1.1 BACKGROUND INFORMATION

The purpose of this Section is to provide the Operator with an overview and general understanding of the City's System(s).

1.1.1 City of Camden

The City of Camden, New Jersey is located in the southwest region of New Jersey, directly across the Delaware River from Philadelphia, Pennsylvania. The 1990 Census population of the City is approximately 87,500. The City provides water service to approximately 54,000 residents as well as commercial, institutional and industrial customers within the portion of the City which comprises the City's water service area which is defined in Section 1.3 and Figure 1-1 of this Schedule 1.

Water is pumped to the City's three treatment plants (Morris-Delair, Parkside and Puchack Run) by 26 existing groundwater wells. All of the City's wells are screened in the Potomac-Raritan-Magothy formation. The Morris-Delair treatment plant is the City's largest treatment facility with a 1960 design capacity of 18 million gallons per day (MGD). The Parkside treatment plant is currently out-of-service and is undergoing substantial renovation. Once completed, the Parkside Water Treatment Plant will have a hydraulic design capacity of three MGD. The well field serving the Puchack Run treatment plant is contaminated with chromium and is currently operated under the direction of New Jersey Department of Environmental Protection (NJDEP) for containment of the chromium plume. The water produced by the Puchack Run treatment plant is currently discharged directly to Puchack Run. The City operates two storage tanks, (five and two million gallons) located within the City limits. A third storage facility, a 0.5 million gallon standpipe located at Whitman Park is not currently operated.

The City provides wastewater collection service to the residential, commercial, institutional and industrial customers located within the City and to approximately 249 customers in Pennsauken Township.

1.2 WATER SYSTEM

The City owns and operates a water supply and distribution system providing for the residential, commercial, industrial and fire protection needs of the residents. Water service is provided for all portions of the City except the area north of the Cooper River. The water service area comprises about six square miles and is shown in Figure 1-1 herein. The Water System serves an estimated 54,000 residents out of a City population of approximately 87,500 (1990 Census), plus industrial, institutional and commercial water users. A total of approximately 13,000 customers use the Water System. In addition, 1,255 fire hydrants serve as the primary source of water supply for fire protection in the Water System's service area.

Adjacent water service districts include:

- New Jersey American Water Company
- Merchantville-Pennsauken Water Commission
- Collingswood Water Department
- Gloucester City Water Department

The City of Camden Department of Utilities staff is responsible for maintaining all parts of the Water System asset, including groundwater supply wells, treatment plants, and the distribution and storage system.

The balance of this section is a summary of the City's Well Fields, treatment plants, distribution and storage systems.

1.2.1 Well Field Description

The City has permits for 26 water supply wells, 24 of these water supply wells are existing. Two wells, Morris Well Nos. 14 and 15 are proposed. Of the 24 existing wells, the City operates 17 wells on a normal basis. Six other permitted wells are currently out of service due to poor water quality or low well production. Two permitted wells are maintained for emergency use only and one permitted well is out of service due to a lack of service piping. The City's wells are primarily located in four well fields: Morris, Delair, Puchack, and Parkside. Two additional wells, Well No. 7 and Well No. 11 are located at Jefferson and 9th Streets and Bulson and 9th streets in the City, respectively. The location of each well at the Morris, Delair, and Puchack Well Fields is shown in Figure 1-2, and the locations of the Parkside and two City wells are shown in Figure 1-3.

1.2.1.1 Morris-Delair Well Field

The Morris Well Field is located adjacent to the Delaware River and is approximately 95 acres. The Morris Well Field is commonly identified as either the Morris North or the Morris South Well Field. This designation is not based on geographic location, but rather on the electric services and water main to which the wells are connected. The Morris North Well Field contains six permitted wells (Well Nos. 1, 2, 3, 4, 12 and 13). Of these six wells, only Well No. 2 is not operational due to lack of service piping, low production and lack of wellhouse.

The Morris South Well Field contains six existing and two proposed permitted wells. The existing wells are Nos. 6, 7, 8, 9, 10, 11 and proposed wells 14 and 15. With the exception of Well Nos. 6 and 9 which are out of service due to a low rate of production, all existing wells in the Morris South Well Field are operational.

The Delair Well Field is located just south of the Betsy Ross Bridge and occupies approximately 15 acres. The Delair Well Field contains three permitted wells. The permitted wells are Well Nos. 1, 2 and 3. All three wells are operational. Therefore, of the 17 permitted wells located in the Morris and Delair Well Fields, 12 wells (five

wells at Morris North, four wells at Morris South and three wells at Delair) are currently operated on a daily basis.

Operational Concerns
The Morris and Delair Well Fields are collectively referred to as the Morris-Delair Well Field. Operational and maintenance issues that currently exist in the Morris-Delair Well Field include but are not limited to:

- Security Needs - These well fields are accessible by trespassers and are used by dirt bikes. Vandalism risks must be dealt with.

- Raw Water Pipelines - The raw water transmission line extending to Morris Well No. 2 is absent, and in general, existing transmission pipelines are subject to tuberculation and leakage.

- Well Rehabilitation - Due to the age and physical condition of some of the wells, a rehabilitation program must be addressed. Production rates for many of the wells has decreased and efforts to increase well production have had limited success.

- Flooding and Wetlands Issues - Due to the proximity of the Morris-Delair Well Field to the Delaware River, wellheads of two wells in Delair Well Field and one well in the Morris North Well Fields subject to high water levels. Raising of the wellheads of those wells that are in danger of or experiencing flooding will be necessary. In addition, a significant portion of the City's Morris-Delair Well Field is within or adjacent to wetlands. The City's two proposed wells are within or adjacent to wetlands which must be addressed appropriately.

1.2.1.2 Puchack Well Field

The Puchack Well Field is located southeast of the Morris and Delair Well Fields, approximately 2,000 feet southeast of the Delaware River. Groundwater from the Puchack Well Field is reported to be contaminated with hexavalent chromium. The Puchack Well Field contains six permitted wells. The permitted wells are Nos. 1, 2, 3, 5, 6 and 7. Of the six permitted wells, only Well No. 1 is operational. The pumps and motors from three of the four non-operational wells have been removed. Well No. 1 is operated at the direction of NJDEP to contain the chromium plume and as of late 1997, is currently discharged directly to Puchack Run and bypasses the treatment plant.

Upon completion of a new Puchack Run Treatment Plant, contingent upon State funding, the wells are to be rehabilitated and new or re-built pumps are to be installed.

1.2.1.3 Parkside Well Field

The Parkside Well Field is located within the City limits approximately four miles to the southwest of the Puchack Well Field. The Parkside Well Field contains three permitted wells (Well Nos. 13, 17 and 18).

Operational Issues
Due to volatile organic compound contamination, only Well Nos. 17 and 18 will be operated on a normal basis. Well No. 13 has not been in service for several years and in addition, a segment of the raw water piping leading to the Parkside treatment plant has been removed. Parkside Wells Nos. 17 and 18 are currently operational.

1.2.1.4 Other City Wells

In addition to the Parkside wells, the City operates two other wells within the City limits. Well No. 7 is dedicated to supplying process water to the Camden County Resource Recovery Facility (approximately 0.8 MGD) and Well No. 11 is used for emergency water supply. Well No. 11 is disinfected at the well head at discharged directly to the distribution system. Use of Well No. 11 is minimized in conformance with the City's corrosion control strategy due to the corrosive nature of this supply. It is the City's practice to operate City Well No. 11 only if sufficient system pressures can not be maintained using the Morris-Delair, Puchack and Parkside Well Fields operable wells.

1.2.2 Water Production

A summary of the permitted capacity, 1996 pumping capacity and original yield for each permitted well is provided in Table 1-1. The water production data for each well presented in Table 1-1 is not based on information from meters, but rather on flow tests and the number of hours of operation for each well.

1.2.3 Water Allocation Permit

The City operates its Water System under Water Allocation Permit No. 5302 (expires December 31, 1998). In accordance with the Water Allocation Permit, the total permitted diversion from the sources identified in Table 1-1 shall not exceed 664 million gallons per month at a rate of 30,000 gpm and shall not exceed 6,928 million gallons per year. The total diversion from City Well Nos. 7 and 11, Parkside Well Nos. 13, 17 and 18 and Puchack Well Nos. 1, 2, 3, 5, 6 and 7 shall not exceed 2,117.343 million gallons per year. The base allocation, if withdrawn at a constant daily rate, represents an average withdrawal rate of approximately 5.8 MGD for the combined total withdrawal from the Puchack Run and Parkside Well Fields and City Wells. The planned Puchack Run Plant may operate partially or fully under a separate permit.

A summary of significant permit requirements is provided in Table 1-2. It should be noted that Table 1-2 is not a complete list of the permit requirements. A complete listing of all permit requirements is provided in Water Allocation Permit No. 5302 and is available for review at the City's Repository.

Included in the Water Allocation Permit are requirements to continue the abandoned well sealing program initiated in 1995 and implementation of the Water Conservation and Drought Management Plan adopted by the City. It is believed that many of the approximately 230 improperly abandoned wells that have been identified in the Water System are located within the Morris-Delair Well Field. Of the 230 such wells, 40 have been located and sealed, approximately 30 have been located and require sealing, and the remaining 160 have yet to be located.

1.2.4 Interconnections

The City of Camden Department of Utilities has established emergency connections with each of the following adjacent water service districts:

New Jersey American Water Company (East Camden and Cramer Hill)
Merchantville-Pennsauken Water Commission
Collingswood Water Department
Gloucester City Water Department (interconnection currently out of service)

The condition and operating status of these interconnections has not been determined.

1.2.5 Treatment Plants

Major water treatment plants in the Water System include the Morris-Delair and Puchack Run Water Treatment Plants (Morris-Delair and Puchack Run respectively) in Pennsauken, New Jersey, and the Parkside Water Treatment Plant (Parkside) in the City. These three treatment plants were constructed in the late 1950s and early 1960s. A summary of the 1996 and 1997 (first three quarters) average and maximum day production for each of the three treatment plants and for City Well Nos. 7 and 11 production is provided in Table 1-3. It should be noted that the 1996 average and maximum day production includes the bulk sale of water, up to five MG, to the New Jersey American Water Company (NJAWC). The bulk sale of water to NJAWC was discontinued in the third quarter of 1996. The figures presented in Table 1-3 are based on treatment plant and City Well discharge flow metering data. Discharge flow metering data were not compared to available raw water metering data. However, the City has reported significant differences between its raw water flow metering data and its discharge flow metering data.

As previously noted City Well No. 7 is dedicated for use by the Camden County resource Recovery System. City Well No. 7 is not currently connected to the distribution system. City Well No. 11 is reserved for emergency use only. The Parkside Water Treatment Plant was taken out of service in June 1996 for renovation.

Renovations to this treatment plant should be complete 1 in 1998. The Puchack Run Water Treatment Plant is currently out of service due to chromium contamination All water produced by the Puchack Run Water Treatment Plant is discharged directly to Puchack Run.

The information presented in the following sub-sections is a summary of information compiled in 1995 in support of the City's Comprehensive Water System Management Study This information has not been updated and may not reflect current operating conditions. This information is not intended to provide a comprehensive review of treatment system, operations or maintenance activities

1.2.5.1 Morris-Delair Treatment Plant

Morris-Delair was constructed in 1960 with a design capacity of 18 MGD based on then current regulations. With the exception of iron and manganese, the source water for this facility is considered to be of good quality. The treatment plant is equipped with aeration, chemical addition, flocculation, clarification, disinfection, and pressure filtration systems, which allow it to meet the federal and State primary maximum contaminant levels (MCLs) and to generally meet secondary MCLs for iron and manganese Typical average daily flow through Morris-Delair in 1996 and the first nine months of 1997 ranged between 9.8 and 12 8 MGD. A schematic of existing treatment processes at Morris-Delair is presented in Figure 1-4.

Plant Operations

Water is provided to Morris-Delair by groundwater wells located in the Morris and Delair Well Fields. All of the wells are screened in the Potomac-Raritan-Magothy aquifer Under normal operating conditions, the wells having the lowest iron concentrations are placed into production before the wells having the higher iron concentrations, such as Morris Well Nos 3, 4, and 10. As demand increases, the wells with the lowest iron levels are placed into service. In general, however, the City uses all of its available wells to meet demand. A current goal is to sufficiently rehabilitate wells and add new wells to allow for several wells to be maintained in reserve for emergency, high flow demand and scheduled maintenance of wells

The Morris-Delair Water Treatment Plant utilizes instrumentation to monitor system pressure, storage tank levels, and chlorine leaks The facility is also equipped with an emergency generator (diesel) which in capable of supporting approximately two-thirds of the treatment plant and well demand in the event of power outages.

A description of each treatment process is provided in the following paragraphs.

Aeration

The existing treatment plant utilizes eight 3.6-MGD capacity aerators to remove carbon dioxide and assist in the oxidation of iron. The aerators are arranged in two banks, one bank of three and one bank of five The bank of three aerators was installed in 1981, and the remaining five were rebuilt in the same year.

Each of the aerators is equipped with a manually operated valve that can be used to divert flow to the other units and prevent overflow No feedback controls are available to automatically distribute the flow evenly between the units or to shut down units during periods of low flow The City has installed flow meters on the influent line of each of the aerators.

Rapid Mixing

Water from the bank of five aeration units is discharged to a mixing channel located adjacent to the aerators. It is reported that mixing in this channel is inadequate A flash mixing basin equipped with a 5 hp mixer was constructed in 1979 and receives flow from the bank of three aerators. This basin is equipped for lime and chlorine addition Current chemical addition to the rapid mixers consists of lime and a non-ionic polymer. Lime dosage is determined by plant personnel and is based on flocculator pH measurements and iron concentration.

Flocculation

Water from the mixing channel and mixing basin is combined in a central conduit and discharges to two 32,000-gallon, vertical-shaft, paddle-type flocculators. The existing flocculation system provides approximately 7 7 and 5 1 minutes of detention time at average and design flows of 12 and 18 MGD, respectively A second mixing and reaction zone exists in the center compartment of each solids contact-type clarifier. The values of 7.7 and 5 1 minutes are below the New Jersey Department of Environmental Protection (NJDEP) minimum required flocculation time of 10 minutes for iron removal treatment plants using solids contact clarifiers (NJAC 7:10-11.11) At average (12 MGD) and design (18 MGD) flows, the water velocities through the flocculation basins are approximately 2 4 and 3 6 feet per minute (fpm), respectively Although NJDEP has no requirements for this parameter, Ten State Standards (section 4.1 3d) recommends a flow through velocity of 0.5 to 1 5 fpm to minimize the potential for breakup of the light iron floc At a flow through velocity of 1.5 fpm, each of the flocculators would have a capacity of 3.7 MGD. The City's long-term capital improvement plans include addition of flocculation capacity

Clarification

The Morris-Delair Water Treatment Plant has two circular clarifiers. Removal of precipitated solids by gravity settling occurs in the sedimentation zone of the clarifiers At a design flow of 18 MGD, the surface loading rate to the clarifiers exceeds the guidelines of 1 0 gpm/sf in both clarifiers (NJAC 7:10-11.11). It is estimated that the surface loading rate is 1.6 gpm/sf Provided the clarifiers are hydraulically balanced, a flow of about 12 MGD could be accommodated, and still meet the NJDEP surface loading guidelines.

Theoretical calculations of clarifier weir loading at average (12 MGD) and design (18 MGD) flows are approximately 5 8 and 8.7 gallons per minute per linear foot (gpm/lf). (1996 figures) This is well within the NJDEP standard of 10 gpm/lf (NJAC 7:10-11 11).

Each Clarifier is equipped with a mechanical scraper. Underflow from the clarifiers is pumped through two 4-inch lines to a common 4-inch line, which expands to an 8-inch line and discharges to the sludge lagoon located just north of Morris Well No. 10. The sludge pumping system consist of two 7.5 hp centrifugal pumps and one older 5 hp centrifugal pump. The 7.5 hp pumps were installed in 1993 and the 5 hp pump is significantly older.

High Service Pumping

The combined flow from the clarifiers flows by gravity to two wetwells located below the high service pumps. Chlorine and sodium polyphosphates are added to the wetwells. Polyphosphate is added in the wetwells as a sequestrant to prevent manganese dioxide build-up on the pump impellers. Each of the wet wells is serviced by three 125 hp high service pumps rated at 1800 rpm. During normal operation, two pumps operate for each wetwell. The City planned to replace the high service pump motors in 1998.

Filtration

Flow from the high service pumps is pumped to 12 steel pressure filters with anthracite media. The filter loading rate with one filter out of service at the design flow of 18 MGD is 2.5 gpm/sf. This value is well below the NJDEP allowable loading rate of 5 gpm/sf for Class 3 or better waters (NJAC 7:10-11.12). At loading rates of 5.0 gpm/sf the filters are rated for a flow of approximately 36 mgd, with one filter out of service. At present, all 12 filters are operational.

Based on an average plant flow of 12 mgd, the filters typically operate at a loading rate of 1.4 gpm/sf. Three filters are backwashed using system pressure each night. All backwashing is performed manually. During a backwash cycle, two cells are backwashed in sequence. A backwash cycle consists of 7 minutes of backwash for each cell, and 3 minutes of rinse at a loading rate of approximately 6 gpm/sf. During backwashing operations, distribution system pressure decreases dramatically until the backwashing ends. This condition will be improved with the start up of the park side plant on or about July 1998. To minimize the impact on system pressure, backwashes are routinely scheduled at night during low-demand periods. Filter backwash water is discharged to a recycle basin. In the filter backwash basin, backwash solids are settled out and the decant is returned to the rapid mixers at the head of the plant. Solids that settle in the backwash recycle basin are periodically removed and discharged to the sludge lagoon.

Chemical Feed Systems

Lime

In 1995, the City installed two new lime slakers at the Morris-Delair Water Treatment Plant. Installation of these units has improved chemical feed control and reduced the need for operator attention to this process.

Lime dosing is not based on system flow, but rather on flocculator and clarifier pH and iron levels. Operators generally target a finished water iron concentration of less than 0.2 mg/L, and pH of approximately, but not more than 9.0 for corrosion control.

Sodium Polyphosphates

Sodium polyphosphate is added in the wetwells prior to the high service pumps as a sequestrant to prevent manganese accumulation on the impellers of the pumps. Sodium polyphosphate solution is mixed in batches and is fed at a constant rate using a belt driven BIF diaphragm pump. The feed rate of this pump can not be adjusted, and the dosage can only be controlled by varying the concentration of the feed solution.

Chlorine

Chlorine is added as a disinfectant into the wetwells and discharge pipeline of the treatment plant using one of two Advance Chlorinators having feed capacities of 400 lb/day. (Chlorine is also fed on an as-needed basis in the rapid mix basin.) There are two chlorine scales, each capable of holding two one-ton containers. The scales are located in a separate room from the chlorinators. Both the chlorinator and scale room are equipped with a chlorine detection system and an exhaust fan to the atmosphere.

The storage area for spare and empty chlorine containers is located outside. The storage structure consists of a concrete slab and flat roof. Because of regulatory restrictions concerning chlorine storage in a residential area, this storage area is also used to hold chlorine needed at the Puchack Run and Parkside treatment plants. The storage area has the capacity to hold approximately 30 cylinders and 11 one-ton containers.

Cationic Polymer

In an effort to reduce the turbidity of the settled and effluent water from the Morris-Delair Water Treatment Plant, the City has installed a polymer feed system. The liquid cationic polymer is supplied to the Plant in 55-gallon drums and is diluted with water in a 500-gallon tank prior to application. The applied dosage is approximately 1.0 mg/L. Poor performance by this polymer since its addition has prompted the City to evaluate additional polymers for use in the Plant. Jar testing was conducted in early 1997 and resulted in the identification of a granulated, high molecular weight cationic polymer, which was effective at reducing finished turbidity in Plant water.

Disinfection

As indicated in the previous section, chlorine is the disinfectant used at the Morris-Delair Water Treatment Plant. Chlorine is added as a disinfectant into the wetwells and discharge pipeline of the treatment plant using one of two Advance Chlorinators having feed capacities of 400 lb/day. Chlorine is also fed on an as-needed basis to the rapid mix basin.

Solids Handling and Residual Disposal

The Solids Handling and Residual Disposal System includes sludge collection pipeline, pumps, transmission pipelines and residuals lagoon. Clarifier underflow is discharged into a residuals lagoon located north of the Morris-Delair Water Treatment Plant approximately 100 ft from Morris Well No. 10. This lagoon is unlined and has no overflow; the slurry is dewatered through a combination of draining through the lagoon bottom and evaporation.

The residuals lagoon is utilizing only a small portion of the available capacity. A backhoe is used to clear the residuals from the area of the pipe discharge.

In addition to the clarifier underflow, accumulated solids from the filter backwash recycle basin are discharged to the sludge lagoon. The decant from the filter backwash recycle basin is pumped to the mixing facilities at the head of the plant.

The residuals lagoon is operated in accordance with the New Jersey Pollutant Discharge Elimination System Discharge to Ground Water (NJPDES-DGW) No NJ0101991

1.2.5.2 Puchack Treatment Plant

The Puchack Run Water Treatment Plant was constructed in 1959 with a design capacity of 6 mgd. As discussed in Section 1.2.1.2, in the years since the Puchack Run Water Treatment Plant was built, the Puchack Well Field has become contaminated with chromium as well as a number of volatile organic contaminants. The City has submitted a 90 percent complete design package for a new Puchack Run Water Treatment Plant to NJDEP for review. The new treatment plant is to have a total capacity of 6 0 mgd and produce 8 mgd of treated water. The 8 mgd capacity includes 2 mgd water supplied by the Morris Well Field, which contains a high concentration of iron. The Morris Well Field water, therefore, will be considered a chemical feed to the new Puchack Run Water Treatment Plant process stream, because its ferrous ion addition will be used for the reduction of hexavalent chromium. Final design of the new Puchack Run Water Treatment Plant has been delayed by the NJDEP (which is funding the project) in order to allow for an investigation of the extent of the chromium plume contaminating the raw water supply.

A schematic of the existing Puchack Run Water Treatment Plant is presented in Figure 1-5. Treatment at the existing Puchack Run Water Treatment Plant consists of aeration for carbon dioxide removal and gas chlorination for disinfection. Carbon dioxide is removed by two slat style aeration towers. The existing facility is not equipped to remove chromium or manganese.

Under the current design, the new Puchack Run treatment process will consist of ferrous ion addition to reduce hexavalent chromium to trivalent chromium as follows: Morris Well Field water would be the primary iron source, with ferrous

sulfate solution as a backup. Four slat style degasifiers will be used to strip out carbon dioxide and some VOCs (Volatile Organic Compounds), and to aid in the oxidation of excess iron. Two rapid mix tanks will be installed. Lime will be added to the rapid mix tanks to raise the pH to 9. Sodium hypochlorite will also be added to prevent bacterial growth in downstream processes and improve manganese and iron oxidation. A polymer will be added to assist settling in the two solids contact clarifiers. Following clarification, the water will be pumped to four air stripping towers for VOC removal. A low dose of a polyphosphate scale inhibitor will be added to prevent calcium carbonate deposition on the tower packing material. Following air stripping, the water will flow to two dual media filters, followed by disinfection with sodium hypochlorite. The sludge from the clarifiers will be processed by gravity thickening and dewatering on a plate and frame filter press, followed by off-site disposal. Filter backwash water and sludge processing water will be recycled to the rapid mix tank or the head of the plant. The upgraded Puchack Run Water Treatment Plant is being designed with one unit of each critical process out of service.

The implementation of the Puchack Run Water Treatment Plant project currently is on hold awaiting a two-year hydrogeologic study by the NJDEP/USGS to obtain additional information on the chromium contamination and the appropriate treatment. The results of this study will be made available upon completion. The NJDEP has also indicated that upon completion of the hydrogeologic study, the scope, budget and schedule for this project will be re-evaluated.

1.2.5.3 Parkside Treatment Plant

The Parkside Water Treatment Plant was completed in 1958 and was originally designed to treat water from Parkside Well Nos. 13, 17, and 18. However, as previously indicated, the Parkside wells have become contaminated with VOCs including trichloroethylene and tetrachloroethylene. Currently, the Parkside Water Treatment Plant is being upgraded to remove VOCs from the water received from the Parkside wells. Upon completion of the upgrade, only Parkside Well Nos. 17 and 18 will be returned to service. The upgraded plant will have a hydraulic design capacity of up to 3.0 mgd; however, operating capacity may be further limited under the 1996 Phase I Improvements by air emission constraints.

The Parkside Water Treatment Plant will be upgraded in a phased approach. A Phase I upgrade flow schematic is provided as Figure 1-6. In the Phase I upgrade, the water from the wells will be pumped directly to a new aerator and will then be discharged to a new wet well. Chlorine (sodium hypochlorite) and lime will be added to the wet well and potassium permanganate will be added prior to the pressure filters, for pH adjustment and additional oxidation of the iron and manganese present in the raw water. The pressure filters will serve as both a catalyst for additional oxidation of iron and manganese and as a physical barrier for the removal of suspended material. After filtration, the water will be conveyed to a packed column air stripper for additional reduction of VOCs to meet the NJ Maximum Contaminant Level. The

water from the packed column air stripper will be discharged to a clearwell where caustic soda or lime will be added for pH adjustment followed by chlorine (sodium hypochlorite) addition for final disinfection. Phase I also consists of new pumps, new piping and valves, and new instrumentation and controls, including a computer and remote plant monitoring and partial operations capability from the Morris-Delair Water Treatment Plant. Phase II of the Parkside Water Treatment Plant improvements may include filter replacement. Phase III, if needed and if economically feasible, may include vapor phase VOC treatment facilities.

1.2.6 Staffing

Information regarding current staffing is provided in Section 3.6 of the RFP.

1.2.7 Water Distribution and Storage System

Since the topography of the Water System service area ranges from about elevation 3 to about elevation 40 feet, the area is presently serviced by one pressure district. Major elements of the finished water transmission system include:

- Finished water pumping systems at each of the three treatment plants,
- Parallel 30-inch and 36-inch transmission mains that transport water approximately five miles from the Morris-Delair and Puchack Run facilities into the City service area,
- A 5 mg ground level reservoir with storage tank and pumping station located adjacent to the Ben Franklin Bridge,
- A 2 mg elevated storage tank in South Camden that floats on system pressure, and
- A 0.5 mg standpipe in the Whitman Park area of the City (not in operation).

The water distribution system consists of about 144 miles of water mains (including transmission mains) ranging in diameter from three inches to 36 inches. The majority of the mains consist of unlined cast iron pipe installed before 1930. However, 14 percent of the old mains were cleaned and cement lined in a major distribution system renovation program in 1962. Additionally, since 1977, about 6,800 linear feet of 4-inch mains have been replaced with new 8-inch lines and about 5,100 linear feet of new 16-inch and 12-inch reinforcing mains have been installed. The replacement of nearly six miles of 3-inch and 4-inch water mains with 6-inch mains is currently being designed. Individual service lines and meters are owned by the customer and maintenance and repair of the service lines and meters is the responsibility of the customer. The City installs new meters, bills the customer for the cost of the new meter, and transfers ownership on the new meter to the customer.

Approximately 2,000 to 3,000 customers are estimated to have lead service lines. USEPA lead and copper regulations require lead service line replacement if lead levels in customer drinking water remain above regulatory limits after corrosion control efforts are undertaken. The current corrosion control program, carbonate

passivation and pH control, has been successful in maintaining lead and copper 95th percentile concentrations below the EPA action levels. The City is currently participating in a reduced lead and copper monitoring program in accordance with NJDEP direction.

Although there are a number of informal maintenance and repair procedures, for example, fixed asset management programs, computerized programs (computerized inventory, work management programs for work orders, service orders, requisition forms, etc.) and preventive maintenance programs for the distribution system functions (meters, hydrants, valves, mains, etc.) are not in place.

The City's Department of Utilities water distribution division is responsible for maintenance and repairs in the distribution system, including:

- valve replacement,
- system flushing,
- fire hydrant maintenance (exercising, clearing, and snow removal), and
- water main repairs

Other responsibilities of the City's Department of Utilities staff include mowing grass, clearing shrubs, removing snow, and providing general maintenance at the water treatment plants, well and storage system locations and access roads to the well fields.

The City operates and maintains a radio based communications system. This communication system is also used by the City's Police Department.

The Department has approximately 13,400 meters to maintain or manage. New meters are equipped with digital encoders to allow for readings to be recorded externally (currently estimated at 2,000 - 3,000 with this capability). However, hand-held RADIX units are used to record the time and date of meter readings, as well as other pertinent data. Meters are read quarterly.

The Department installs and replaces meters, bills the customer for the cost of the new meter, and transfers ownership of the meter to the customer. There is no program in place for testing smaller, residential meters. In general, large meters are required to be tested by the customers every three years, at their expense, and the test results must be provided to the Department of Utilities. In 1997, the City took ownership of meters associated with its largest customers and will now be responsible for their maintenance and regular calibration.

The City plans to institute a preventive leak detection program whereby a specialty contractor surveys the distribution system. The last survey was performed approximately eight years ago.

1.3 WASTEWATER COLLECTION SYSTEM

1.3.1 Overview

The City of Camden has a total area of approximately ten square miles. In addition to a City population of about 87,500 (1990 Census), the City's wastewater collection area also includes approximately 250 customers located in Pennsauken Township and stormwater flow from a larger part of Pennsauken Township. Unlike the Water System, the Sewer Collection System services all of Camden. There are approximately 6,400 customers in East Camden that are serviced by the City's wastewater collection system that are provided water service by New Jersey American Water Company (NJAWC). The average daily wastewater flow generated within the City is estimated to be approximately 20 million gallons per day (MGD) although no metering data is available.

This information provided in this Section is based on an inventory of the Wastewater Collection System performed in 1980 with updates to the information provided by the City in 1992. The City is currently performing a Sewer System Inventory and Assessment/Facilities Inventory and Assessment Analysis (Sewer System Inventory). It is anticipated that the Sewer System Inventory will present an updated Wastewater Collection System inventory that is different than the inventory presented in this Section. The respondent should consider and review all available information in preparation of the Proposal.

The wastewater collection system of the City of Camden Department of Utilities consists primarily of combined sewers. According to City records, there presently exist approximately 150 miles of combined sewers containing nearly 4,000 storm inlets, about 60 percent of which were constructed before 1920. When initially constructed, these pre-1920 sewers served to convey both sanitary sewage and storm drainage directly to the nearest river without treatment. In the 1950s, interceptor sewers with regulator chambers were constructed to convey both sewage and combined flows from the wastewater collection system to the Baldwins Run and the City's Main Sewage Treatment Plants.

The newest section of the City, Fairview, was originally served by its own treatment plant and is the only area in Camden which has separate sewer and storm conveyance systems. Fairview has an area of about 0.7 square miles and contains 20 miles of sanitary sewers and approximately five miles of storm sewers. While not verified, the City believes that additional separate collection systems are located along the Camden waterfront.

Today, the majority of wastewater and a portion of the stormwater is conveyed via pump and gravity flow from the City to the Delaware No. 1 Wastewater Treatment Plant, formerly the Main Sewage Treatment Plant which is owned by the Camden County Municipal Utilities Authority. The balance of the wastewater and stormwater is discharged to the Delaware River. Baldwins Run and Main Sewage Treatment

Plants were purchased from the City by CCMUA in 1975. In addition to owning and being responsible for operation of the Delaware No. 1 Wastewater Treatment Plant, the CCMUA is responsible for operation of one pumping station and force main from the Baldwins Run interceptor sewer in the northeast portion of the City to the CCMUA's wastewater treatment plant. The City has retained ownership of the interceptors, eight pumping stations, and lift stations. Figure 1-7 is a schematic showing the basic elements and relationships between the various components of the sewer system.

1.3.2 Interceptor Systems

During the 1950s, the City undertook a major project to construct interceptor systems that would convey all sewage and combined flow to the City-owned treatment plants. The project included modifications to the existing Baldwins Run Sewage Treatment Plant, construction of the Camden Main Sewage Treatment Plant and construction of the following intercepting sewer systems:

- Delaware River System
- Cooper River System
- Baldwins Run System

The two treatment plants were sold by the City to the Camden County Municipal Utilities Authority (CCMUA) in 1975, but the City has retained ownership of the interceptor systems and pumping stations. In the late 1980s the CCMUA closed the Baldwins Run treatment plant and constructed a new pumping station in the vicinity of the 27th St. pumping station. Construction of CCMUA's pumping station allowed the City to abandon its own 27th St. pumping station. The pumping station constructed by CCMUA conveys combined sewage and storm flows generated in the Baldwins Run interceptor and a portion of the wastewater flow from Pennsauken Township to the Delaware No. 1 Wastewater Treatment Plant.

1.3.2.1 Collection and Interceptor Sewers

Delaware River System - This system runs north-south along the Delaware River from Coopers Point to Fairview and intercepts fourteen sewer outlets and the Cooper River interceptor. Sewage from this system is conveyed to the Delaware No. 1 Wastewater Treatment Plant. The Delaware River interceptor sewer was constructed in the early 1950s and is about 32,000 feet long. Pipe sizes range from 12 to 72 inches in diameter and are constructed mainly of reinforced concrete pipe. Except for some small lengths of 18-inch pipe which are made of clay, and a 12-inch cast iron force main in the Fairview section, the Delaware River interceptor sewer is constructed of reinforced concrete pipe.

In 1992 the City acquired, at no cost, the Audobon Park sewer system. This system was constructed in 1955 and consists of approximately 7,500 feet of eight-inch cast iron pipe. This system was originally constructed to convey sewage from the

community of Audobon Park to the Delaware River interceptor system. Presently, the Audobon Park sewer system is used only to convey sewage from a trailer park located on the fringe of the service area. The Audobon Park community is presently connected to CCMUA's sewer system.

Cooper River System - This system intercepts flows from eleven sewer outlets discharging to the Cooper River and then cuts toward the Delaware River along Spruce Street to 2nd Street, where it ties into the Delaware River interceptor. Sewers in this system range from eight to 36 inches in diameter and are made of either reinforced concrete or clay, with cast iron force mains. This system was built during the late 1950s and early 1960s

Baldwins Run System - Unlike the Delaware River or Cooper River interceptors, the Baldwins Run interceptor sewer conveys combined sewage and storm flows to a pumping station constructed, owned and operated by CCMUA. Prior to the interceptor construction, most of the flow generated in this area was being treated at the Baldwins Run Plant. The interceptor sewer consists of approximately 2,300 feet of 12-inch clay sewer and about 3,300 feet of ten-inch cast iron force main. The Baldwins Run interceptor is the oldest of the three systems and was completed before 1953.

1.3.2.2 Pumping Stations

Delaware River System - As shown in Figure 1-7, the Delaware River System contains the Fairview and Arch Street pumping stations and 13 regulator chambers. Due to the existence of separate sanitary and storm sewer systems within the Fairview drainage basin, the Fairview pumping station conveys sewage exclusively. As indicated in Figure 1-7, the Cooper River Interceptor System and the wastewater collection system ultimately discharge into the Delaware River Interceptor. One pumping station and one regulator, both located at the Main Plant site, have become the property of the CCMUA. Major components of the Delaware River System are summarized in Table 1-4.

Cooper River System - The Cooper River system contains four pumping stations and seven regulator chambers. The State St., Federal St. and Baird Blvd. pumping stations convey combined storm and sewage flows to the Cooper River interceptor system. The Cooper River interceptor conveys storm and sewage flows to the Pine St. pumping station. The Pine St. pumping station conveys storm and sewage flows to the Delaware River interceptor and ultimately the Delaware No. 1 Wastewater Treatment Plant. The location of the components of the Cooper River interceptor system are indicated on Figure 1-7. The major components of the Cooper River System are summarized in Table 1-5.

Baldwins Run System - There are two regulators and one pumping station in the Baldwins Run interceptor system. The 27th St. pumping station is currently

abandoned, however the pumps have not been removed from the station. The CCMUA constructed a new pumping station in the vicinity of the abandoned 27th St. pumping station and presently all flows conveyed by the Baldwins Run interceptor are pumped via a new force main to CCMUA's Delaware No. 1 Wastewater Treatment Plant. This force main was constructed by and is maintained by the CCMUA. Table 1-6 lists major components of the Baldwins Run System.

Wastewater Collection System - There are two pumping stations and two ejector type stations. There are no regulators in this system. Table 1-7 lists major components of this system.

1.3.3 Combined Sewers

The size and type of collection sewers in the Camden system varies considerably. Circular sewers range from six to 90 inches in diameter, while oval sewers exist in sizes from 16 in. x 20 in. to 68 in. x 126 in. Small circular sewers are almost exclusively made of clay. Approximately one-half of the 15" to 20" sewers are clay and the remaining are reinforced concrete. Sewers greater than 20 inches in diameter consist typically of either concrete or brick. Oval sewers are constructed primarily of brick with clay sometimes used for the smaller sizes. Cast iron and asbestos cement pipe are also used.

Tables 1-8 through 1-10 list the lengths of sewer for the Camden combined and separate sewer systems, the various pipe sizes and approximate dates of installation. The data in these tables were obtained from a sewer inventory maintained by the City and upgraded annually until 1964, at which time no further data were recorded. Table 1-11 lists the lengths of all pipes repaired or replaced between 1980 and 1992, as reported by the City. It should be noted that there are certain discrepancies between the inventory presented here and a similar sewer inventory performed by the CCMUA as part of recent Infiltration/Inflow Analysis [1,2]. Significant differences include the lengths of 16" x 24", 20" x 30" and 30" pipelines. Sources of error for the reported discrepancies are unknown at this time.

The CCMUA's treatment plant is designed to handle only a portion of the wet weather flow, with the flows above the plant's design capacity overflowing to local rivers. Approximately 35 overflow structures (mechanical regulators and static weirs) exist on the City's approximately 180 miles of sewer system. Both the Ferry

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[1]Weston, Speitel, Watermation, (for the Camden County Municipal Utilities Authority), "Infiltration/ Inflow Analysis for Service Area 6, Camden City and Audubon Park Borough, District I - Delaware Basin", January 1980.

[2]Weston, Speitel, Watermation, (for the Camden County Municipal Utilities Authority), "infiltration/Inflow Analysis for Service Area 7, Camden City - Baldwins Run, District II - Delaware Basin", March, 1980

Avenue and Mt Ephraim pump stations have bypass overflow structures and the Fairview pumping station has a static weir overflow structure.

All overflow regulators were inspected in a 1980 Combined Sewer Overflow Study for the CCMUA. According to this study, almost half of the regulators experience some dry weather overflow and two-thirds are subject to tidal inflow. In general, at that time (1980) the regulators were reported to be in good structural condition and poor mechanical condition.[3]

In order to comply with the 1986 amendments to the Clean Water Act, the City is implementing a combined sewer overflow (CSO) program. The City has received a Sewerage Infrastructure Improvement Act (SIIA) Grant from the NJDEP and the City, in conjunction with the CCMUA and Gloucester City, are currently preparing a number of reports and studies related to the CSOs. The first of these reports is a 1997 Interim Solids/Floatables Control Plan submitted to the NJDEP by CH_2M Hill on behalf of the City of Camden, CCMUA and Gloucester City. In addition, CH2M Hill has also prepared a draft Sewer System Inventory and Assessment/Facilities Inventory and Assessment dated October 1997. A primary goal of this inventory assessment was to produce up-to-date, to-scale, electronic maps of the wastewater collection and conveyance systems in the City's of Camden and Gloucester. Computerized geographical information systems (GIS) technology was used to create these sewer system maps using ArcInfo Software.

1.3.4 Separate Stormwater Collection Systems

The locations of stormwater-only pipelines are indicated in Table 1-12. The location, size and length of stormwater sewers in the Fairhill portion of the City are well documented. However, detailed information for suspected stormwater sewers located in other parts of the City and the Camden Waterfront is not available. Other suspected stormwater sewers are identified in Table 1-13. The Respondent should consider and review all available information in preparation of the proposal.

1.3.5 Issues/Conditions That May Affect Wastewater Collection

The interceptor sewer systems of Camden are between 30 and 40 years old, which is approximately one-half of the normal sewer service life.

The pumping stations vary in age from 30 to 70 years; however, most were built in the late 1950s. There have been a number of improvements made to certain pumping stations. In 1954, new pumps and related equipment were installed at the Fairview Pumping Station, and the superstructure was rebuilt. In 1979, pumps were rebuilt at

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[3]Weston, Speitel, Watermation, (for the Camden County Municipal Utilities Authority), "Final Report - Combined Sewer Overflow Study, Districts I and II Combined Sewer Areas", March 1980.

the Arch Street Pumping Station; in 1990, two new pumps were installed at the Baird Boulevard Pumping Station; in 1983, two of three pumps at the Pine Street Pumping Station were rebuilt; in 1992, a third pump at the Pine Street Pumping Station was rebuilt and other general rehabilitation work was performed

There are frequent failures in the Wastewater Collection System. Approximately 20% of the annual sewer budget is expended to repair collapsed sewers and adjacent utility structures and roadways. The City has approximately 6 staff members dedicated to the repair of collapsed sewers. Over 60 percent of the combined sewers and 80 percent of the sanitary sewers are in excess of 75 years old, with many over 100 years old. There were 244 sewer collapses in 1997. The house connections to the sewer (laterals) are owned by the customer and the customer is responsible for repairs to the laterals located both on the customer's property and within the street

The City's Department of Utilities staff is responsible for maintaining and repairing all aspects of the Wastewater Collection System, except customer services, including but not limited to sewers, laterals, pumping stations, catch basins, manholes, and combined sewer overflow (CSO) structures

1.4 BILLINGS AND COLLECTIONS

The source of information summarized in this Section is the Comprehensive Water System Management Study, prepared for the City in 1996 by WRc, Inc., and updated with information provided by City personnel

1.4.1 Overview

There are 13,096 accounts in the Water System and 19,485 accounts in the Wastewater Collection System The billings and collection activities of the Water and Wastewater Collection Systems are performed by the City's Data Processing and Revenue Collection Departments The primary function of the Data Processing and Revenue Collection Departments is the collection of taxes, process payment received and record liens.

1.4.2 Billing

Water meter readings and customer billings are done quarterly with approximately one third of the meters being read and the corresponding customers being billed each month. Water and sewer bills are mailed on the 20th of each month. Quarterly flat fees are charged to 90 accounts for fireline service and 264 accounts for un-metered water usage The City is in the process of installing meters on all un-metered connections to the distribution system. All connections to the distribution system must be metered in accordance with the City's Water Allocation Permit No 5302 before December 31, 1998

Existing water meters consist of manual and automatic reading meters. The most common manufacturer of meters in use by the City is Sensus/Rockwell with some plastic Badger meters in use. The City has implemented a program to install new "touch-read" probes. These touch-read meters are scattered throughout the City. The manual read meters are read by one of four meter readers using Radix hand-held data entry devices. The Radix units do not interface with the Sensus "touch-read" system.

The billing system utilizes an IBM AS-400 minicomputer (AS400) that is designed to provide all necessary data for processing billing, collection and meter reading. The Sensus "touch-read" system is not compatible with the AS400 system.

Table 1-14 presents the current billing schedule. Customers receiving City water and sewer service are billed for sewer collection services at a rate of 65 percent of the water bill. A total of 6,140 residents of East Camden and 249 residents of Pennsauken Township receiving only City sewer services are sent a sewer-only bill. The amount of the sewer bill for customers receiving water service from NJAWC is determined by converting the usage information provided by NJAWC from gallons to cubic feet, applying the City's current water rates, and billing the sewer account for 65% of this amount. Water billing information for sewer customers in East Camden receiving water service from NJAWC is provided via telephone line on a quarterly basis from NJAWC. Water billing information for sewer customers in Pennsauken Township is provided physically on a quarterly basis from NJAWC and is processed manually.

1.4.3 Collections

Bills for all classes of water service are payable upon receipt. In the event of failure to pay for service within 30 days after the billing date, a 10 percent late payment charge and an eight percent interest charge (compounded daily) on the outstanding balance is assessed to the delinquent customer. Outstanding water and/or sewer balances of approximately one year are transferred to property lien. The City has a shut-off program. As of June 1995, the City had water utility liens in the amount of $240,000 which represents approximately one-third of its, annual water billing. The City has recently adopted an ordinance that permits the City to foreclose on a property having outstanding water or sewer liens.

As previously noted, there are 249 customers in Pennsauken Township who receive City wastewater collection services only. Unlike City residents, Pennsauken Township residents are not effected by the City's water shut-off program since water service is provided by another water purveyor.

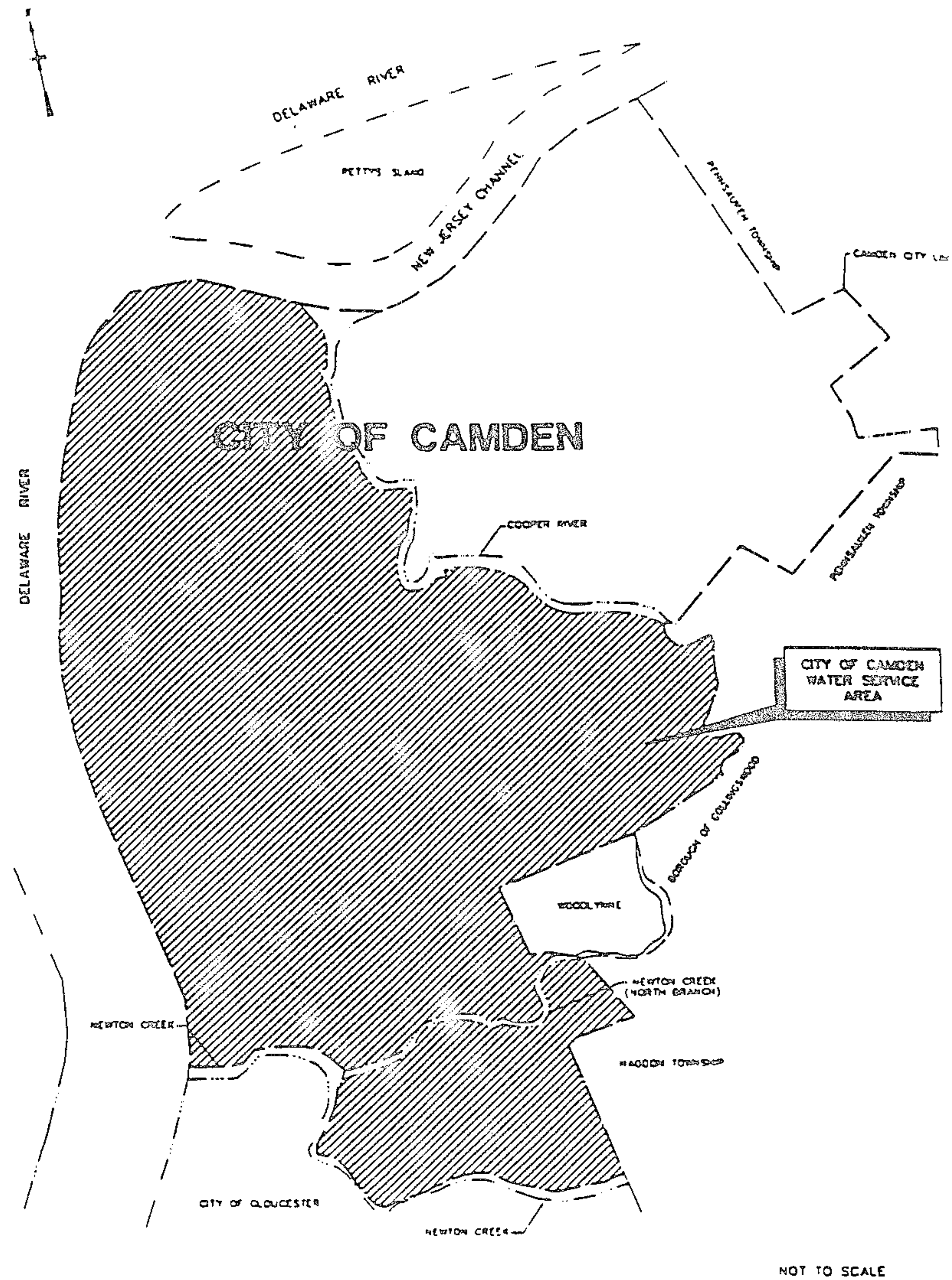
A summary of the Water and Sewer Collection System billings and collections is provided in Table 1-15.

1.4.4 Free Water and Sewer Service

The City currently provides free water and sewer service to the customers identified in Table 1-16.

1.5 ADDITIONAL INFORMATION

The City has compiled additional information and documents for review by the Respondent in preparing its Proposal. A list of the available information is provided in Exhibit 7 (Repository). The documents are available for review or purchase at $ 25 per page for 8-1/2 x 11 and 11 x 17, and $3 00 for drawing size over 11 x 17, from the Department of Utilities located at 520 Market Street, Room 419, Camden, NJ 08101



Source: Map of the City of Camden, New Jersey, Division of Engineering and Construction Management

I:\ACAD\PROJ\0380307\WATSYS Scale 1:24000 Date: 01/07/1998 Time: 08:39

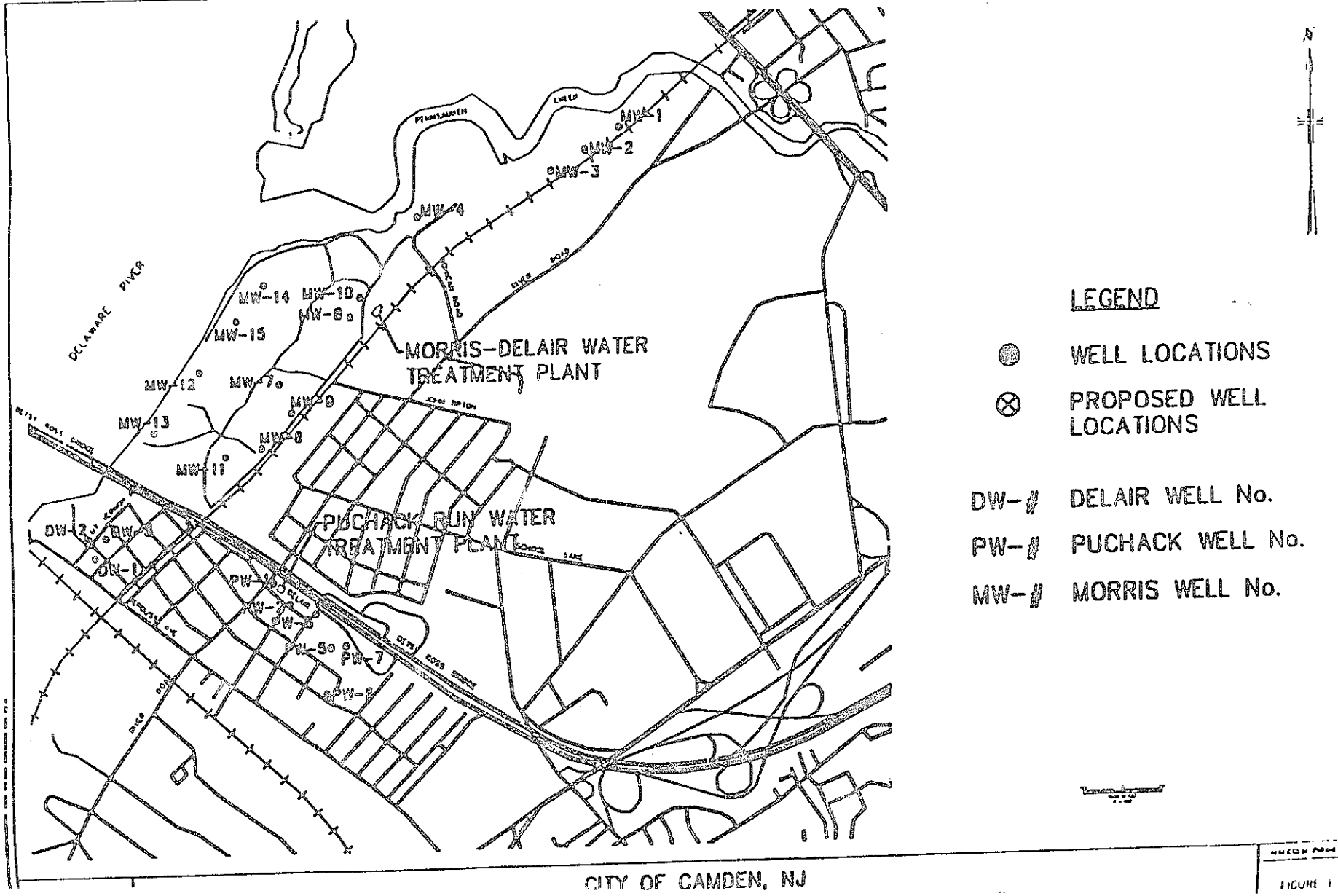
7688 ADMIN

MALCOLM PIRNIE

CITY OF CAMDEN
CAMDEN, NEW JERSEY

LOCATION MAP OF WATER SERVICE AREA

FIGURE



CITY OF CAMDEN, NJ

FIGURE 1-2

LEGEND

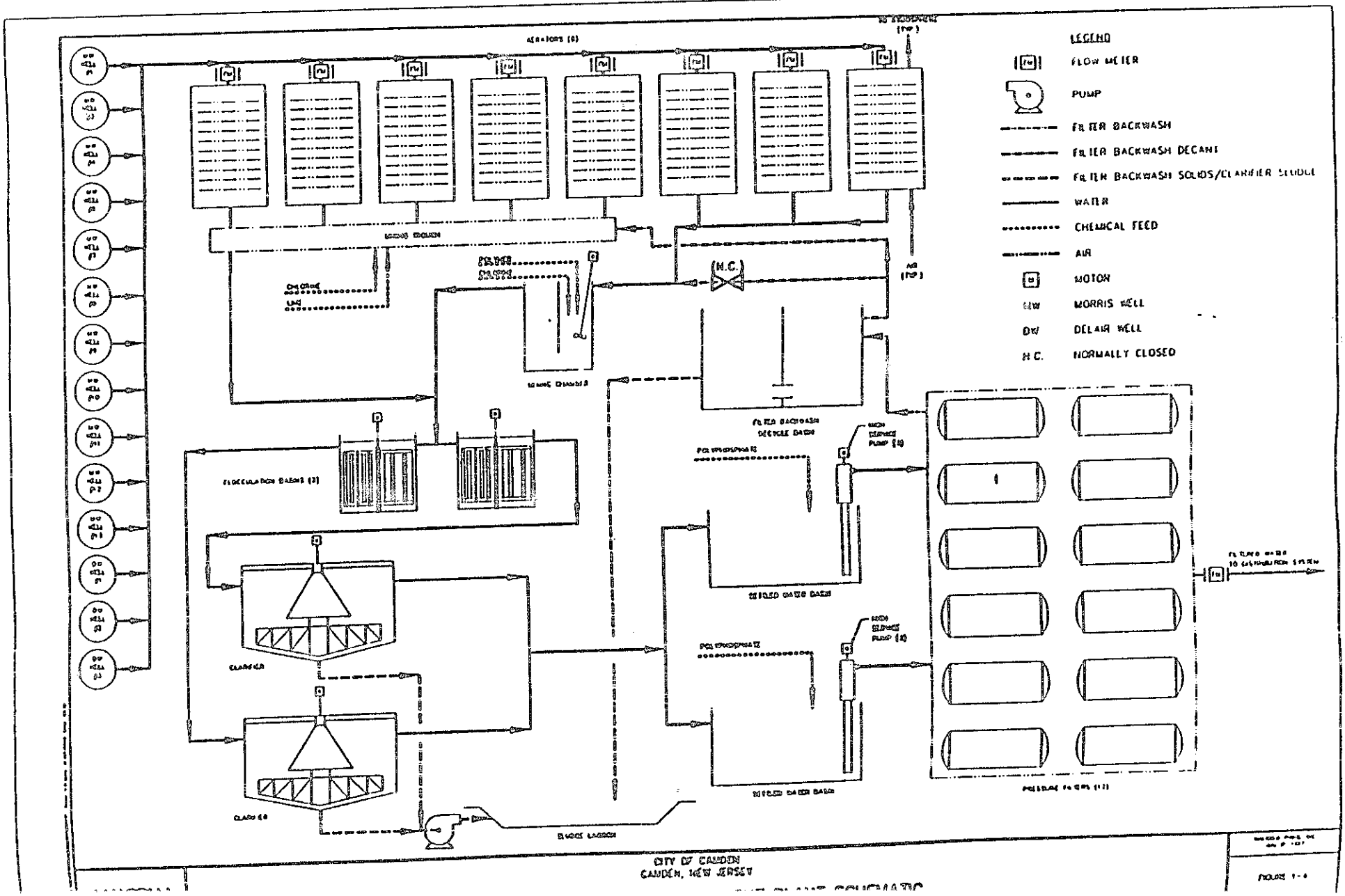
● WELL LOCATIONS

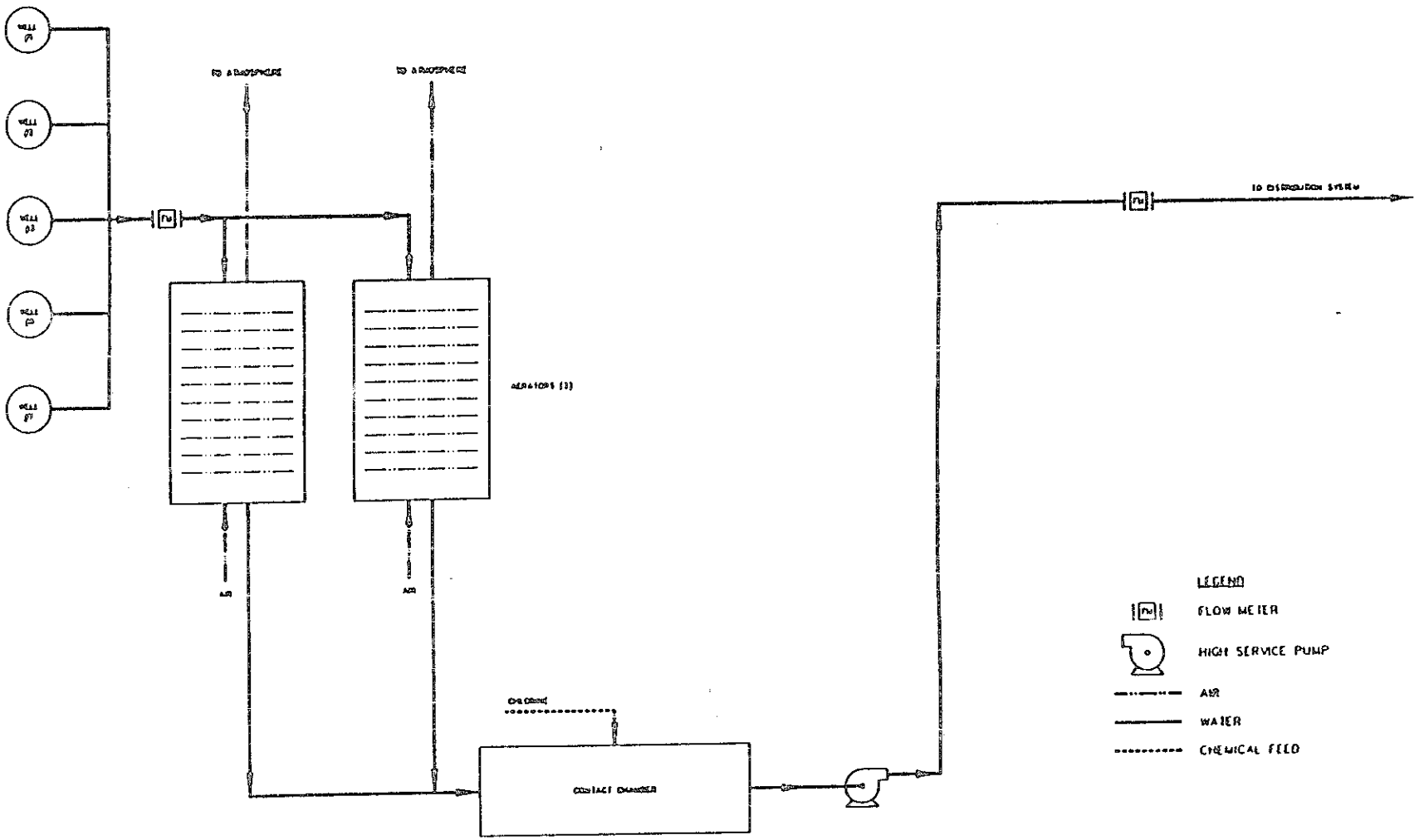
CW-# CITY WELL No.

PK-# PARKSIDE WELL No.

CITY OF CAMDEN, NJ

FIGURE


LEGEND
FLOW METER
PUMP
FILTER BACKWASH
FILTER BACKWASH DECANT
FILTER BACKWASH SOLIDS/CLARIFIER SLUDGE
WATER
CHEMICAL FEED
AIR
MOTOR
MW MORRIS WELL
DW DELAIR WELL
N.C. NORMALLY CLOSED
(N.C.)
CLARIFIER
CLARIFIER
CITY OF CAMDEN
CAMDEN, NEW JERSEY

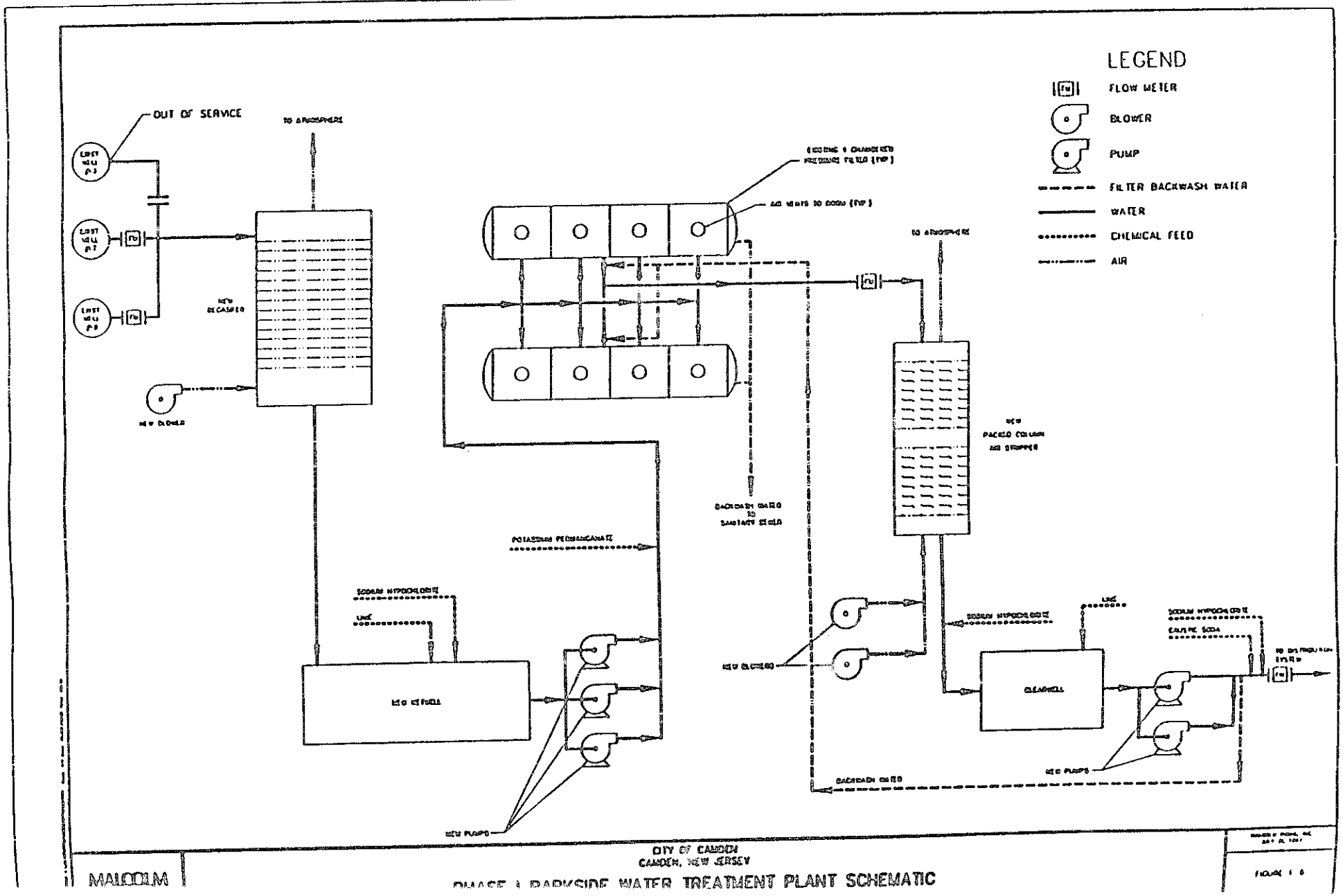


Note. Due to chromium contamination, only Well #1 is currently operating. This well is operated as directed by NJDEP to retard the chromium contaminant plume's migration.

CITY OF CAMDEN
CAMDEN, NEW JERSEY

MALCOLM

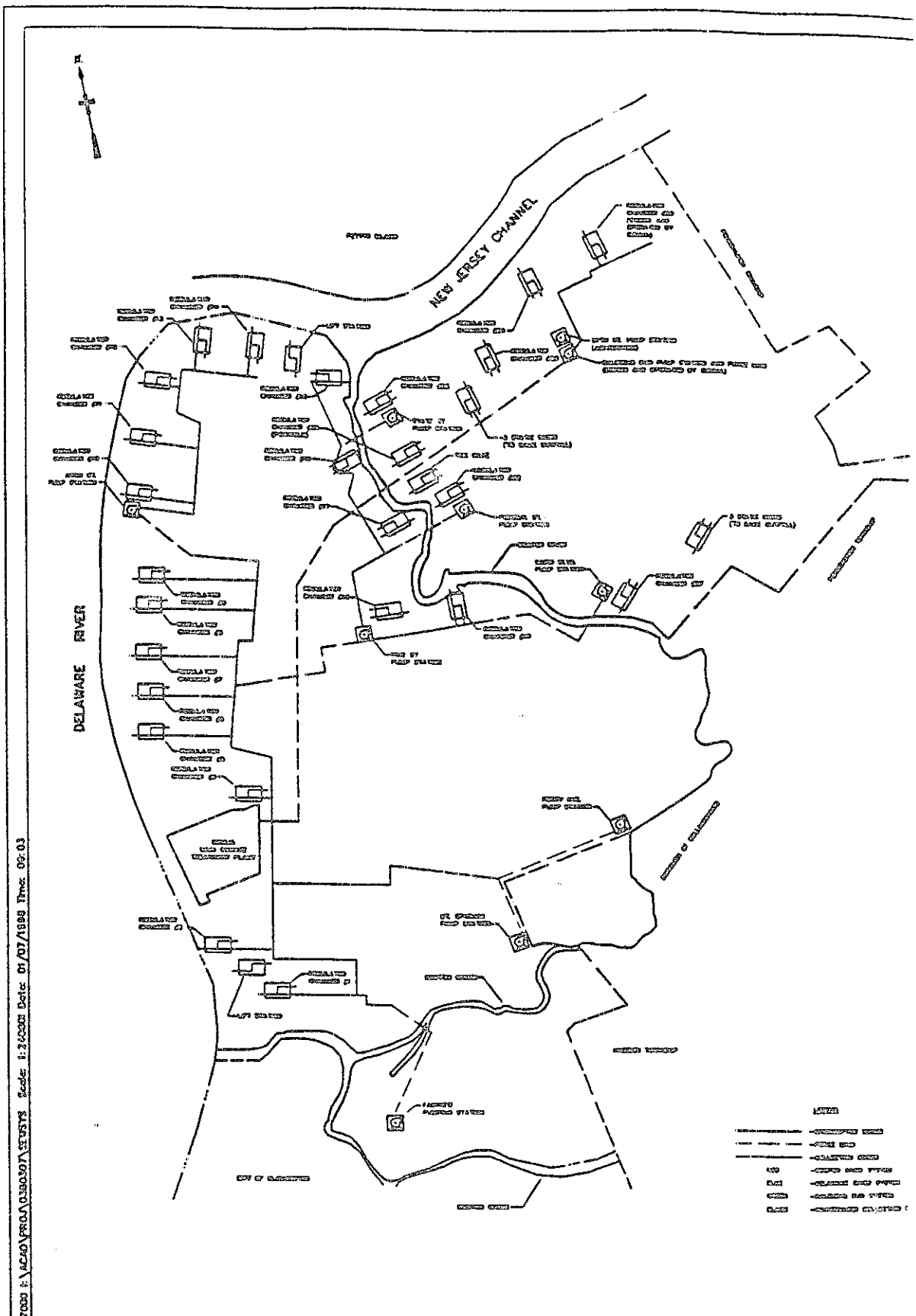
EXISTING PUMP BACK RUN WATER TREATMENT PLANT SCHEMATIC



CITY OF CAMDEN
CAMDEN, NEW JERSEY

MALCOLM

PHASE I PARKSIDE WATER TREATMENT PLANT SCHEMATIC



CITY OF CAMDEN

DIAGRAM OF INTERCEPTOR SEWER SYSTEM

MALCOLM PIRNIE

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Table 1-1
Groundwater Withdrawal Wells

Permit No.	Well No.	Year Drilled	Depth (feet)	June 1996 Production (gpm) (1)	Permitted Pump Capacity (gpm) (2)	Original Yield (gpm) (3)
Morris Wellfield						
5100050	1	1961	107	750	1600	1000
3151984	2	1941	115	no pump	1000*	1000
3100945	3	1953	107	800	1800	1000
3104252	4	1960	130	1200	1600	1585
5100051	6	1932	133	325	1700	1944
5100052	7	1960	120	1056	1680	1630
3100944	8	1953	124	603	1670	1000
5100076	9	1932	143	700	1670	1900
3104251	10	1960	115	1230	1400	1529
3115745	11	1979	144	815	2030	2030
3116814	12	1981	117.6	887	2030	2030
3116813	13	1980	130	800	2060	2060
Proposed	14				2060**	
Proposed	15				2060**	
Delair Wellfield						
5100053	1	1930	138	1100	1680	1980
5100054	2	1930	141	550	1830	1330
5100055	3	1930	135	650	1830	1850
Puchack Run Wellfield						
5100056	1	1924	140	1080	1500	1320
5100057	2	1924	169	996	1000	1440
5100058	3	1924	175	1280	1280	1184
5100059	5	1924	186	1120	1324	1119
3105450	6	1970	220	1831	2260	1800
3108526A	7	1975	180	1284	1681	1287
City Wells						
5100060	7	1966	163	1023	1500	1023
5100061	11	1942	159	791	1010	1005
3100904	13	1953	230	690	1200	1000
3101250	17	1954	270	0	1500	1000
3109574	18	1976	290	1062	1200	1250

Notes:
* - Anticipated Pump Capacity
** - Proposed
(1) - As reported by City personnel 7/1/96
(2) - As reported in NJDEP Water Allocation Diversion Permit No. 5302 effective 10/2/97
(3) - As reported in NJDEP Staff Reports (dated 6/91) regarding Application No. 5302, updated by City personnel 7/1/96 and original construction details

Table 1-2

Water Allocation Permit Requirement Summary[1]

Permit Condition	Status
Locating and Sealing Abandoned Wells	Continuing - to be completed by the Contract Partner prior to December 31, 2000.
Submission and Implementation of the Water Conservation and Drought Emergency Plan	Continuing
Reporting Monthly Diversions and Static Well Level	Continuing
Annual Chloride Monitoring	Continuing
Install Meters on All Existing and New Services	Continuing - to be completed by the Contract Partner prior to December 31, 2000.

(1) - Not a complete list of permit requirements. All permit requirements are described in Water Allocation Permit No. 5302.

Table 1-3

Water Production Summary

Facility	1996		1997	
	Annual Average	Maximum Day	Annual Average	Maximum Day
Morris-Delair Water Treatment Plant	12.81	16.65	9.82	14.02
Parkside Water Treatment Plant	0.55	2.01	0.00	0.00
Puchack Run Water Treatment Plant	1.65	2.84	1.02	1.93
City Well No. 7	0.11	1.11	0.59	1.66
City Well No. 11	0	0	0	0

Source of data is Public Water Supply Diversion Reports

TABLE 1-4

1980 INVENTORY - DELAWARE RIVER INTERCEPTOR SYSTEM

Interceptor Sewers and Force Mains[1]

	Pipe Size (in.)										
	12	15	18	27	30	36	42	48	54	72	Total
Interceptor Sewers (ft)	--	1,420	3,885	840	1,150	9,745	2,145	4,330	1,665	4,015	29,195
Force Mains (ft)	3,190	--	--	--	--	--	--	--	--	--	3,190
											32,385

Pump Stations[2]

Location	Pumps		Motors		Year Built	Year Improved
	No.	Capacity each (mgd)	hp	Type		
Arch Street	3	5-7	75	Constant Speed	1956	1979
	1[4]	5-7	75	Constant Speed	1991	
Fairview	2	1.5	15	Constant Speed	1963	--

Regulators[3]

- 12 Structures with tide gates and/or mechanical regulators

Notes:

1. Source: Havens & Emerson Report on Interception Collection and Treatment of Sewage, Part I, March, 1946 Updated with information supplied by the City.
2. Source: Construction Record Drawings.
3. Source: Weston, Speitel, Watermation, Combined Sewer Overflow Study, March, 1980.
4. Pump used for bypass operations.

TABLE 1-5

1980 INVENTORY - COOPER RIVER INTERCEPTOR SYSTEM
[City to Verify Pump Capacities]

Interceptor Sewers and Force Mains[1]

	Pipe Size (in.)							
	8	12	15	16	24	30	36	Total
Interceptor Sewers (ft)	--	3,617	4,479	--	1,013	3,907	2,330	15,346
Force Mains (ft)	320	--	--	540	--	3,256	--	4,116
								19,462

Pump Stations[2]

	Pumps			Motors		
Location	No.	Capacity each (mgd)	hp	Type	Year Built	Year Improved
Pine St.	3[4]	0.4-8	125	variable speed	1963	1980
Federal St.	3[4]	2	15	constant speed	1963	--
		5	25	constant speed		
		5	25			
Baird Blvd.	2	0.8	15	constant speed	1963	1980
State Street	3[4]	0.5	7.5	constant speed	1963	--
		0.5	7.5	constant speed		
		1.0	15			

Regulators[3]

- 7 structures with tide gates and/or mechanical regulators.
- 1 simple overflow structure.

Notes:

1. Source: Havens & Emerson Report on Interception Collection and Treatment of Sewage, Part I, March 1946. Updated with information supplied by the City.
2. Source: Construction Record Drawings.
3. Source: Weston, Speitel, Watermation, Combined Sewer Overflow Study, March 1980
4. One pump not in service.

TABLE 1-6

1980 INVENTORY - BALDWINS RUN INTERCEPTOR SYSTEM

Interceptor Sewers and Force Mains[1]

	Pipe Size (in.)		
	10	12	Total
Interceptor Sewers (ft)	--	2,268	2,268
Force Mains (ft)	3,331	--	3,331
			5,599

Pump Stations[2]

	Pumps		Motors			
Location	No.	Capacity each (mgd)	hp	Type	Year Built	Year Improved
27th St.[3]	3	1.0	15	constant speed	1956	--
		1.0	15	constant speed		
		0.5	7 1/2	constant speed		

Regulators[3]

- 2 Structures with tide gates and/or mechanical regulators.

Notes:

1. Source: Havens & Emerson Report on Interception Collection and Treatment of Sewage, Part I, March 1946. Updated with information supplied by the City.
2. Source: Construction Record Drawings.
3. Reported by the City as not in service.
4. Source: Weston, Speitel, Watermation, Combined Sewer overflow Study, March 1980.

TABLE 1-7

1980 INVENTORY - PUMP STATIONS IN
WASTEWATER COLLECTION SYSTEM

	Pumps		Motors			
Location	No.	Capacity each (mgd)	hp	Type	Year Built	Year Improved
Ferry Avenue	2	1.5	25	Constant Speed	1929	1954, 1978
Mt. Ephraim Avenue	2	0.5	7.5	Constant Speed	1963	--

Source: Construction record drawings and discussions with City personnel.
Note: Collection system also includes two package-type ejector stations.

TABLE 1-8

1980 INVENTORY - COMBINED SEWERS

Pipe Size (in.)	Year of Installation: Before 1920	1920-29	1930-39	1940-49	1950-59	1960-64	Total Length (ft.)
6	183	2,703	--	--	--	--	2,886
8	2,490	2,113	1,892	595	293	--	7,383
10	6,680	5,673	622	454	4,109	220	17,758
12	13,273	7,582	1,378	3,619	3,777	559	30,188
15	6,265	994	260	2,737	15,486	4,086	29,828
16	--	256	--	--	--	--	256
18	981	465	--	551	6,888	828	9,713
15x22½	--	--	1,546	--	--	--	1,546
20x21	342	821	560	857	308	--	2,888
15x21	--	--	--	--	46	--	46
16x20	14,010	26,530	--	--	--	(16)	40,524
16x22	224	--	--	--	--	--	224
16x24	122,428	90,167	1,577	--	(465)	(1,236)	212,471
18x27	3,095	652	--	--	--	--	3,747
20x28	700	--	--	--	--	--	700
20x30	105,322	17,029	1,083	130	(3,695)	(436)	119,433
22x33	7,307	1,216	--	--	(518)	--	8,005
24	24,478	9,302	223	512	3,555	1,248	39,318
22x36	960	--	--	--	--	--	960
24x32	620	--	--	--	(270)	--	350
24x36	10,140	6,022	--	--	(318)	--	15,844
26x39	2,941	--	--	--	--	--	2,941
28x42	2,701	1,399	--	--	--	--	4,100
27	--	--	--	--	550	--	550
30	3,819	14,912	465	517	2,146	3,127	24,986
33	--	718	--	--	--	--	718
21x41	--	--	--	--	35	--	35
30x41	690	--	--	--	--	--	690
32x42	2,250	--	--	--	--	--	2,250

TABLE 1-8

1980 INVENTORY - COMBINED SEWERS

Pipe Size (in.)	Year of Installation: Before 1920	1920-29	1930-39	1940-49	1950-59	1960-64	Total Length (ft.)
36	104,350	9,931	(223)	--	(8,876)	(5,688)	99,494
36x45	370	--	--	--	--	--	370
30x60	--	--	--	--	475	--	475
40x60	2,130	--	--	--	--	--	2,130
42	4,699	3,787	--	--	926	1,996	11,408
42x48	509	--	--	--	--	--	509
42x54	--	--	--	--	69	--	69
43x68	600	--	--	--	--	--	600
48	24,296	7,026	--	--	405	2,343	34,070
54	2,360	311	--	--	1,007	1,897	5,575
54x72	2,500	--	--	--	--	(446)	2,054
57x78	760	--	--	--	--	--	760
60	7,560	4,774	--	--	(4,864)	1,714	9,184
66	--	1,816	--	--	--	--	1,816
68x126	3,725	--	--	--	--	--	3,725
72	5,493	292	--	--	2,265	1,209	9,259
78	--	5,203	--	--	--	--	5,203
84	--	2,808	--	--	--	(8)	2,800
90	--	632	--	--	--	--	632
Total (ft)	496,738	225,134	9,383	9,972	22,251	11,397	774,875
Total (%)	64%	29%	1.2%	1.3%	3%	1.5%	100%

Notes:

1. Source: Annual tabulations on sewer lengths maintained by City personnel, 1918 to 1964.
2. Values in parentheses indicate pipes retired from service.
3. City records indicate that no combined sewers were installed after 1964.

TABLE 1-9

1980 INVENTORY - SANITARY SEWERS

Pipe Size (in.)	Year of Installation: Before 1922	1922-29	1930-39	1940-49	1950-59	1960-64	Total Length (ft)
6	55,496	--	--	--	--		55,496
8	36,965	2,994	--	1,667	8,040		49,666
10	799	4,998	--	--	137		5,934
12	120	302	--	--	--		422
15	804	--	--	--	--		804
18	2,696	--	--	--	--		2,696
Total (ft)	96,880	8,294	--	1,667	8,177		115,018
Total (%)	84.2%	7.2%	--	1.4%	7.2%		100%

Notes:

1. Source: Annual tabulations on sewer lengths maintained by City personnel, 1918 to 1964.
2. City records indicate that no combined sewers were installed after 1964.

TABLE 1-10

INVENTORY - STORM SEWERS

Pipe Size (in.)	Year of Installation: Before 1922	1922-29	1930-39	1940-49	1950-59	1960-64	Total Length (ft)
10	316	–	–	–	101		417
12	5,255	–	–	307	150		5,712
15	4,503	–	215	888	–		5,606
18	2,475	–	225	142	970		3,812
20	846	–	–	–	–		846
24	3,259	–	490	–	248		3,997
27	509	–	–	–	–		509
30	238	–	815	–	–		1,053
36	1,763	–	512	–	–		2,275
72	–	–	–	–	2,095		2,095
Total (ft)	19,164	–	2,257	1,337	3,564		26,322
Total (%)	72.8%	–	8.6%	5.1%	13.5%		100%

Notes:

1. Source: Annual tabulations on sewer lengths maintained by City personnel, 1918 to 1964.
2. City records indicate that no combined sewers were installed after 1964.

TABLE 1-11

1992 INVENTORY - POST 1980 REPAIRED/REPLACED PIPE[1,2]

Pipe Size (in.)	Year Installed	Length (ft.)
12	1990	519
18	1988	1,031
	1990	803
24	1984	415
	1990	1,060
30	1990	519
36	1986	944
60	1990	1,075
TOTAL		6,366

Notes:

1. Data supplied by the City.
2. Pipe lengths assumed to repair/replace oldest combined sewers.

Table 1-12
Separate Storm Sewers

Location	From	To	Size (inches)	Length (feet)
Kearsarge Rd.	Monitor Rd.	Ironsides Rd.	10	250.00
NW Kearsarge Rd.	Kearsarge Ave.	WS Kearsarge Rd.	10	66.00
WS Tuckahoe Road	Tuckahoe Rd.	D41-A	12	78.00
Alley/Sumter Road	Niagara Rd.	Ironsides Rd.	12	241.00
Sumter Road	Alley	Niagara Rd.	12	114.00
Sumter Road	Walkway	S. Common Rd.	12	78.00
Sumter Road	Walkway	N. Common Rd.	12	78.00
Niagara Road	Porter/Tuckahoe	Essex Rd.	12	338.60
Trent Road	Alley	Porter Rd.	12	130.00
Wasp/Kansas Rd.	Rear Kansas Rd.	Sumter Rd.	12	369.50
Alley/Alabama	Argus Rd.	Chesapeake Rd.	12	98.00
Alley	Kansas/N. Common	Sumter Rd.	12	169.00
Idaho Road	Tuckahoe Rd.	Newton Creek	12	80.00
Idaho/Yorkship	Alley	Outfall	12	92.00
Congress Road	Congress/Constitution	Yorkship/Constitution	12	432.00
Collings Road	Kearsarge Ave.		12	37.00
Octagon Road	Alley	Yorkship Sq/Octagon Rd.	12	269.00
W. America Road	Yorkship Sq.	Octagon Rd.	12	264.00
Yorkship Square	W. America Rd.	Octagon Rd.	12	372.00
Yorkship Road	Octagon Rd.	Yorkship Sq.	12	335.00
Hornet Road	Constitution Rd.	Congress Rd.	12	250.20
Alley	East America Rd.	Alabama Rd.	12	75.00
Argus Road	Alley	Alabama Rd.	12	252.50
Tuckahoe Road	Idaho/Tuckahoe	Tuckahoe Rd.	12	174.00
Republic Road	Congress Rd.	Constitution Rd.	12	241.00
Alley	Argus Rd.	Constitution Rd.	12	107.00
Congress Road	Hull Rd.	Merrimac Rd.	12	156.00
Chesapeake Road	Northward	Alley	12	121.00
Chesapeake Road	Hartford Rd.	Eastward	12	226.00
Congress Road	Olympia Rd.	Chesapeake Rd.	12	160.00

Table 1-12
Separate Storm Sewers

Location	From	To	Size (inches)	Length (feet)
Alley Both Sides	Chesapeake Rd.	Congress/Constitution	12	194.00
Collings Road	Alley	S. Collings Rd.	12	152.50
Alabama Road	Hartford Rd.	N. Collings Rd.	12	160.00
Congress Road	Alley	S. Collings Rd.	12	285.10
Atlanta Road	Alley	S. Collings Rd.	12	209.00
Minnesota Road	Atlanta Rd.	Mt. Ephraim Ave.	12	286.00
Atlanta Road	Alley	Minnesota Rd.	12	210.00
Alley	Southward	Minnesota Rd.	12	118.00
Alley	Southward	Minnesota Rd.	12	114.00
Alley	Northward	Minnesota Rd.	12	95.00
Atlanta Road	Alabama Rd.	Independence Rd.	12	117.00
Congress Road	Alabama Rd.	Alley	12	100.00
Alley	Congress Rd.	Eastward	12	92.00
Alley	Eastward	Mt. Ephraim Ave.	12	92.00
Kearsarge Rd.	Collings Rd.	Monitor Rd.	15	147.00
Tuckahoe Road	Monitor Rd.	Niagara Rd.	15	403.00
Niagara Road	Sumter Rd.	Essex Rd.	15	200.00
Trent Road	Sumter Rd.	Alley	15	268.50
Tuckahoe Road	Tuckahoe Rd.	Outfall	15	192.00
Congress Road	Yorkship/Constitution	Outfall	15	397.00
Collings Road	Chesapeake Rd.		15	147.00
Independence Road			15	390.00
Yorkship Square	Kearsarge Rd.	W. America Rd.	15	147.00
N.E. Walkway	Yorkship Rd.	Constitution Rd.	15	219.00
Alabama Road	Chesapeake Rd.	Alley	15	125.00
Collings Road	Merrimac Rd.	Congress Rd.	15	664.00
Minnesota Road	Congress Rd.	Atlanta Rd.	15	225.00
Congress Road	Alabama Rd.	Northward	15	200.00
Collings Road	Tuckahoe West	Kearsarge Rd.	18	271.65
Tuckahoe Road	Collings Rd.	Monitor Rd.	18	177.00
Sumter Road	Niagara Rd.	S. Common Rd.	18	156.00
Octagon Road	Walkway	Kearsarge Rd.	18	388.95

Table 1-12
Separate Storm Sewers

Location	From	To	Size (inches)	Length (feet)
Yorkship Square	Yorkship Rd.	Walkway	18	106.00
Alabama Road	Alley	Octagon Rd.	18	177.30
Chesapeake Road	Eastward	Merrimac Rd.	18	168.00
Chesapeake Road	Constitution Rd.	Congress Rd.	18	278.00
Minnesota Road	Constitution Rd.	Congress Rd.	18	261.00
Alabama Road	Constitution Rd.	Atlanta Rd.	18	452.00
Independence Road			18	65.00
Collings Road	Atlanta Rd.	Constitution Rd.	18	472.00
Collings Road	Yorkship School	Ironsides Rd.	18	343.00
Sumter Road	S. Common Rd.	N. Common Rd.	20	120.00
Octagon Road	Yorkship School	Walkway	20	46.50
Constitution Road	Alabama Rd.	Outfall	20	416.00
Collings Road	Tuckahoe Rd.	Westward	24	500.00
Sumter Road	N. Common Rd.	Newton Creek	24	620.00
S. Octagon Road	School Walkway	Yorkship School Walkway	24	144.00
Yorkship Square	N.E. Walkway	Argus Rd.	24	557.30
Constitution Road	Argus Rd.	Merrimac Rd.	24	318.40
Chesapeake Road	Merrimac Rd.	Constitution Rd.	24	225.00
Merrimac Road	Minnesota Rd.	Outfall	24	339.50
Minnesota Road	Constitution Rd.	Merrimac Rd.	24	457.00
Collings Road	Constitution Rd.	Merrimac Rd.	24	414.00
Collings Road	Chesapeake Rd.	Outfall	24	278.00
Collings Road	New Jersey Rd.	Yorkship Rd.	24	123.00
Collings Road	Newton Creek	Eastward	27	195.00
Merrimac Road	Constitution Rd.	Chesapeake Rd.	27	107.00
Octagon Road	Alabama Rd.	Yorkship School Walkway	30	237.90
Yorkship School	Octagon Rd.	Newton Creek	36	922.76
Merrimac Road	Chesapeake Rd.	Collings Rd.	36	372.00
Collings Road	Merrimac Rd.	Outfall	36	470.00
Alabama Road	N. Collings Rd.	Southeastward	15	250.00
Constitution Road	Republic Rd.	Argus Rd.	20	264.00

Table 1-13
Potential Separate Storm Sewers

Location	From	To	Size (inches)	Length (feet)
Vesper Blvd.	Ormond Ave.	Copper River	NA	NA
Kaighn Ave.	Euclid Ave.	Cooper River	NA	NA
Riverside Dr.	Federal St.	Mickle Blvd.	NA	NA
Jersey Joe Walcott Blvd.	Federal St.	Clinton St.	NA	NA
Martin Luther King Jr. Blvd.	Haddon Ave.	Riverside Dr.	NA	NA

NA - Not Available

TABLE 1-14

BILLING SCHEDULE

A Cycle - Fairview, Whitman Park, Parkside

January
April
July
October

B Cycle - South Camden

February
May
August
November

C Cycle - North Camden

March
June
September
December

This cycle is also applicable for East Camden sewer billing. In this area water is provided by New Jersey American Water Company.

Table 1-15
Water and Sewer Collection System Billing and Collections

Water System

Year Ending	Levy	Cash Collections
June 30, 1995	$6,538,585.47	$6,791,877.72
June 30, 1994	$7,667,628.91	$5,867,232.21
June 30, 1993	$6,279,225.51	$6,050,053.70

Wastewater Collection System

Year Ending	Levy	Cash Collections
June 30, 1995	$3,387,368.46	$3,337,654.00
June 30, 1994	$3,757,660.01	$3,292,759.99
June 30, 1993	$3,548,885.74	$3,078,044.15

Table 1-16 Customers Receiving Free Water and Sewer Service
Fire Stations and Shops
Headquarters, 3rd & Federal Street
Mt. Ephraim & Kaighn
Liberty Station, 1301 Broadway & Liberty
9th & Morgan
27th & Hayes Avenue
6th & Kaighn Avenue
1150 Wright Avenue
27th & Federal Street
Local #788
Credit Union
Police Department Sub-Stations and Mini-Stations
Administration Building, 1 Police Plaza, 800 Federal St.
1st Police District, 7th & State Street
2nd Police District (temporarily located at 800 Federal St.)
3rd Police District, 29th & River Road
4th Police District, 1222 Kaighn Avenue
1st District, Walter Rand Transportation Center
2nd District, Yorkship Square
3rd District, 2612 Federal Street
3rd District, 33rd and Westfield
3rd District, 219 Marlton Pike
4th District, Our Lady of Lourdes Hospital