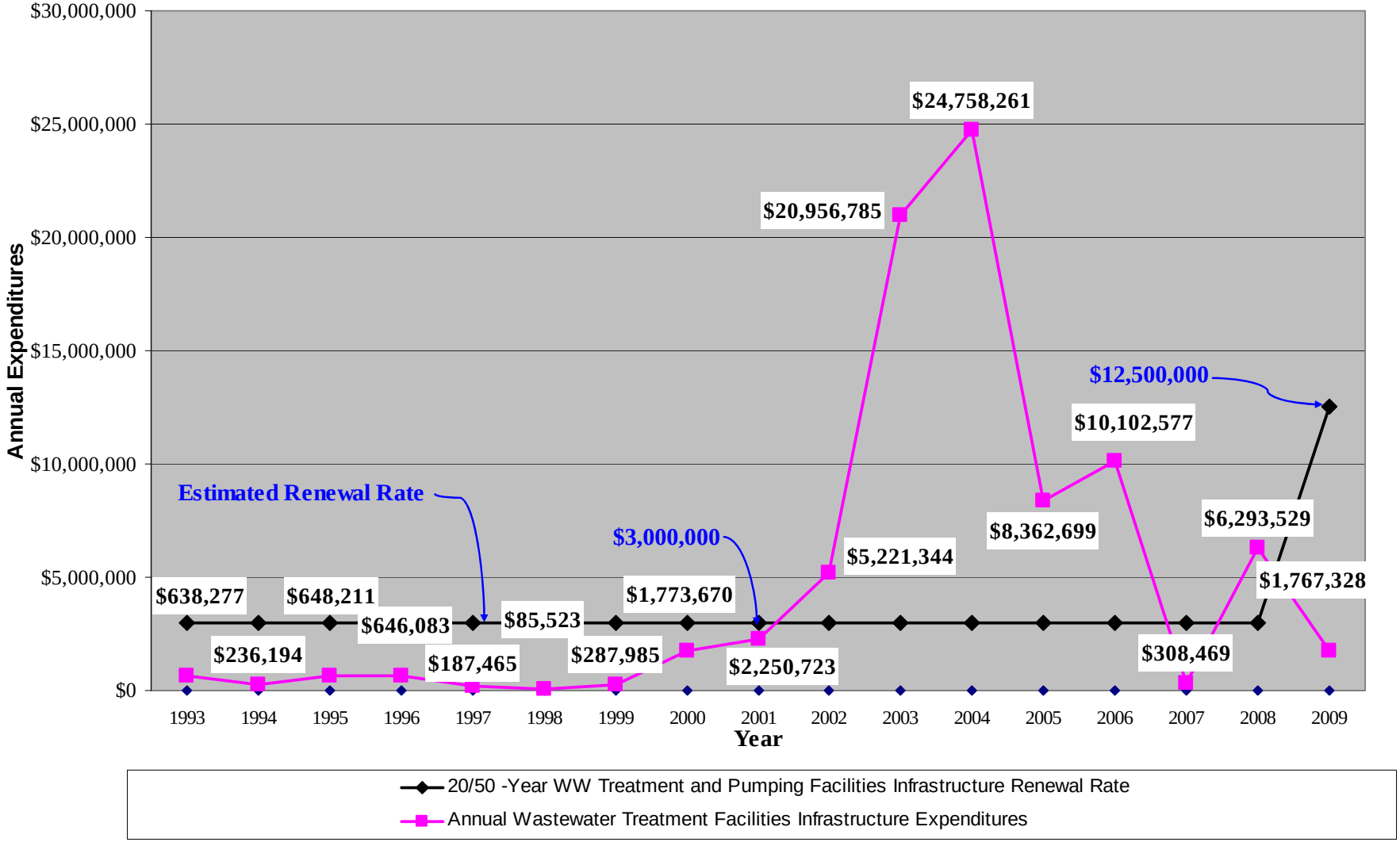


WATER SUPPLY, TREATMENT, AND PUMPING FACILITIES ANNUAL INFRASTRUCTURE RENEWAL

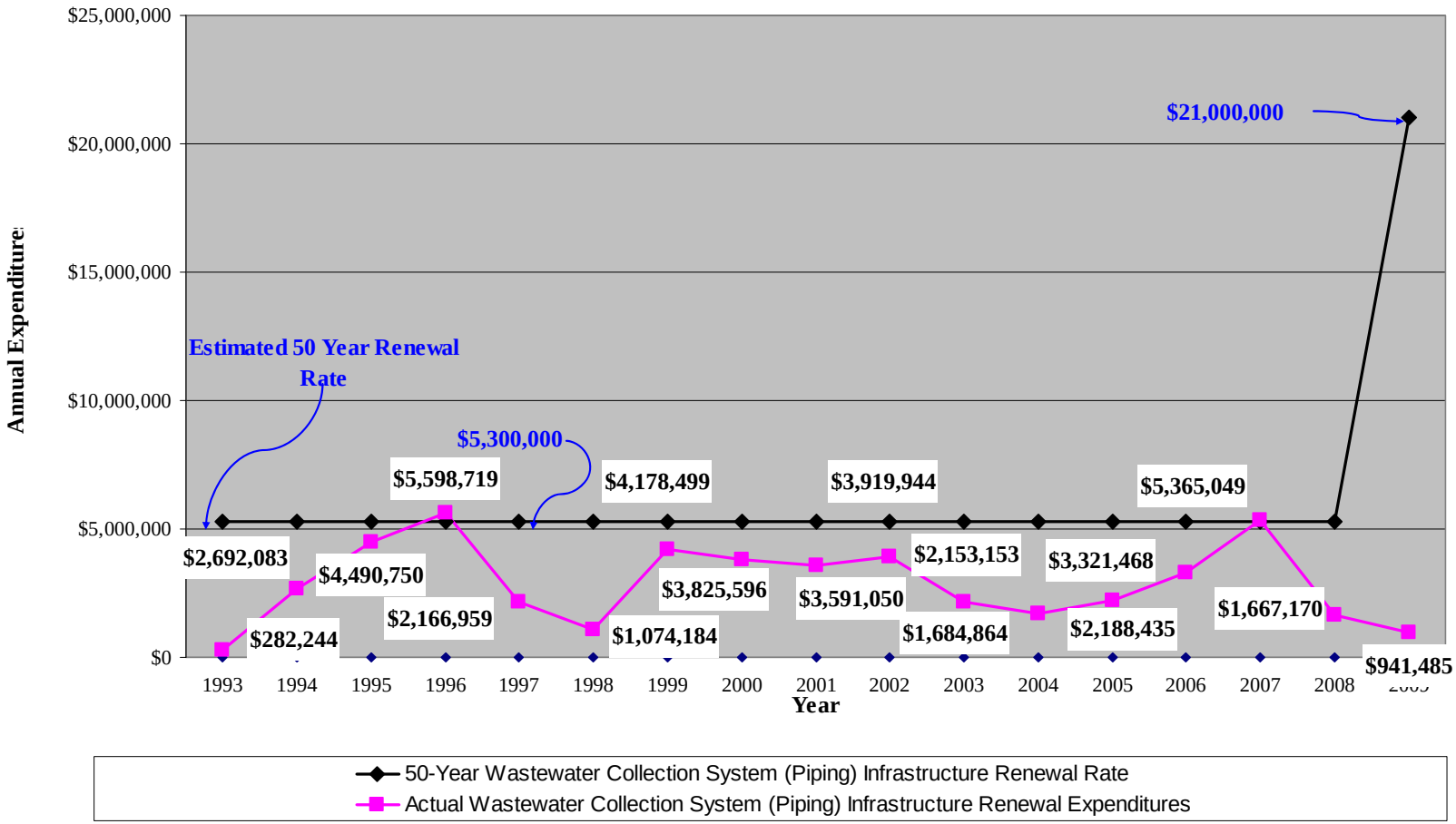


50-Year Water Distribution System (Piping) Infrastructure Renewal Rate
Annual Water Distribution System [Water Piping] Infrastructure Expenditures

WATER DISTRIBUTION SYSTEM ANNUAL INFRASTRUCTURE RENEWAL



WASTEWATER TREATMENT AND PUMPING FACILITIES ANNUAL INFRASTRUCTURE RENEWAL



WASTEWATER COLLECTION SYSTEM ANNUAL INFRASTRUCURE RENEWAL

ROADWAYS INFRASTRUCTURE

Roadways infrastructure assets are the physical road structures with related bridges, overpasses, and appurtenance which are used by vehicular traffic.

The level of operability as reflected by such parameters as lost time due to alternative routing for detours is highly dependent upon the condition and functional capability of the roadway infrastructure assets.

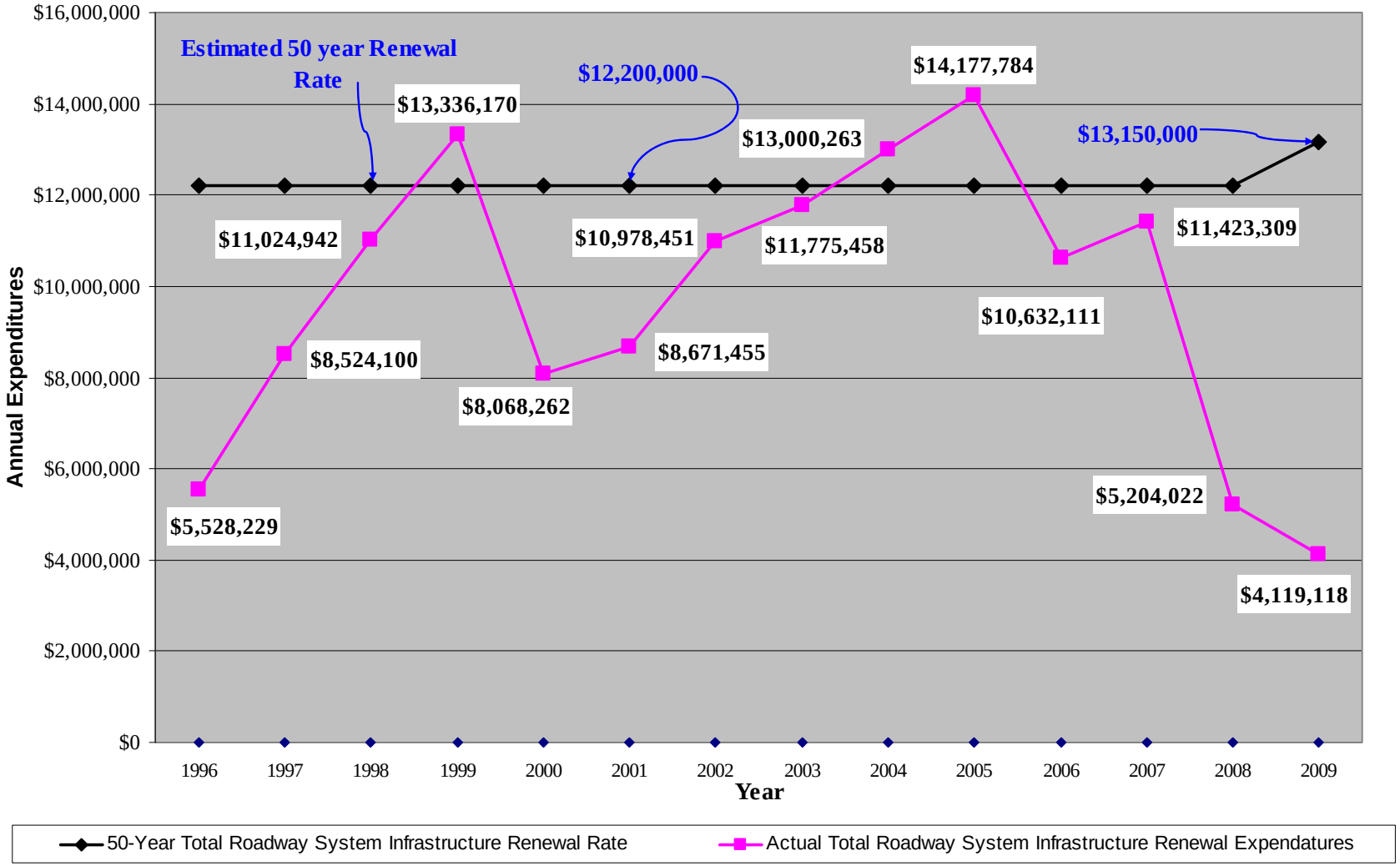
Overall Roadway Infrastructure Assets

For many years the City of Shreveport was very aggressive in procuring funding for their roadway system. Driving the City, these projects are apparent in the many loops and overpasses that move vehicles very efficiently around the City. In the 1990's the normal yearly expenditures for roadway improvement was $13.5 million. Since that time funding has dwindled to minimal levels of $5.5 million. The current 2010 budget for asphalt roadway maintenance and concrete roadway maintenance is $1.05 million. This reduction in funding is apparent as you travel the City and see the streets with numerous cracks and potholes. As an emphasis is placed on water and sewer infrastructure, the roadways should not be neglected or the City will leave itself in the position of reactive replacement at a premium cost vs. proactive maintenance at a reasonable price.

Categories of Roadway Infrastructure Assets

The two major categories of roadway infrastructure assets are (1) concrete roadways and appurtenances and (2) asphalt roadways and appurtenances.

The following is a graph of roadway annual investment.



ROADWAY SYSTEM ANNUAL INFRASTRUCTURE RENEWAL

STORMWATER DRAINAGE INFRASTRUCTURE

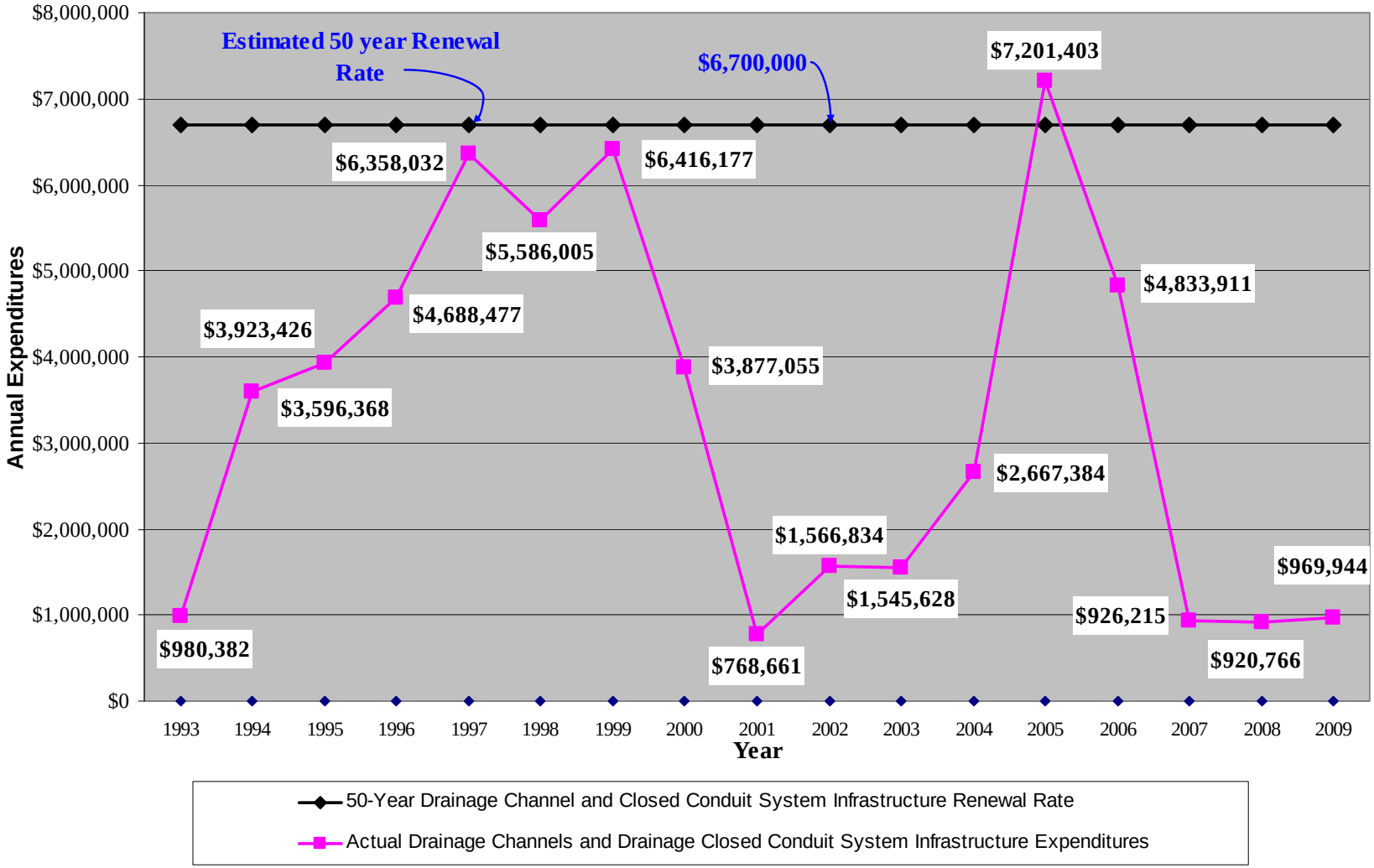
Stormwater drainage infrastructure assets are the physical structures which convey stormwater to waterways.

The level of operability as reflected by such parameters as annual liability costs due to flooding is highly dependent upon the condition and functional capability of the stormwater system.

Categories of Stormwater Infrastructure Assets

The major categories of stormwater infrastructure assets are (1) open ditches and channels and (2) closed conduit, pumping, and piping systems.

The following is a graph of stormwater infrastructure annual investment.



DRAINAGE SYSTEM ANNUAL INFRASTRUCTURE RENEWAL

CONCLUSIONS AND RECOMMENDATIONS

As our infrastructure system has aged without the benefit of the appropriate level of annual maintenance and replacement we are in a position that we cannot keep up with the projects at hand and at some levels we are jeopardizing the public safety. On average, the cost of “band-aid”/emergency projects is double the cost of a planned repair or replacement. In some cases the cost can be 3 to 5 times as much. A recent example is a collapse of a 12-inch sewer main in an alley downtown. The cost to replace 50 feet of sewer main was $96,000. If a project for rehabilitation had been planned and completed prior to the collapse, the main could have been rehabilitated for $15,000.

To reach a sustainable level of infrastructure condition, the City needs to:

1) Finalize implementation of City-Wide GIS and asset management tools and systems to allow systematic management of the infrastructure (integrated management of operations, maintenance, and capital improvements). The costs of this program range from $15 to $20 million.

2) Assure that operations/maintenance management of assets as well as ongoing evaluation of operability (i.e., adequate service level) of assets is included as integral parts of the decision process in the determination of capital improvements.

3) Provide funding for infrastructure improvements to essentially ‘catch up’ to current expected levels of service. While the City has funded $320 million since 2000 for capital improvements, this figure does not come close to the nearly $1.5 billion identified in the “Capital Projects and Proposed Infrastructure Improvement Programs that is needed to ‘catch up’.

4) As provided previously and as reflected in this document, it is estimated that approximately $74,850,000 annually is needed to replace water, sewer, streets and drainage infrastructure assets which become operationally obsolete. This is in addition to the funding needed to “catch up” on the current state of infrastructure disrepair.

5) Implement a budget which reflects a water, sewer, streets and drainage rate/tax structure which supports all of the above aspects of cost-effective, systematic infrastructure asset management.

POTENTIAL FUNDING SOURCES

Impact fees for water, sewerage, and roadway infrastructure.

Implementation of a stormwater utility enterprise fund.

Implementation of a dedicated sales tax for infrastructure.

Implementation of a dedicated property tax for infrastructure.

Implementation of a taxing authority around Cross Lake for upkeep of the lake.

General Obligation Bonds.

Water and Sewer Utility Rate Increases.