OPERATIONS AND MAINTENANCE PROGRAM

4.1 COLLECTION SYSTEM MAPS AND INFORMATION

A. Information Management

The Department of Public Works strives to maintain accurate electronic records of our inventory of sewer assets as well as all work performed on those assets. This section describes the software programs utilized to maintain this information.

A.i AutoCAD Utility Underground Map Books

AutoCAD (CAD) is the graphics program used for construction design work and to print citywide underground utility map books. Map books are hard-bound sets of over 285 map tiles that display parcels and streets along with sewer and storm assets. Each sewer and storm maintenance vehicle carries a citywide underground map book. Maps are referenced for maintenance activities as well as for determining how storm drainage networks can be blocked in the event of a sewage spill. Exhibit 4.1.A.i is one sample page from the underground map book.

AutoCAD Sewer Layer Structure
Sanitary sewer collection system information is maintained in a Master AutoCAD sewer file (Sewer.dwg). This drawing file contains the following layers:

- **SS-MANHOLES**: point features identifying the location of sewer manholes, abandoned manholes, clean-outs, wet-wells, valves and plugs
- **SS-MAINLINES**: line features identifying the location of sewer gravity mainlines, forcemains, and abandoned gravity mainlines and forcemains
- **SS-LATERALS**: line features representing sewer service lines
- **SS-PUMPSTATIONS**: polygon features identifying the location of sewer pumping station buildings

In AutoCAD, information pertaining to sewer features (such as manhole number, rim and invert elevations, mainline size and length) is displayed as text annotation layers. CAD feature layers (non-text layers) are exported into an ArcSDE Geodatabase (geodatabase) as GIS feature classes. In GIS, these features have the CAD text information stored as data in layers attribute tables along with other pertinent data.

A.ii GIS Computer Mapping Program

GIS is a computer mapping system that links graphic features on a map to databases of related information. The City has converted all of its sanitary sewer assets into a GIS system. While AutoCAD is used primarily for design work, GIS is utilized for storage/retrieval of asset information. Exhibits 4.1.A.ii through 4.1.A.vii were created using GIS ArcView software.
ArcSDE Sewer Layer (Feature Class) Structure
Sanitary sewer collection system information is maintained in an ArcSDE Geodatabase that contains the following sewer GIS layers and attribute data:

SS-MANHOLES: point features identifying the location of sewer manholes, abandoned manholes, clean- outs, wet-wells, valves and plugs
[data fields: ObjectID, Shape, CAD Handle #, Layer, LegacyID, OldID, Location, Neighborhood, FacilityID, Condition, Condition Date, Warranty Date, Cleaning Area, Notes, Rim Elevation, Invert Elevation, Interior Drop, Access Diameter, MH Location, Install Date, Latitude, Longitude]

In 2011, with the implementation of a citywide manhole inspection program, all data collected during the Manhole Assessment Condition Program (MACP) inspection (such as manhole component materials, sizes, condition, etc.) is captured in a GIS layer named SS-MH-INSPECT.

SS-MAINLINES: line features identifying the location of sewer gravity mainlines, forcemains, and abandoned gravity mainlines and forcemains
[data fields: ObjectID, Shape, CAD Handle #, Layer, LegacyID, Length, FacilityID, Location, Condition, Condition Date, Warranty Date, Cleaning Area, Diameter, Material, Install Date, SSML Location]

In 2011, in preparation for sharing GIS information with CCTV contractors, staff added upstream and downstream manhole numbers as separate fields, added upstream manhole address, use of sewer, owner and pipe shape to the SS_MAINLINES layer.

SS-LATERALS: line features representing sewer service lines - not an exact representation of the location of the lateral in the field – but a line providing linkage between the parcels, with ownership information, and the receiving sewer mainline
[data fields: ObjectID, Shape, CAD Handle #, Layer, LegacyID, Length, FacilityID, Location, Condition, Condition Date, Warranty Date, Cleaning Area, Material, APN, Street #, Street Name, Zip code, Year Structure Built, Install Date, ROW vs. Easement, Cleanout Type, Tap Type, Tap Location]

SS-PUMPSTATIONS: polygon features identifying the location of sewer pumping station buildings, as well as data regarding wet wells, pumps and maintenance information
[data fields: ObjectID, Shape, CAD Handle #, Layer, Pumpstation Name, Wet well CAD Handle#, Station Type, LegacyID, Location, FacilityID, Condition, Condition Date, Warranty Date, Pipe Inlet Diameters, Discharge/Forcemain Diameter, Pump Capacity, Total Dynamic Head, Date Station Built, Pump #1 #2 & #3 Information, Pump #1 #2 & #3 Install Date, Pump #1 #2 & #3 Rebuild Date, Pump #1 #2 & #3 Model #, Pump #1 #2 & #3 Serial #]

SS-BASINS: polygon layer for the City’s 5 major sewer basins
SS-SUBBASINS: polygon layer outlining small sub-sections within each sewer basin
SS-CLEANINGAREAS: polygons further dissecting sub-basins. Cleaning areas identify how the collection system operates and flow is carried from peripheral lines to major trunklines for maintenance crews to effectively clean pipe networks. Polygons are snapped to the outside boundaries of parcels served at each small network to identify property owners within each cleaning area.

Aii CMMS – Azteca’s “Cityworks”

The City utilizes Azteca’s “Cityworks” computerized maintenance management (CMMS)/asset management system for planning and scheduling preventative maintenance work and for tracking maintenance history on sewer assets. This GIS-based application provides access to information pertinent to each asset (pipe diameter, length, material, etc.) as well as to maintenance activities (work orders), resident complaints and requests for work (service requests).

The primary functions of the Azteca Asset Management Program are:

- Maintain service request and maintenance history for each collection system asset
- Produce and regularly update the maintenance schedule based on feedback from the operators
- Generate reports that support data analysis and decision making
- Provide documentation for use in regulatory compliance reporting
- Indicate line segments or structures that may be candidates for replacement or rehabilitation under the capital improvement program

The CMMS program functions with the proper maintenance of key fields throughout GIS Layers.

Key Fields:

- HANDLE – CAD Handles are unique alpha-numeric character strings automatically assigned by CAD to each map feature in a drawing file. Public Works uses this unique identifier (ID) to maintain linkages between CAD graphical elements and geodatabase records
- LEGACYID – A Cityworks required field (20 characters). This field contains asset feature ID’s (i.e. Manhole #’s or Sewer Mainline ID’s, which are the alpha-numeric upstream manhole # followed by the alpha-numeric downstream manhole #)
- FACILITYID – A Cityworks required field (20 characters) that must be unique from all other identifiers of features in the geodatabase. Originally, feature classes in the geodatabase had a FacilityID populated using a concatenation of letters (“SS” for sanitary sewer, “SD” for storm drainage) plus the CAD Handle. This character string provided the required unique ID for each feature in the geodatabase.
After a couple years of using the above referenced FacilityID system, the FacilityID was replaced with the all numeric manhole #'s and for mainlines, the all numeric upstream manhole number and all numeric downstream manhole #. This way, depending on whether staff or contractors are using the older or newer version of the underground map book, the segments can be cross-referenced.

- **LOCATION** – A Cityworks required field (100 characters). This field is populated with an associated address or nearest address/intersection.

- **CONDITION & CONDITIONDATE** – Cityworks required fields (30 characters & a date field). This field is populated with the overall condition index rating following a thorough CCTV inspection of a mainline or inspection of a manhole (utilizing the NASSCO coding systems) along with the date on which the inspection was performed.

- **WARRANTYDATE** - A Cityworks required field (date field). This field is populated when new assets are installed and have manufacture warranty periods.

**B Map Update and Maintenance Procedures**

Keeping the sewer collection system maps up to date is an ongoing effort with all modifications coordinated through the Engineering Technician assigned to the Asset Management Project Manager. The following routine actions are part of the program.

- Field personnel note any discrepancies or errors on field maps. These mark ups are submitted to the Engineering Technician and Project Manager for verification and map updates. The master underground utilities AutoCAD map is modified and updated underground utilities map book pages are distributed. AutoCAD updates are transferred to the GIS system, attribute information is updated and associated maps (Sewer Cleaning District Maps, etc.) are re-printed reflecting new information.

  With the purchase of POSM CCTV inspection software in 2012, the Project Manager is able to more effectively identify and correct inaccuracies in the electronic versions of the sewer collection system as manholes are found and mainline lengths verified through CCTV.

- In-house AutoCAD (CAD) drawings for all capital improvement and system rehabilitation projects are sent to the Engineering Technician as part of project close-out. The master underground utilities AutoCAD map is modified and updated underground utilities map book pages are distributed. Project Manager transfers the AutoCAD updates into the GIS system and updates GIS layer attribute information. Associated maps (Sewer Cleaning District Maps, etc.) are re-printed reflecting new information and capital improvement details are entered in the Cityworks CMMS system.
Developers submit “as-builts” of final sewer system construction to the City Engineer. These mark ups are submitted to the Engineering Technician for map updates. The master underground utilities AutoCAD map is modified and updated underground utilities map book pages are distributed. AutoCAD updates are transferred to the GIS system, attribute information is updated and associated maps (Sewer Cleaning District Maps, etc.) are re-printed reflecting new information. Improvement details are entered in the Cityworks CMMS system.

**CAD STANDARDS**

To ensure that all plan information, both generated within the Department and developed by consultants or private owners can be seamlessly incorporated into electronic maps, staff developed a set of AutoCAD standards. The standards condition AutoCAD work to be performed utilizing a copy of the AutoCAD project file “legend.dwg.” This drawing file and associated plot style table files contain standardized map layer attributes, legend, and title blocks for submitting project plans & profiles. The CAD Standards document can be found in SSMP Appendix 4.1.

The Engineering Technician performing edits to the master AutoCAD underground utility map files (e.g. the Sewer.dwg file located in the Q:\PW\PWENG\MASTER CAD folder) should always follow the editing rules listed below. These rules facilitate the transition of edits into the GIS sewer layer files.

**ALTER** – When a feature is spatially altered in CAD, e.g. a pipeline is spatially relocated, the CAD operator should edit the existing feature element, adjusting it while keeping its original CAD Handle.

**ADD** – When a new feature is added to a CAD sewer file, the feature is given a new unique CAD Handle. It is useful to provide maps of new sewer features to the GIS operator displaying the annotation text information that will need to be entered into the GIS attribute fields.

**DELETE** – Prior to deleting features from a CAD sewer file, it is useful to provide maps of the features to the GIS operator displaying the CAD handle with a notation as to why the feature is being removed.

**STANDARD RULES** – All sewer pipes need to be individual line segments and have two end points snapped at each end of the line segment. Pipes can not extend through any one manhole. If a pipe is stubbed, the end of the line segment shall have a point snapped to it with a layer name of “SS-MH-NO.” If a pipe segment extends far enough that it may warrant a manhole to be installed at the end of the pipe, it shall have a point snapped to the end with a layer name of “SS-MH-FUTURE.”
4.2 PREVENTATIVE OPERATIONS AND MAINTENANCE

4.2.A Overview

The Environmental Services Division Sewer Operations and Maintenance Section (Sewer Maintenance) has developed several maintenance approaches for the sewer collection system. Citywide mainline cleanings, ongoing preventative maintenance of problem areas, use of closed circuit camera inspections (CCTV) of mainlines, along with coordination with sewer engineering efforts and activities to minimize FOG entering the collection system all support the goals and objectives of Sewer Maintenance.

Sewer Maintenance is responsible for these collection system management goals:

1. Proper maintenance, operations and management of all parts of the wastewater collection system.
2. Provision of adequate capacity in the collection system to convey peak flows.
3. Minimize the frequency of sanitary sewer overflows (SSOs).
4. Mitigate the impact of SSOs.

Objectives of Sewer Maintenance Preventative Maintenance Program include:

1. Increase Preventative Maintenance on the collection system to decrease SSOs.
   a. Clean all sewer mainlines of sewer districts within the identified required maintenance period.
   b. Continue with monthly, quarterly, bi-annual and annual preventative maintenance hydro-cleaning and power-rod cleaning of identified sewer mainline target (problem) areas.
   c. Conduct a video condition assessment of each sewer mainline every five years.
   d. Maintain Root Control Program and root-foam one of the identified two areas impacted by roots every other year (182,987 L.F. during odd years, 313,044 L.F. during even years).
   e. Refer mainlines with repeat non-scheduled maintenance to sewer engineering for evaluation.
   f. Conduct appropriate analysis/evaluation of SSOs utilizing historical maintenance and activity data and records and provide recommendations to reduce future risk.
2. Identify collection system blockages due to fats, oil and grease (FOG) and develop strategies to decrease backups.
3. Operate all pumpstations at peak efficiency and perform preventative maintenance on equipment at all sanitary sewer pumpstations.
4. Maintain records of the sanitary sewer system and respond to inquiries.

5. Assist with the development of a capital improvement program directed at maintaining the current sewer assets, improving system reliability and providing adequate future capacity.

Tables listing the equipment and personnel dedicated to maintenance of the sewer collection system can be found in Appendix 4.8.

4.2.B CITYWIDE SEWER DISTRICT CLEANING

One goal of the Sewer Division is to clean each and every sewer mainline within an identified required time period. A system was developed to send crews out for mainline cleaning in the most effective way, to track these efforts and document the problems found in the system.

The Sewer Division divided the collection system into five major sewer basins and then further divided into subbasins that identify how pipe networks converge into trunk lines and flow is carried to the wastewater treatment plant.

Subbasins were then further divided into “cleaning areas.” Cleaning areas are logical boundaries identifying small areas of the collection system that can be cleaned within a few days. The maps also follow flow so that crews can clean outlying pipes and work down as mainlines converge into trunk lines.

These basin, subbasin and cleaning areas boundaries were created in a GIS program and are currently GIS layers.
Individual cleaning area maps are utilized to manage crew activities and ensure proper and thorough mainline cleaning. These maps provide space for crews to note the dates, time spent, vehicles used, type of cleaning performed (jet, powerrod, hydrosaw, etc.) and the names of the operators as well as document the problem found in each pipe segment.

Staff studied the overall collection system basin map, terrain of the city and utilized crew knowledge and the history of calls logged in the asset management/computerized maintenance management system (Azteca’s Cityworks software), to develop a cleaning frequency for each collection system sub-basin.

**2011 PROGRAM UPDATES**

In 2011, sewer maintenance crews (crews) incorporated cleaning of larger pipes into the preventative maintenance program. Staff realized that contracted close-circuit television inspection (CCTV)/pipe assessment and condition projects (PACP) up through 2009 did not include sewer mainlines 14” to 21” in diameter. Further, crews did not traditionally clean pipes in this size range either, resulting in over 14 miles of sewer pipe that had not been thoroughly cleaned in at least a decade. Crews purchased and were trained on using necessary equipment to take on cleaning of these larger lines. During 2011, in addition to cleaning districts citywide, crews cleaned all pipes with diameters of 14” to 21”.

A special large diameter pipe cleaning and CCTV contract was completed in 2011 for pipes 24 inches and larger. Future contracted Clean and CCTV projects will include all...
pipes up to and including 21” so they receive proper condition assessment every five years. Pipes larger than 21” will be contracted out for cleaning and pipe condition assessment at least every five years.

4.2.C TARGET CLEANING OF PROBLEM AREAS

The Sewer Division has an aggressive preventative maintenance (PM) program for identified problem areas (“hot-spots”) of the sewer collection system. Sewer mainlines that tend to have frequent blockages caused by hardened FOG, root intrusion, poor grade or sags are referred to as sewer “hot-spots.” The list of hot-spot problem areas (target areas) was developed over the years through historical knowledge and experience of operators, tracking locations of repeat sewer blockages and surcharges using our CMMS, and through closed-circuit television inspection (CCTV) findings. Hot-spot sewer mainlines are put on a monthly, quarterly or bi-annual preventive maintenance cleaning schedule. This list is continually updated as new target areas are identified.

The Sewer Division meet annually, or more often if necessary, to evaluate the effectiveness of certain types of cleanings, discuss whether the frequency of cleaning is appropriate at each location and identify if other problem areas have surfaced that should be added to the PM list.

Crews are able to evaluate the effectiveness of PM cleaning and increase or decrease the length of time between cleanings based on field knowledge and experience as well as with the assistance of closed circuit television inspections (CCTV).

After CCTV, if it is determined that rehabilitation or replacement of the line may be necessary, or may present an opportunity to remove this are from the PM list, sewer engineering staff are notified. At this point, engineering will evaluate findings in the pipe and handle the rehabilitation or replacement if necessary. Hot-spots will remain on a preventative maintenance schedule until subsequent observations determine that the potential for obstruction or blockage has been reduced or eliminated.

The preventative maintenance schedule and list of target areas, as well as a map depicting hot-spot locations, is attached as SSMP Appendix 4.7.

4.2.D CLEANING PROCEDURES

Sewer Maintenance staff are trained on proper line-cleaning procedures. Various cleaning methods are used to ensure thorough cleaning of sewer mainlines, including hydrojet, hydrosaw, handrod, powerrod, and flail. Standard operating procedures for sewer mainline cleaning and related safe practices are attached as SSMP Appendix 4.3.
4.2.E  COLLECTION SYSTEM PERFORMANCE

Objectives of preventative maintenance activities include the decrease in sewer mainline blockages and SSOs. Performance indicators are useful in assessing the effectiveness of these activities.

Table 4.2.E.i reflects sewer maintenance performance measurements for the last four fiscal years along with comparisons to the average performance of sewer agencies reported in the American Society of Civil Engineers (ASCE) 1999 document, “Optimization of Collection system Maintenance Frequencies and System Performance,” and Water and Environment Research Foundation (WERF) 2003 document, “Effective Practices for Sanitary Sewer Collection System Operations and Maintenance.”

Table 4.2.E.i  Sewer Maintenance Performance Indicators

<table>
<thead>
<tr>
<th>FISCAL YEAR</th>
<th># Wet Weather SSOs</th>
<th># Dry Weather SSOs</th>
<th>Total # SSOs</th>
<th># Dry Weather Blockages</th>
<th># Emergency Sewer Calls (lats &amp; mains)</th>
<th>% Meet 2hr response to Sewer Emerg.</th>
<th># Odor Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY05-06 total</td>
<td>7 (CAT1) 0 (CAT2)</td>
<td>5 (CAT1) 13 (CAT2)</td>
<td>25</td>
<td>223</td>
<td>2,022</td>
<td>97.1%</td>
<td>15</td>
</tr>
<tr>
<td>FY06-07 total</td>
<td>0 (CAT1) 1 (CAT2)</td>
<td>5 (CAT1) 15 (CAT2)</td>
<td>21</td>
<td>252</td>
<td>1,819</td>
<td>98%</td>
<td>15</td>
</tr>
<tr>
<td>FY07-08 total</td>
<td>31 (CAT1) 0 (CAT2)</td>
<td>8 (CAT1) 17 (CAT2)</td>
<td>56</td>
<td>245</td>
<td>1,953</td>
<td>97%</td>
<td>10</td>
</tr>
<tr>
<td>FY08-09 total</td>
<td>7 (CAT1) 0 (CAT2)</td>
<td>19 (CAT1) 32 (CAT2)</td>
<td>58</td>
<td>184</td>
<td>1,609</td>
<td>96%</td>
<td>15</td>
</tr>
<tr>
<td>FY09-10 total</td>
<td>11 (CAT1) 2 (CAT2)</td>
<td>10 (CAT1) 36 (CAT2)</td>
<td>59</td>
<td>98</td>
<td>1,222</td>
<td>94%</td>
<td>16</td>
</tr>
<tr>
<td>FY10-11 total</td>
<td>14 (CAT1) 1 (CAT2)</td>
<td>7 (CAT1) 28 (CAT2)</td>
<td>50</td>
<td>86</td>
<td>1,002</td>
<td>95.5%</td>
<td>25</td>
</tr>
<tr>
<td>FY05-06 per 100 mile/yr</td>
<td>3</td>
<td>7.6</td>
<td>10.6</td>
<td>94</td>
<td>857</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>FY06-07 per 100 mile/yr</td>
<td>0.4</td>
<td>8.5</td>
<td>8.9</td>
<td>107</td>
<td>770</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>FY07-08 per 100 mile/yr</td>
<td>13</td>
<td>10.6</td>
<td>23.6</td>
<td>104</td>
<td>828</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>FY08-09 per 100 mile/yr</td>
<td>3</td>
<td>21.6</td>
<td>24.6</td>
<td>78</td>
<td>682</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>FY09-10 per 100 mile/yr</td>
<td>5.5</td>
<td>19.5</td>
<td>25</td>
<td>42</td>
<td>518</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>FY10-11 per 100 mile/yr</td>
<td>6.4</td>
<td>14.8</td>
<td>21.2</td>
<td>37</td>
<td>424.5</td>
<td>-</td>
<td>10.6</td>
</tr>
<tr>
<td>WERF/100mi/yr</td>
<td>2+</td>
<td>2</td>
<td>-</td>
<td>16</td>
<td>179</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ASCE/100mi/yr</td>
<td>4.5</td>
<td>4.5</td>
<td>-</td>
<td>13</td>
<td>400</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Refer to Exhibits 9.3.A, 9.3.B, 9.3.C, and 9.3.D under Element 9, Monitoring, Measurement and Performance Indicators for data recorded by calendar year and for
4.3 REHABILITATION AND REPLACEMENT PLAN

4.3.A. Condition Assessment and Inspection

The Environmental Services Division has a goal of conducting a video condition assessment of each sewer mainline every five years. A five year period was selected to provide sufficient information to trend the condition of the lines and schedule repairs prior to failure.

The CCTV inspection is performed by contracted services. Information from the CCTV inspection is documented in Azteca and is utilized in prioritizing annual mainline repair projects. To provide consistency in data collection, review of pipe conditions and better understanding of the collection system, the Environmental Services Division developed a standard operating procedures manual for CCTV inspections along with standardized rating system (SSMP Appendix 4.3). The CCTV inspection will identify any lines that need a follow-up inspection in less than five years.

In addition to the programmed area for condition assessment, the following locations are added to the annual CCTV program:

- Lines with more than three service requests within the past year
- Lines under roadway scheduled for rehabilitation
- Lines identified by field personnel as problem locations

These added lines are re-inspected irrespective of the date of a previous CCTV inspection to ensure we have up-to-date information on problem lines. Ongoing collaboration between Sewer Maintenance and Engineering staff ensure CCTV projects identify an inclusive list of pipes and rehabilitation efforts are suitably prioritized.

In 2012, staff identified locations of sewers that crossed waterways (whether private laterals or public sewer mainlines). Quarterly inspection work orders are generated for crews to inspect the condition of these pipes and report problematic conditions to a PW Supervisor. These locations and work orders for this program can be found with the PM Hot-Spots PM Program and work orders in Appendix Section 4.7.

4.3.B. Prioritization of Repair and Rehabilitation

The City dedicates approximately 2% of the valuation of the collection system for annual rehabilitation and repair. This funding is in addition to any major line replacement or pumpstation upgrades identified in the five year capital improvement programs. The funding has been established to make prioritized line repairs identified in the annual CCTV condition assessment of the collection system. This program prioritizes the repair of structural defects to ensure the system can consistently provide service and also
prioritizes repair of defects such as protruding taps and roots that cause backups and SSOs.

4.3.C. Five Year and Two Year Rehabilitation and Replacement Program

The City has a two-year business plan (Budget) that includes a Five-Year Capital Improvement Program (CIP). The approved Five-Year CIP can be found in the Appendix Section 2.1 (Budget).

Individual CIP projects run cradle-to-grave and therefore can begin before and continue beyond the budget cycle. The Five-Year CIP will only identify funds being newly allocated to the existing project. The primary CIP project targeted at ongoing rehabilitation of the collection system is project #469913, Citywide Sanitary Sewer Rehabilitation. This program receives funds annually from sewer use fees. The funds in project #469913 are used for spot-repair, slip-lining or full-line replacement. Repair projects are identified as described in 4.3.B above.

Table 4.3.C.1 Total Expenditures on Sewer Repair and Rehabilitation Projects by FY

<table>
<thead>
<tr>
<th>FISCAL YEAR (FY)</th>
<th>TOTAL EXPENDITURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY10-11</td>
<td>$1,382,148.79</td>
</tr>
<tr>
<td>FY09-10</td>
<td>$1,334,603.84</td>
</tr>
<tr>
<td>FY08-09</td>
<td>$1,452,425.80</td>
</tr>
<tr>
<td>FY07-08</td>
<td>$1,154,108.10</td>
</tr>
<tr>
<td>FY06-07</td>
<td>$1,094,186.71</td>
</tr>
<tr>
<td>FY05-06</td>
<td>$1,102,939.31</td>
</tr>
<tr>
<td>FY04-05</td>
<td>$1,328,919.71</td>
</tr>
<tr>
<td>FY03-04</td>
<td>$1,721,807.70</td>
</tr>
<tr>
<td>FY02-03</td>
<td>$919,898.21</td>
</tr>
<tr>
<td>FY01-02</td>
<td>$1,309,385.85</td>
</tr>
<tr>
<td>FY00-01</td>
<td>$1,123,652.65</td>
</tr>
<tr>
<td>FY99-00</td>
<td>$495,851.23</td>
</tr>
<tr>
<td>FY98-99</td>
<td>$579,346.06</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>$14,999,273.96</td>
</tr>
</tbody>
</table>

Managing the annual capital investment in sanitary sewer rehabilitation, inflow/infiltration improvements and capacity upgrades (Sewer CIP) requires long-term conceptual planning. Although this planning document is not officially approved by the City Council, it identifies probable long-term financial needs and targets future projects and is used to develop sewer rates and plan for the issuance of necessary bonds. Table 3 of the Bartles & Wells Associates May 6, 2009 Sewer Rate Study & Financing Plan Update (found in Appendix 3.2 Sewer Fees), identifies the CIP anticipated expenditures. This chart identifies an ongoing commitment of funds for inflow and infiltration reduction in addition to significant funding identified for the capacity relief sewer projects.
4.4 PUMPSTATION MAINTENANCE

The pump crew, two Pump Mechanic II staff positions, is in charge of the operations and maintenance of the twenty-five sewage pumping stations (pumpstations). The Dale Avenue Pumpstation is operated by the wastewater treatment plant and maintained by the pump crew.

Of the twenty-five pumpstations, all have pumps that alternate automatically and there are no lead / lag pumps. Wet well operations are set to limit pump starts and stops and in-line storage of wet weather flows occurs automatically. Power outages occur infrequently and average about eight a year. Three portable generators (exercised under load annually) are assigned specifically to the pump crew for use in power outage situations.

Pumpstations are thoroughly inspected quarterly (Dale avenue is inspected daily) as part of the sewer maintenance pumpstation preventative maintenance program. Work activities are developed and prioritized based on these inspections and completed prior to the next inspection.

Preventative maintenance inspections cover the following:

<table>
<thead>
<tr>
<th>LUBRICATION</th>
<th>INSPECTION</th>
<th>LEAK CHECKS</th>
<th>EXERCISE</th>
<th>HOUSEKEEPING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motors</td>
<td>Sump Pumps</td>
<td>Fuel/Oil lines</td>
<td>Motors</td>
<td>Clean Interior</td>
</tr>
<tr>
<td>Main Pumps</td>
<td>Belts</td>
<td>Valves</td>
<td>Valves</td>
<td>Clean Exterior</td>
</tr>
<tr>
<td>Drive Shafts</td>
<td>Flap Gates</td>
<td>Packing</td>
<td></td>
<td>Leaf/debris pickup</td>
</tr>
<tr>
<td>Valves</td>
<td>Backflow Preventors</td>
<td>Seals</td>
<td></td>
<td>Purge Air Systems</td>
</tr>
<tr>
<td>Locks &amp; Padlocks</td>
<td>Controls/Alarms</td>
<td>Lubricators</td>
<td></td>
<td>Wash Down Grit</td>
</tr>
<tr>
<td>Latches &amp; Hinges</td>
<td>Wet Well</td>
<td>Air Systems</td>
<td></td>
<td>Chamber</td>
</tr>
<tr>
<td></td>
<td>Exhaust Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where appropriate, the pump crew forwards to engineering recommendations for major rehabilitation or formal engineering inspection of specific stations as a standard part of the preventative maintenance program.

The pump crew utilizes a SCADA system to monitor pump run-times. Alarms sent to the pump crew include, but are not limited to: high and low wet well levels, pump overload, dry pit flooding, and power failure.

4.5 SEWER MAINTENANCE STAFF TRAINING

City of San Mateo Sewer Maintenance staff is required to complete various types of training as listed below in Table 4.5.1. Maintenance staff is encouraged to study, prepare for and take CWEA Certification testing. Specific training dates for employees can be found in Appendix 4.5 Sewer Crew training.

Table 4.5.1 Sewer Maintenance Staff Training – List of Classes

<table>
<thead>
<tr>
<th>CORE</th>
<th>Customer Service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sexual Harassment</td>
</tr>
<tr>
<td></td>
<td>Cultural Diversity</td>
</tr>
</tbody>
</table>

Last update: 11-14-14
<table>
<thead>
<tr>
<th>CITY OF SAN MATEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBLIC WORKS DEPARTMENT</td>
</tr>
<tr>
<td>ENVIRONMENTAL SERVICES DIVISION</td>
</tr>
<tr>
<td>OPERATIONS AND MAINTENANCE PROGRAM</td>
</tr>
</tbody>
</table>

**Last update:** 11-14-14  
4 - 14  
City of San Mateo SSMP  
Element 4: OPERATIONS AND MAINTENANCE PROGRAM

| Commercial Driver License  
| Injury and Illness Prevention Program  
| CWEA Certifications (optional)  
| Fire Extinguisher |

**EQUIPMENT**  
Mainline Cleaning (Powerrodder, Hydrojet/vac truck, HydroSaw, Flail)  
Chainsaw  
Mobile Crane Truck safe operation  
Forklift  
Mobile Electrical Generators  
Tractor Loader/Backhoe  
Bobcat loader and attachments

**OPERATIONS**  
Fall Protection  
Confined Space  
Lock Out Tag Out/Electrical Safety  
Silica – Concrete Dust Generating Operations  
4 Gas Monitor usage (Detection)  
Excavation safety  
Work Zone safety (Traffic Control)  
USA Locating  
Transit America Services (Cal Train) Railroad Worker Protection  
SSO Prevention  
SPCC  
ICS 100, 200, 700  
STOPPP

**PUMP CREW**  
Electrical training  
SCADA  
Mechanical applications (Pump Repairs)

**EMERGENCY**  
Hazmat  
Emergency Action Plan (Evacuations)  
Sanitary Sewer Overflow Emergency Response Plan (OERP)

**MEDICAL TRAINING**  
Blood Borne Pathogen  
Dehydration / Heat Stroke  
CPR-First Aid- AED
4.6 O&M PROGRAM GOALS: 2007 – 2010

- Compliance with Preventative Maintenance Targets
- Upgrade root removal equipment and improve maintenance program
- Identify City maintained laterals and incorporate into preventative maintenance program
- Identify manholes that have a history of overflowing, or are in locations that cannot be monitored, and install remote sensing devices.
- Develop contingency equipment and replacement part inventory
- Implement training and CWEA certification requirements for collection system maintenance workers.

O&M PROGRAM GOALS: 2011 - 2015

- Implement in-house software for pipe condition assessment storage, retrieval, and analysis of contracted CCTV data.
- Update sewer mainline GIS layer with pipe criticality information.
O & M PROGRAM EXHIBITS

4.1 COLLECTION SYSTEM MAPS AND INFORMATION

4.1.A 4.1.A.i Underground Utilities Map Page
       4.1.A.ii Sewer Pumpstations and Trunklines Map
       4.1.A.iii Sewer Collection System Pipe Sizes
       4.1.A.iv Sewer Collection System Terrain Map
       4.1.A.v Sewer Collection System Basin Map
       4.1.A.vi Sewer Collection System Subbasin Map
       4.1.A.vii Sewer Collection System Cleaning Areas Map
       4.1.A.viii Sewer District Cleaning Schedule Maps

O & M PROGRAM APPENDIX

4.1 AutoCAD Standards
4.2 CCTV Standards
4.3 Sewer Mainline Cleaning Procedures
4.4 Pumpstation Maintenance
4.5 Sewer Maintenance Crew Training
4.6 Manhole Inspection Program
4.7 Targeted Cleaning of Problem Areas “Hot-Spots” & Leak Detection Program
4.8 Sewer Maintenance Dedicated Equipment and Personnel
4.9 2009 to current Annual Cleaning Schedule Maps
## Summary of Pipe Sizes

### Gravity Sewers

<table>
<thead>
<tr>
<th>Pipe Dia. (inch.)</th>
<th>Length (ft)</th>
<th>Length (mi)</th>
<th>% of Active Gravity System by length</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2,609</td>
<td>0.50</td>
<td>0.20%</td>
</tr>
<tr>
<td>6</td>
<td>712,325</td>
<td>135.00</td>
<td>60%</td>
</tr>
<tr>
<td>8</td>
<td>264,841</td>
<td>50.00</td>
<td>22.10%</td>
</tr>
<tr>
<td>10</td>
<td>61,919</td>
<td>11.70</td>
<td>5.20%</td>
</tr>
<tr>
<td>12</td>
<td>35,985</td>
<td>6.83</td>
<td>3%</td>
</tr>
<tr>
<td>14</td>
<td>372</td>
<td>0.07</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>31,908</td>
<td>6.04</td>
<td>2.70%</td>
</tr>
<tr>
<td>18</td>
<td>35,699</td>
<td>6.76</td>
<td>3%</td>
</tr>
<tr>
<td>21</td>
<td>7,162</td>
<td>1.36</td>
<td>0.60%</td>
</tr>
<tr>
<td>24</td>
<td>11,602</td>
<td>2.20</td>
<td>1%</td>
</tr>
<tr>
<td>27</td>
<td>5,304</td>
<td>1.00</td>
<td>0.40%</td>
</tr>
<tr>
<td>30</td>
<td>6,547</td>
<td>1.25</td>
<td>0.60%</td>
</tr>
<tr>
<td>33</td>
<td>4,061</td>
<td>0.80</td>
<td>0.30%</td>
</tr>
<tr>
<td>36</td>
<td>5,904</td>
<td>1.12</td>
<td>0.50%</td>
</tr>
<tr>
<td>39</td>
<td>5,016</td>
<td>0.95</td>
<td>0.40%</td>
</tr>
<tr>
<td>48</td>
<td>117</td>
<td>0.02</td>
<td>-</td>
</tr>
<tr>
<td><strong>SUBTOTAL:</strong></td>
<td><strong>1,191,371</strong></td>
<td><strong>225.6</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

### Force Main

<table>
<thead>
<tr>
<th>Pipe Dia. (inch.)</th>
<th>Length (ft)</th>
<th>Length (mi)</th>
<th>% of Active Force System by length</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1,691</td>
<td>0.32</td>
<td>5%</td>
</tr>
<tr>
<td>6</td>
<td>795</td>
<td>0.15</td>
<td>2.40%</td>
</tr>
<tr>
<td>8</td>
<td>2,962</td>
<td>0.6</td>
<td>9.70%</td>
</tr>
<tr>
<td>10</td>
<td>5,572</td>
<td>1</td>
<td>16%</td>
</tr>
<tr>
<td>12</td>
<td>2,283</td>
<td>0.43</td>
<td>7%</td>
</tr>
<tr>
<td>14</td>
<td>7,493</td>
<td>1.4</td>
<td>22.60%</td>
</tr>
<tr>
<td>21</td>
<td>4,118</td>
<td>0.8</td>
<td>12.90%</td>
</tr>
<tr>
<td>30</td>
<td>4,797</td>
<td>0.9</td>
<td>14.50%</td>
</tr>
<tr>
<td>33</td>
<td>2,521</td>
<td>0.5</td>
<td>8%</td>
</tr>
<tr>
<td>36</td>
<td>548</td>
<td>0.1</td>
<td>1.60%</td>
</tr>
<tr>
<td><strong>SUBTOTAL:</strong></td>
<td><strong>32,777</strong></td>
<td><strong>6.2</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

### 54" Force Outfall

- Abandoned Gravity: 10,062 ft (1.9mi)
- Abandoned Forcemain: 2,826 ft (0.5mi)