

## SECTION IV

### SPECIFICATIONS FOR WATER SYSTEM

SECTION IV  
TABLE OF CONTENTS

	<u>PAGE NO.</u>
401: SPECIFICATIONS	
401.1 General	37
401.2 Prior to Construction	37
401.3 Property Damage	38
401.4 Backfill	38
401.5 Trees and Shrubs	38
401.6 Methods of Construction	38
401.7 Materials	42
401.8 Administrative Procedures Prior to Tapping of Mains	47
401.9 Testing and Disinfection Procedures	47
401.10 Abandonment of Water Services	51
	<u>SHEET NO.</u>
402: STANDARD DETAILS	
Water Main Crossing/Offset	1W
Water Main Protective Cradle	2W
Thrust Block Detail for Water Main	3W
Stabilized Access Road	4W
Future Water Main and Wet Tap Connections	5W
Concrete Encasement	6W
Fire Hydrant Connection	7W
Post Hydrant Blowoff	8W
Air Release Manhole	9W
Meter Pit Plan View	10W
Meter Pit Section View	11W
Water Service Connection	12W

## 401: WATER MAIN SPECIFICATIONS

### 401.1 GENERAL

Water mains are installed to provide a means for conveying water from the wells or storage tanks to some distance point where it may be used for human consumption, fire protection, watering of lawns and gardens or for many other purposes. Since this water is used for human consumption among other things, the necessity for safe potable water is easily recognized.

In order to provide a water distribution system of high reliability, the construction of same must be inspected to insure that all rules and regulations are being met and that workmanship in general meets minimum specification requirements. After construction has been completed, all lines must pass a chlorine residual test, a pressure test and a bacteriological test.

It shall be the responsibility of the developer or owner to maintain these lines after preliminary inspection has been completed and the water mains activated. The Authority reserves the right to direct the responsible party to have the water mains retested when, in the opinion of the Authority, the water mains or appurtenances have been subjected to stresses or damage to such a degree that retesting is deemed necessary.

Once all construction has been completed but prior to the Authority accepting the lines, an inspector from the Authority will perform a final inspection of all water boxes and valves to see that they are physically sound and to proper grade. All hydrants and valves will be inspected and tested to see that they operate properly and that all valves are accessible. Should any problems be encountered during this inspection, it will be the developer's or owner's responsibility to make the necessary repairs and/or replacements.

### 401.2 PRIOR TO CONSTRUCTION

Prior to starting construction of any water main, the developer or owner must have in his possession a set of Authority approved drawings. In addition, he must have paid all the necessary charges and fees, and submitted the necessary bonds. When easements are necessary, all deeds and agreements must be submitted in a form satisfactory to the Authority. If road opening permits are required, these must also be obtained before work can start.

#### 401.3 PROPERTY DAMAGE

When private or public property is damaged during construction, it will be the responsibility of the contractor to reestablish same in as good or better condition than it was prior to construction.

#### 401.4 BACKFILL

Select fill will be used for trenches when, in the opinion of the inspector, the soil removed from the trench is not suitable for use as backfill.

#### 401.5 TREES AND SHRUBS

The contractor will use the utmost care not to uproot or damage any more trees or shrubs than is absolutely necessary during construction of water mains or associated work.

#### 401.6 METHODS OF CONSTRUCTION

A. EXCAVATION: Excavation shall not be carried below the required level except where unstable soil is encountered. Whenever excavation has been made below the required level, it shall be replaced with 3/4" crushed stone and shall be thoroughly tamped. The Engineer shall determine the depth of removal of unstable soil encountered. Excavation for manholes and other structures shall have a twelve inch (12") minimum clearance and twenty-four inch (24") maximum clearance on all sides. The width of trenches for pipe shall equal pipe outside diameter plus two feet (2'), unless otherwise provided by the Engineer. Rocks and boulders present in excavation shall be removed within six inches (6") of pipe. Excavations shall be confined within the narrowest possible limit and made as nearly as possible in a vertical line, and any sheathing, shoring, bracing and timbering which is necessary to obtain this result shall be done as hereinafter specified. Preliminary excavation shall be made only to a depth of three inches (3") above the final depth of any trench or other excavations. The remaining depth shall be carefully excavated, shaped, and formed with hand tools immediately preceding laying of pipe or placing concrete. Trench bottoms shall be accurately formed to receive and support the bottom of the barrel of pipe. Additional excavation shall be made in pipe trenches at the pipe joints and to

prevent any possibility of a pipe resting on the bell rather than the barrel.

- B. GRADING: Ground adjacent to the excavations shall be graded to prevent water from running in. The contractor shall remove any water accumulating in excavations by pumping or other suitable means.
- C. BRACING, SHORING, SHEETING: The contractor shall do all bracing, shoring, and sheeting necessary to satisfy OSHA regulations; prevent failure of the banks of the excavation and to protect the work, workmen, public, under and above ground utilities and structures, pavements, and public and private property. No bracing, shoring, or sheeting shall be placed below the bottom of the pipe or structure unless approved by the Engineer. Shoring, sheeting and bracing of any kind shall be withdrawn as the backfilling proceeds, except that the Engineer may require such bracing to be left in place if it has been placed below the bottom of any structure or pipe, or if he deems it necessary in order to protect adjacent structures, utilities or property.
- D. DEWATERING: The contractor shall provide, install, and operate an adequate well-point system for dewatering when necessary to stabilize trench bottoms and banks or other excavations or when necessary, to protect the work, workmen, public, under and above ground utilities and structures, pavements, and public and private property. The well-point system or portions thereof shall be removed by the contractor upon the completion of backfill, and the holes remaining from the points shall be backfilled and thoroughly tamped.
- E. KEEPING TRENCH DRY: Any and all groundwater which may gather in the trenches from any source whatsoever, must be pumped or bailed to provide a dry trench during the pipe laying functions. No water will be permitted to run through the open pipe joints or through the pipe during the construction period. All water pumped from the trenches shall be disposed of in a manner satisfactory to the owner, developer and/or the Authority inspector.
- F. BACKFILLING: After the structure has been completed, inspected and approved, or, in the case of pipe, after each joint has been made, inspected and approved, backfill shall proceed immediately. When pipe has been laid, this shall be done in six inch (6") layers of loose granular material free from large stones, each layer thoroughly tamped, to a height of twenty-four inches (24") above the outside top of pipe. The remainder of the trench and the entire excavation of all structures other than pipe shall be backfilled in twelve inch (12")

layers, loose measure, each layer thoroughly tamped. Dampening of the material to be tamped may be required by the Engineer.

- G. COMPACTING OF SOIL: Compaction shall conform to Section 207 of the New Jersey State Highway Department Standard Specifications except that puddling will not be permitted.

H. PIPE BEDDING:

Care must be taken to bed the pipe properly on a stable bottom. When required, varying amounts of stone must be used to stabilize the area under the pipe. The grading of the trench bottom must be such that the bottom of the pipe, for its entire length, is resting on stable material (stoned bottom or virgin soil) which will result in even loading along the pipe after the trench is backfilled and, during the earth settling process. When this material, in the opinion of the Authority Inspector, is not suitable, the area around the pipe must be filled with stone or select fill up to the spring line.

At no time will stone be scraped up from along the sides of the trench and piled along the sides of the pipe. The practice of pyramiding stone along the line is unacceptable.

I. PIPE LAYING

Inspection: Once the trench has been established at the proper depth and grade and the bottom of the trench satisfactorily stabilized, the pipe and associated items shall be installed. Installation of all lines and appurtenances shall be done in the presence of the Authority Inspector. The builder and/or the contractor is responsible for notifying the Authority Inspection Department forty-eight (48) hours in advance that inspection will be required at a specific time and place. Should the contractor neglect to notify the Authority that inspection is required, and proceed without inspection, all work performed without inspection will be considered unacceptable.

Alignment: Water mains shall be laid in straight lines except when otherwise specifically approved by drawings or directed by the Authority Inspector. When deviation from a straight line is permitted, the deflection of each joint shall not exceed the manufacturer's recommended maximum for the type of joint and size of pipe being installed. Pipe shall be laid with at least four feet (4') of cover over the pipe to proposed finished grade or to the future finished grade when such is lower. Along extensions of roads which are unimproved, the

pipe shall be laid with at least five feet (5') of cover over the top of the pipe to the existing grade. The depth of pipe may be increased locally to pass obstructions. Grade changes shall be accomplished by fittings and/or dividing the necessary deflection among several joints as approved by the inspector.

Water Service: Laterals shall be laid in straight lines and special care shall be exercised to remove all dirt, stones and other materials from each pipe as it is laid, and to prevent any such materials from entering the pipe line. The contractor shall see that the entire line is maintained absolutely clean on the inside and that all valves and hydrants are clean and in good working order when installed. Open ends shall be adequately protected at all times and shall be securely sealed with approved plugs whenever work is stopped for any reason whatsoever. After removing a plug, the interior of the pipe line shall be inspected and the ends of the pipe and all joint members shall be thoroughly cleaned before resuming pipe laying operations.

Examining Pipe for Defects Prior to Installation: Before placing each length of pipe, the contractor shall carefully examine it for breaks, cracks or other defects and shall discard any section which appear in any way to be defective. All pipe and fittings shall be handled and installed with care to avoid damage. Ringing of cast iron with a small hammer is recommended to detect cracks in the pipe that may not be readily visible to the naked eye.

Trench Construction: Each section of pipe shall be solidly bedded in the trench bottom and shall be supported for its full length.

Layout and Installation: All mating shall be done in strict accordance with the manufacturer's recommendations and the requirements of the Authority inspector. The contractor shall do all necessary pipe cutting and shall locate valves, fittings and fire hydrants in the exact positions indicated on approved drawings. He shall provide and use cutting tools of an approved type and in good order, so as to insure clean, square cuts to exact measurements. All fittings and valves shall be set accurately true to and square with pipe lines. Valve stems shall be accurately plumb. Fittings and valves shall be supported by approved blocking so as to insure that they remain accurately in position during jointing and that their weight will not place undue strain on connecting pipe or joints. Valve boxes shall be set plumb, accurately centered with respect to the valve stem, well supported by solidly tamped earth and with their tops flush with the finished grade of the roadway or surface of the ground where set.

Separate Trench: No water service pipe shall be laid:

1. In the same trench with a gas pipe, drain or any other facility of any utility company;
2. Within three feet (3') of any open excavation;
3. In conflict with any sidewalk or driveway running at right angles to the front of the building; and
4. Within ten feet (10') of a cesspool or septic tank.

Except as permitted below, the underground water service pipe and the sanitary sewer shall be not less than ten feet (10') apart horizontally and shall be separated by undisturbed or compacted earth:

1. The bottom of the water service pipe at all points shall be at least twelve inches (12') above the top of the sewer line at its highest point.
2. The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
3. The number of joints in the water service pipe shall be kept to a minimum.
4. The materials and joints of sewer and water service pipe shall be installed in such manner and shall possess the necessary strength and durability to prevent the escape of solids, liquids, and gases therefrom under all known adverse conditions such as corrosion, strains due to temperature changes, settlement, vibrations and superimposed loads.
5. The installation is approved by the building/plumbing inspector.

#### 401.7 MATERIALS

- A. DUCTILE IRON PIPE: All ductile iron pipe shall conform to the requirements of ANSI A21.51 (AWWA C151) and shall be manufactured in eighteen (18) or twenty (20) foot nominal lengths.

The joints shall be of the Tyton Joint Type (push-on-joint) using a single elongated gasket to effect the joint seal, unless mechanical



joints are noted on the drawings. All mechanical joints and push-on-joints shall conform to the requirements of ANSI A21.11 (AWWA C111).

The pipe shall conform to the specifications shown on the following schedule:

<i>SIZE PIPE INCHES</i>	<i>PRESSURE CLASS</i>
<i>4" through 12"</i>	<i>350</i>
<i>14" through 24"</i>	<i>250</i>

All manufacturers will validate, other than by certification, the ductility of each length of pipe by an Underwriters Laboratory approved method. All ductile iron pipe is to have Underwriters Laboratory approval.

- B. *CEMENT LINING*: All ductile iron water pipe shall be cement lined in accordance with ANSI Specifications A21.4, seal coated inside (BCL & SC), four inch (4") through twelve inch (12") pipe - minimum 1/8", eighteen inch (18") pipe - minimum 3/16", (AWWA C-104); outside coating 1 mil. bitumastic material.
  
- C. *PIPE FITTINGS*: Shall be cast iron fittings conforming to the requirements of ANSI A21.10 (AWWA C110) with a minimum pressure rating of 250 psi. Fittings shall be cement lined and seal coated inside, and coated outside in accordance with the paragraph in this specification entitled "Cement Lining".

Mechanical joints will be used at fittings only. Gasket type push-on joints are the Authority standard for the remaining portions of the water line unless prior approval is obtained from the Authority.

- D. *VALVES AND VALVE BOXES*: Valves shall be Mueller, Kennedy, U. S. Pipe, or approved equal, and shall be in accordance with the latest standard specifications for resilient seated gate valves, as designated in AWWA C509, except as otherwise noted below. Valves to be iron body; bronze mounted double disc with parallel or inclined resilient seats; water working pressure to equal 200 pounds; non-rising stem type; mechanical joint ends and 316 stainless steel nuts, bolts and

test plugs. All valves shall be opened by turning to left, or counterclockwise. Valves opening clockwise are not to be used.

All valves shall be provided with cast iron extension boxes and covers (minimum 6" diameter) set at grade. Valve box lids shall be marked "WATER". Two (2) "T" handle socket wrenches of 5/8" round stock and long enough to extend two feet (2') above top of deepest valve box shall be provided for each size of valve furnished. Valve boxes shall have lid locking or retaining mechanisms.

When use of any pipe other than cast or ductile iron is desired, prior written approval must be obtained from the Authority.

E. FIRE HYDRANTS

The following hydrants shall be acceptable:

- Darling hydrant ..... B-62-B
- Mueller hydrant ..... Supercenturion 200
- Kennedy hydrant ..... K-81

or as approved by the Executive Director of the Authority.

All fire hydrants shall comply with the following requirements:

1. Size of hydrant - five inch (5") minimum.
2. Direction to open - clockwise.
3. Size and shape of operating nut - 1½" from point to flat -- pentagon.
4. Size of hose nozzle: 2-2½ I.D. National Standard. Thread - 7½ threads per inch. One (1) steamer nozzle O.D. 5.750 - I.D. 4½". Four (4) threads per inch.
5. Internal valve opening - 5¼".
6. Color:  
Barrel - red.  
Top and nozzle caps - fluorescent white.

- 7. Depth of bury - 4'6".
- 8. Size and type of connection to main - 6" - MJ.

Hydrants must be located no further than 500 feet from one another along road or street lines.

Hydrants will be located in accordance with Evesham Township Fire Marshal and Authority approved drawings. The steamer connection will be turned to face the road or street to provide easy access.

The elevation of the hydrant will be such that the bottom of the steamer connection will be not less than eighteen inches (18"), nor more than twenty-four inches (24") from the finished grade.

A stone sump two feet (2') in length, width and depth will be installed under each fire hydrant to permit the hydrant to drain after it has been turned off. (Use 3/4" stone.)

A concrete thrust block will be poured behind the "tee". The hydrant shall be rodded (see hydrant sketch).

F. TIE RODS:

When tie-rodding is necessary, the following, as a minimum, shall be required:

NUMBER OF 3/4" RODS REQUIRED

PIPE SIZES (INCHES)	NO. OF RODS
12" and less	2
14" and 16"	4
18" and 20"	6
24"	8

G. THRUST BLOCKS:

Thrust blocks will be installed or lines rodded at all bends and at all tees, plugs, valves, blowoffs, reducers and fire hydrants. This is to prevent movement of the lines or appurtenances under pressure. The

contractor will use rods instead of thrust blocks or the reverse when directed by the Authority inspector.

The following is a list of requirements governing the construction of thrust blocks:

1. All thrust blocks will be constructed of poured concrete with a minimum twenty-eight (28) day compression strength of 4,000 psi. Dry laid concrete block or any other type of construction is not acceptable for thrust blocks unless prior approval has been obtained in writing from the Authority inspector.
2. The bearing area of the thrust blocks will be poured against undisturbed soil and the bearing area shall be sufficient to prevent any movement when lines are tested and again when they are put into operation. The thrust block size will vary with the size of the line and the soil bearing properties of the exposed earth. In making this calculation, always use 150 psig as the internal line pressure. See nomograph included with this specification for determining thrust block size.

#### H. WATER METER PITS:

When and if required and/or necessary, the design of all meter pits shall be approved by the Authority.

The meter pits, as a minimum, shall meet the following requirements:

1. Waterproof.
2. Frost proof.
3. Constructed with sump.
4. A sump pump shall be installed.
5. The minimum clearance from shutoff valves to end of pit shall be twelve inches (12").
6. The minimum sidewall clearance of piping shall be twenty-four inches (24").
7. Hinged, locking access hatch shall be provided for the entire length and width of pit (minimum size 4' x 4'), or of sufficient

size to gain complete vertical access to all meters and entrance into the meter pit, via wall mounted ladder. The hatch shall be constructed of aluminum and withstand a loading of 500 lbs./S.F. The hatch shall be as manufactured by Bilco or an approved equal.

8. A retractable ladder extension (Bilco Ladder-up or equal) shall be provided for access purposes.
9. Telephone and electric service shall be required at each meter pit to allow connection of the meter to the Authority's meter reading system and the installation of an electric sump pump.

I. INTERIOR WATER METER INSTALLATION:

All water meters installed in buildings shall be located in a heated area as close as possible to the point of water service entry.

The meter shall be installed a minimum of thirty-six inches (36") and a maximum of forty-eight inches (48") above the floor and a minimum of twelve inches (12") and a maximum of twenty-four inches (24") offset from the wall. This shall include the required isolation valves and fittings and the telephone line connection for the Authority's automatic meter reading system.

401.8 ADMINISTRATIVE PROCEDURES

Tapping of the main shall not be permitted until W-3 approval has been granted and the appropriate performance bonds have been posted.

401.9 TESTING AND DISINFECTION PROCEDURES

A. Purpose

The purpose of this procedure is to establish a uniform method of testing public water supply systems for exfiltration, chlorine residual, disinfection, and bacteria.

B. Exfiltration Test Procedure

The tests shall be performed in the presence of the Authority inspector.

1. After the pipe has been laid or installed, it shall be subjected to a hydrostatic pressure test. For pressure piping, it is recommended that testing be conducted prior to the complete backfilling of the trench. For pressure piping in structures, testing shall be conducted prior to the completion of any construction which would make it impossible or difficult to gain access to the pipe if found defective. The contractor shall test sections of pipe between valves, or as otherwise instructed by the Engineer.
2. The contractor shall make the necessary arrangements with the Authority to obtain the water required for pressure and leakage tests, and for subsequent sterilization procedures. The Contractor shall furnish the necessary labor, pumps, valves, pressure gauges, water meters and all other equipment required for this purpose.
3. During testing, each section of pipe shall be slowly filled with water and the pipe shall be gradually subjected to a hydrostatic pressure of 150 psi and maintained for a period of two (2) hours with no more than 5 psi variation during the test. Before applying the specified test pressure, all air shall be expelled from the pipe, through hydrants, blowoffs, or any taps that may be necessary for the release of air from the highest points. Taps required for the release of air and blowoffs required for filling the line shall be furnished and installed by the contractor. The cost of such taps shall be included in the unit prices bid for the water main. Prior to beginning the two (2) hour test period, a five (5) minute stabilization period is recommended.
4. When the test pressure has been reached, the amount of make-up water to maintain the test pressure shall be measured. No pipe installed will be accepted if the amount of leakage exceeds twelve (12) gallons per day per inch of diameter per mile of pipe. Where sections of pipelines fail to meet this requirement, they shall be repaired, again maintained under pressure for two (2) hours, and retested as necessary until these requirements are satisfied. All visible leaks shall be repaired regardless of the amount of leakage.
5. Calculations to determine water loss per inch of pipe per day per mile shall be done as follows:

- o  $\frac{\text{Gallons of make-up water} \times 24}{\text{duration of test (in hours)}} = \text{gals. loss/day}$
- o  $\frac{\text{gals. loss/day} \times 5,280 \text{ ft./mile}}{\text{feet of pipe being tested}} = \text{gals/inch dia/mile/day}$
- o  $\frac{\text{gals loss/mile/day}}{\text{pipe dia. (in inches)}} = \text{gals/inch/dia/mile/day}$

Maximum allowable exfiltration rate is 12 gals/inch dia/mile/day.

C. Disinfection

1. Each completed unit of the water distribution system shall be thoroughly sterilized with chlorine before it is placed in operation. Calcium hypochlorite tablets shall be used for disinfection.
2. The amount of chlorine applied shall be such as to provide a dosage of at least 50 ppm. The contact period shall be at least twenty-four (24) hours, at the end of which time the chlorine residual shall be at least 10 ppm. This residual shall be verified by the Authority. The line should then be flushed with clean water until the chlorine residual is not greater than 0.2 ppm or the background residual.
3. Generally, the required chlorine shall be provided in the form of high test calcium hypochlorite (HTH) in tablets approximately 5-g in weight and containing sixty-five percent (65%) available chlorine by weight. The number of tablets required per length of pipe shall be determined from the following table:

TABLETS PER SECTION

LENGTH OF SECTION	6"	8"	10"	12"
13'	2	3	4	4
18'	3	3	4	6
20'	3	4	5	6

4. The required number of tablets should be fastened to the top of each length of pipe as it is laid using hot tar or "Permatex No. 2" gasket cement as the adhesive. Care should be taken to see that the adhesive only covers one (1) side of each tablet so that as much surface as possible is exposed to the water when it is introduced into the main. One (1) tablet shall also be placed in each hydrant, hydrant branch and other appurtenance. The velocity of the water used to fill the line shall not exceed 1 foot/second.
5. Other methods of sterilization may be used, however, prior approval must be obtained from the Engineer in writing prior to the test being performed.

#### D. Bacteria Test

1. After flushing has been completed and the chlorine residual is not greater than 0.2 ppm or background, a bacteriological test shall be performed. Chlorine residual and bacteriological quality shall be determined in accordance with the New Jersey Department of Environmental Protection and Energy, Potable Water Standards Bulletin PW-D 10, December 1970. If water or debris has entered the line prior to chlorination and testing, samples shall not be taken until sixteen (16) hours after flushing. At least one (1) test shall be taken for each 2,500 L.F. of water main.
2. The mouth of the valve, hydrant, blowoff, etc. used for collection of the sample shall be sterilized using a propane torch or equivalent and water shall then allowed to flow for a period of not less than five (5) minutes prior to taking sample.
3. The sample shall be collected in sterile bottles treated with sodium thiosulfate as required by Standard Methods for the Examination of Water and Wastewater (SMEWW). A New Jersey certified lab must pick up the sample in the field.
4. Samples will be collected in the presence of Authority personnel or Engineering representatives, who will note the date and time of the samples taken. The sample will then be delivered to a certified laboratory approved by the Engineer. The cost of all testing shall be borne by the applicant.



5. Analysis shall consist of testing of bacteriological quality (both Total Coliform and Total Heterotrophic Plate Count) in accordance with SMEWW. Copies of the analysis shall be sent to the Authority and Authority Engineer directly from the laboratories. The Authority Engineer shall issue written approval prior to activation of the water mains.
6. In the event that the chlorine residual is found to exceed 0.2 ppm or the background level, the line shall be reflashed and allowed to sit for sixteen (16) hours, after which time samples may be taken for retesting.
7. In the event that the laboratory analysis shows bacteria present (coliform greater than 0/100 mL, HPC greater than 100/100 mL), the line shall be rechlorinated, flushed, allowed to sit sixteen (16) hours, and a new sample taken. This process shall be repeated until such time as the test results are in conformance with the above standards.
8. The locations for bacteriological testing shall coincide with the sections of main as pressure tested unless otherwise approved or required by the Engineer.
9. In the event that a water main is not placed into active service (at least one occupied building connection) within thirty (30) days from the bacteriological test, the line shall be retested. If the second bacteriological test is not passed, the main shall be disinfected and tested again.

Prior to any public water supply system being accepted by the Authority, all of the requirements contained herein shall have been satisfied.

401.10

#### ABANDONMENT OF WATER SERVICES

The method to be used to formally abandon a water service shall be determined by the Authority upon inspection of the service line to be abandoned.

## 402: WATER SYSTEM STANDARD DETAILS

## SECTION V

### SPECIFICATIONS FOR SEWERAGE SYSTEM

SECTION V  
TABLE OF CONTENTS

		<u>PAGE NO.</u>
501:	SPECIFICATIONS	
	501.1 General	55
	501.2 Basic System Requirements	56
	501.3 Materials	58
	501.4 Methods of Construction – General	59
	501.5 Methods of Construction - PVC Pipe	65
	501.6 PVC Pipe Installation	67
	501.7 Minimum Grades and Velocity	71
	501.8 Pumping Station	72
	501.9 Sanitary Force Mains	82
	501.10 Inspection and Testing of Sanitary Sewer System	84
		<u>SHEET NO.</u>
502:	STANDARD DETAILS	
	PVC Gravity Sewer Main and Lateral Trench/ Bedding	1S and 2S
	Precast Concrete Sanitary Sewer Manhole (48")	3S
	Precast Concrete Sanitary Sewer Manhole (60")	4S
	Precast Concrete Sanitary Sewer Drop Manhole	5S
	Sanitary Force Main Blowoff Manhole	6S
	Sanitary Lateral Observation Riser (In Paving)	7S
	Sanitary Sewer Service Lateral	8S
	Sanitary Force Main Air Release Manhole	9S
	Sanitary Force Main Discharge Manhole	10S
	Thrust Block for Sanitary Force Main	11S
	Stabilized Access Road	12S
	Two Strap Saddle	13S
	Dry Well Bypass	14S
	Concrete Cradle at Crossings with Water Mains	15S

## 501: SANITARY SEWER MAIN SPECIFICATIONS

### 501.1 GENERAL

The Purpose of this document shall be to set forth rules, regulations, and standards to guide developers and builders in Evesham Township, so as to promote the public health, safety, convenience and general welfare of the municipality. These rules and specifications shall be administered by the Authority to insure the orderly growth, development and construction of the sanitary sewer system, so as to provide the best possible sewage collection and treatment facilities in accordance with the requirements of the Department of Environmental Protection and Energy of the State of New Jersey, and of the Authority.

A sanitary sewer system consists of a wastewater treatment plant and a network of pipes, manholes and lift stations necessary to collect and transmit wastewater from its origin to the point of treatment.

This specification delineates both general and detailed requirements for the construction of the sanitary sewer lines and accessories under the jurisdiction of the Authority.

These regulations will be administered by the Authority and are minimum requirements. They are intended to apply to the usual conditions encountered during design and construction. These specifications are subject to amendment for exceptional situations. The Authority reserves the right to specify greater or less stringent requirements in any case in their judgment to be in the best interest of the community.

It is advisable before detailed design proceeds on any sanitary sewer or system to prepare preliminary reports and plans and submit them to the Authority Office for the purpose of review and discussion of the proposal. At this time, the Authority will make comments and/or provide pertinent data applicable to these plans. The Authority will also provide the forms and information necessary to obtain approval for the construction of new sanitary sewer facilities and for obtaining wastewater treatment services.

The Authority recognizes the fact that questions may arise during the planning, construction and/or testing phases of sanitary sewerage development that may or may not be covered by specifications, rules or regulations. In these cases, the Authority will take whatever action is necessary to either clarify the meaning of the specifications or provide direction or information necessary for the developer, builder or contractor to understand and meet Authority requirements.

## 501.2 BASIC SYSTEM REQUIREMENTS

The maximum length of any line between manholes shall not exceed 400'.

A manhole shall be constructed at any point where the line changes direction or grade; no curved lines will be allowed.

A drop manhole shall be constructed when the inverts of the influent and effluent lines of the manhole differ by more than twenty-four inches (24").

Force mains shall not be tied directly into the gravity manhole. An energy dissipation manhole will be constructed adjacent to the gravity manhole and the force main terminated in this manhole. The effluent from the energy dissipation manhole will flow by gravity into the manhole which is part of the gravity system.

Sanitary sewer mains shall be installed at least five feet (5') from curbs or sidewalks. No underdrains, conduits and/or cables of any nature will be installed in the same trench with sanitary sewerage. Unlined ductile iron pipe will be used when the sanitary main is installed at a depth less than thirty-six inches (36") and at all stream crossings or along any bodies of water where the distance to the embankment is less than ten feet (10'). In no instances shall sanitary mains or laterals be installed with less than thirty inches (30") cover.

Sewer and water mains generally shall be separated a distance of at least ten feet (10') horizontally. If such lateral separation is not possible in the opinion of the Engineer, the pipes shall be in separate trenches with the sewer at least eighteen inches (18") below the bottom of the water main or as otherwise approved by the Authority. In general, the vertical separation at a crossing of sewer and water lines shall be at least eighteen inches (18"). Where this is not possible, the sewer shall be constructed of ductile iron pipe using "push-on" or mechanical joints for a distance of at least ten feet (10') on either side of the crossing, or other suitable protection as approved by the Engineer, shall be provided.

Any sewer within one hundred feet (100') of a water supply well or below-grade reservoir shall be of ductile iron, cast iron or other suitable material, properly protected and of completely watertight construction.

When a new sanitary line is constructed and tied into an active manhole, the new line will be plugged. This line will remain plugged until all testing has

been completed on the new sanitary sewer main and all associated lines. This plug will not be removed without the approval of the Authority or their representative.

All sanitary sewer laterals that are scheduled for connection to a specific sewer main must be connected and extended to the curb line prior to performing any acceptance testing on that line.

Neither repair clamps nor saddles are permitted to be used on new sanitary sewer lines within Evesham Township. These items are to be used in cases of emergency, and then only with the prior written approval of the Authority.

When trenching or boring in or along State, City, Borough, Town, County and/or Township highways, the contractor will be governed by the conditions, restrictions and regulations made by the State Highway Department, the County Commissioners, Municipal Officials and/or the Township Commissioners. These regulations shall be in addition to those set down in this specification.

Extensions to the sanitary sewer main shall be installed in a dedicated right-of-way or easement and extended to a point directly opposite the building to be serviced.

No sewer service lateral shall be laid in the same trench with any gas pipe, electrical service, or any other facility of any utility company, nor within three feet (3') of any open excavation, vault, meter pit; nor shall the location be in conflict with any sidewalk or driveway running at right angles to the front of the building.

Except as permitted below, the underground water service pipe and the sanitary sewer lateral shall be not less than ten feet (10') apart horizontally and shall be separated by undisturbed or compacted earth:

1. The bottom of the water service pipe at all points shall be at least twelve inches (12") above the top of the sewer line at its highest point.
2. The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
3. The number of joints in the water service pipe shall be kept to a minimum.
4. The materials and joints of sewer and water service pipe shall be installed in such manner and shall possess the necessary strength and durability to prevent the escape of solids, liquids, and gases

therefrom under all known adverse conditions such as corrosion, strains due to temperature changes, settlement, vibrations and superimposed loads.

5. Approval of the installation is given by the building/plumbing inspector.

### 501.3 MATERIALS

#### A. Ductile Iron Pipe and Fittings for Gravity Mains

Ductile iron pipe shall be centrifugally cast in conformance with AWWA C-151, shall be pipe thickness Class 51 and shall be manufactured in eighteen foot (18') or twenty foot (20') nominal lengths. Cement lining of ductile iron pipe is prohibited for sewer service installations.

Ductile iron joints shall be push-on type conforming to AWWA C151 with gaskets conforming to AWWA C111.

Ductile iron pipe fittings shall be push-on type, conforming to AWWA C110 with a minimum pressure rating of 250 psi.B. PVC Gravity Sewer and Fittings

PVC gravity sewer for proposed sanitary sewer systems shall be as follows:

1. ASTM D-3034; SDR 35; sizes four inch (4") through fifteen inch (15").
2. ASTM F-679; sizes eighteen inch (18") through twenty-seven inch (27"); minimum pipe wall thickness T-1.
3. ASTM F-794; sizes eighteen inch (18") through forty-eight inch (48") ribbed.

Joint design shall be ASTM D-3212, push-on type joint using an elastomeric ring gasket.

Infiltration shall not exceed 12 gallons/inch diameter/mile/day.

Joint material shall be elastomeric ring rubber gasket, ASTM D-3212.



Joint material primer/adhesive shall be as provided or specified by pipe manufacturer.

#### 501.4 METHODS OF CONSTRUCTION - GENERAL

##### A. Excavation:

Excavation shall not be carried below the required level except where unstable soil is encountered. Whenever excavation has been made below the required level, it shall be replaced with 3/4" crushed stone, coarse aggregate No. 57 or equivalent, and shall be thoroughly tamped. The Engineer shall determine the depth of removal of unstable soil encountered.

Excavation for manholes and other structures shall be a twelve inch (12") minimum clearance and twenty-four inch (24") maximum clearance on all sides. The width of trenches for pipe shall equal pipe outside diameter plus two feet (2'), unless otherwise provided by the Engineer. Rocks and boulders present in excavation shall be removed within six inches (6") of pipe. Excavations shall be confined within the narrowest possible limit and made as nearly as possible in a vertical line, and any sheathing, shoring, bracing and timbering which is necessary to obtain this result shall be done as hereinafter specified. Preliminary excavation shall be made only to a depth of three inches (3") above the final depth of any trench or other excavations. The remaining depth shall be carefully excavated, shaped, and formed with hand tools immediately preceding laying of pipe or placing concrete. Trench bottoms shall be accurately formed to receive and support the bottom of the barrel of the pipe. Additional excavation shall be made in pipe trenches at the pipe joints and to prevent any possibility of a pipe resting on the bell rather than the barrel.

##### B. Grading:

Ground adjacent to the excavations shall be graded to prevent water from running in. The contractor shall remove any water accumulating in excavations by pumping or other suitable means.

##### C. Bracing, Shoring and Sheeting:

The contractor shall do all bracing, shoring and sheeting necessary to prevent failure of the banks of the excavation and to protect the work,

workmen, public, under and above ground utilities and structures, pavements, and public and private property. No bracing, shoring or sheeting shall be placed below the bottom of the pipe or structure unless approved by the Engineer. Shoring, sheeting and bracing of any kind shall be withdrawn as the backfilling proceeds, except that the Engineer may require such bracing to be left in place if it has been placed below the bottom of any structure or pipe, or if he deems it necessary in order to protect adjacent structures, utilities or property.

D. Dewatering:

The contractor shall provide, install and operate an adequate well-point system for dewatering when necessary to stabilize trench bottoms and banks or other excavations or when necessary to protect the work, workmen, public, under and above ground utilities and structures, pavements and public and private property. The well-point system or portions thereof shall be removed by the contractor upon the completion or backfill, and the holes remaining from the points shall be backfilled and thoroughly tamped.

E. Keeping Trench Dry:

Any and all groundwater which may gather in the trenches from any source whatsoever must be pumped or bailed to provide a dry trench during the pipe laying functions. No water will be permitted to run through the open pipe joints or through the pipe during the construction period. All water pumped from the trenches shall be disposed of in a manner satisfactory to the owner, developer and/or the Authority Inspector.

F. Backfilling:

After the structure has been completed, inspected and approved, or, in the case of pipe, after each joint has been made, inspected and approved, backfill shall proceed immediately. When pipe has been laid, this shall be done in six inch (6") layers of loose granular material free from large stones, soil aggregate 1-8 or equivalent, each layer thoroughly tamped to a height of twenty-four inches (24") above the outside top of pipe. The remainder of the trench and the entire excavation of all structures other than pipe shall be backfilled in twelve inch (12") layers, loose measure, each layer thoroughly tamped. Dampening of the material to be tamped may be required by the Engineer.

G. Compacting of Soil:

Compaction shall conform to Section 207 of the New Jersey State Highway Department Standard Specifications, except that puddling will not be permitted.

H. Pipe Bedding:

Care must be taken to bed the pipe properly on a stable bottom. When required, varying amounts of stone must be used to stabilize the area under the pipe. The grading of the trench bottom must be such that the bottom of the pipe, for its entire length, is resting on stable material (stone bottom or virgin soil) which will result in even loading along the pipe after the trench is backfilled and during the earth settling process. When this material in the opinion of the Authority Inspector, is not suitable, the area around the pipe must be filled with stone or select fill up to springline.

At no time will stone be scraped up from along the sides of the trench and piled along the sides of the pipe. The practice of pyramiding stone along the line is unacceptable.

I. Pipe Laying:

Once the trench has been established at the proper depth and grade and the bottom of the trench satisfactorily stabilized, the pipe and associated items shall be installed. Installation of all sanitary sewer lines and appurtenances shall be done in the presence of the Authority Inspector. The builder and/or the contractor is responsible for notifying the Authority Inspection Department forty-eight (48) hours in advance that inspection will be required at a specific time and place. Should the contractor neglect to notify the Authority that inspection is required, and proceed without inspection, all work performed without inspection will be considered unacceptable.

J. Appurtenance Installation:

Construction details for manholes are provided on the sketches included as part of this specification. The general requirements are as follows:

1. Manholes: All manholes shall incorporate removable, high density polyethylene manhole inserts, 1/8" thick, between the manhole casting frame and lid to prevent surface water inflow

into the sanitary sewer system. Inserts shall have factory installed upper and lower gaskets, a ventilating valve and shall be constructed with a heavy duty nylon strap to allow for one-person removal and replacement.

Manholes shall be constructed of precast concrete. Concrete bases under manholes must extend six inches (6") beyond the manhole.

When constructing a drop manhole, a concrete base is required under the manhole that will extend at least six inches (6") beyond the manhole and the concrete drop.

No inside drops will be permitted on any manholes within Evesham Township.

At the time of initial construction, all castings will be set in cement to final grade and pointed so as to eliminate any chances of infiltration.

All manhole channels will be constructed of concrete to a depth of eighty percent (80%) of the pipe size and the width of the channel must be equal to that of the pipe it is servicing.

Ladders will be installed on the downstream side of the manhole just to the left of the channel. This ladder location in all cases will be the flat side of the manhole.

Ladder rungs shall be aluminum alloy 6061-T-6 conforming to the current American Society for Testing Materials. Bitumastic material or other approved methods shall be used to prevent corrosion on the aluminum rung where it is embedded in concrete.

The absolute maximum horizontal offset of ladder rungs will be two inches (2") from a ladder centerline from the top of the manhole to the bottom.

Ladder rungs will not protrude in excess of one and one-half inches (1½") beyond the rung above or below it.

The optimum spacing between rungs will be twelve inches (12"), and in no case will exceed fourteen inches (14").

A pipe terminating in manholes will be trimmed to within one and one-half inch (1½") beyond the rung or below it.

2. Precast Manholes: A minimum of eight inches (8") of stone will be required under all precast manholes or manhole bases.

All precast manholes will be installed with the ladder on the downstream side just to the left of the channel.

Rubber gaskets are required between each manhole section.

Joints between manhole sections and lift holes must be filled with non-shrink grout.

At least two (2) courses of brick or concrete spacers are to be installed under all manhole castings to allow for rim adjustment at a later date. The additional height resulting from the two (2) courses of brick must be taken into consideration when ordering manholes.

A maximum of four (4) courses of brick or concrete spacers will be used on any precast manhole. When a greater number of courses is required to attain the proper grade, another precast section will be used.

Flat tops for precast manholes will be permitted only when prior written approval has been granted by the Authority.

3. Laterals: All service laterals are to be connected to the main by means of a wye connection only. The standard residential lateral connection will be a minimum of six inch (6") diameter DIP or PVC pipe from the sewer main to a cleanout just behind the curb line and six inches (6") from the curb line to the house. Larger pipe sizes for laterals may be approved by the Authority as conditions warrant. All service laterals installed between the main and the lateral cleanout will be of the same material and laid with the same care prescribed in sewer mains, which includes stoning of the trench bottom when necessary to obtain a stable base under the pipe.

The standard sewer house service lateral will be constructed of cast iron, ductile iron, or Schedule 80 PVC. If the owner or builder desires to use pipe of a material other than that listed above, he must obtain the prior written approval of the

Authority. The Authority strongly recommends using the same material for both the service lateral and house service lateral. Adaptation from the service lateral to house service lateral, if required, must be approved by the Authority; i.e., iron to plastic.

All sanitary sewer laterals should be installed at a grade equal to one-quarter inch ( $\frac{1}{4}$ " ) per foot. Exceptions to this requirement must be obtained in writing from the Authority.

All laterals will be installed at a constant grade and in a straight line. There will be a cleanout constructed just behind the curb line and at any point where there is a change in the direction of the lateral. Cleanouts are required every fifty feet (50') on laterals. For cleanout and lateral construction details, see sketch which is part of this specification.

When the sanitary sewer main is over nine feet (9') in depth, the construction of a vertical riser is required up to a point eight feet (8') below finish grade. For construction details, see the sketch which is part of the specification.

Minimum depth for a PVC sanitary sewer house and service lateral is thirty-six inches (36").

Minimum depth for a DIP sanitary sewer house and service lateral is thirty-two inches (32").

4. Lateral Connection to Existing Main: Lateral connections to existing mains shall be completed using "wye" configuration sewer saddles. The saddle shall have an extra heavy cast iron base, specifically designed to conform to the contour of the existing pipe. The saddle shall be securely held in place with two (2) stainless steel straps and an O-ring which will form a seal between the existing main and the cast iron saddle base. The wye shall have a gasketed bell end, fabricated to exactly match the type of pipe being connected to the main.

The saddle shall be installed on the top half of the sewer main, forty-five degrees (45  ) from vert machine-drilled to provide a smooth, round hole, sized to provide one-eighth inch ( $\frac{1}{8}$ " ) space between the shoulder of the fitting and the face of the main sewer pipe. Joint material, if required to fill voids, shall be compatible with the gasket and

shall be completely waterproof and capable of withstanding the stresses normally encountered in construction or maintenance. The entire connection shall be encased in concrete, six inches (6") thick.

The entire connection shall be encased in concrete, six inch (6") thick.

#### 501.5 METHODS OF CONSTRUCTION - PVC PIPE

##### A. Reference standards used in this specification section:

1. American Society for Testing and Materials (ASTM):
  - a. ASTM D-3034: Type PSM Polyvinyl Chloride (PVC) sewer pipe and fittings.
  - b. ASTM F-679: PVC large diameter plastic gravity sewer pipe and fittings.
  - c. ASTM F-794: PVC large diameter ribbed gravity sewer pipe and fittings based on controlled inside diameter.
  - d. ASTM D-3212: Joints for drain and sewer plastic pipes using flexible elastomeric seals.
2. American Association of State Highway and Transportation Officials:

M-45-70 (1974): Aggregate for Masonry Mortar.
3. New Jersey Department of Transportation, Standard Specifications for Road and Bridge Construction, latest Supplement.

##### B. Submittals:

1. Manufacturer's literature and recommendations to be submitted to Engineer for review and approval.
  - a. Submit manufacturer's descriptive literature for all materials to be used.

- b. Submit pipe manufacturer's recommended method of gasket installation.
2. Certificates:
- a. Submit manufacturer's certified letter stating that pipe or joint material ordered meets requirements of this specification. Letter shall indicate compliance with appropriate ASTM designations listed.
  - b. Submit two (2) copies prior to installing materials.

C. Product Delivery, Storage and Handling:

1. Storage of Materials:
- a. Store materials to prevent physical damage.
  - b. Store pipe and fittings off ground to prevent dirt and debris from entering.
  - c. Store flexible gasket materials and joint primer or adhesive compounds, in cool dry place. Keep rubber gaskets clean, away from oil, grease, excessive heat, and out of direct rays of sun.
2. Handling of Materials:
- a. Protect materials during transportation and installation to avoid physical damage.
  - b. Use extra care in cold weather when flexibility and impact resistance of PVC pipe is reduced.
  - c. Do not install out-of-round pipe.
  - d. Unload pipe to prevent abrasion.
  - e. Do not drag, drop or push pipe when handling or distributing on project site.



D. Inspection by Contractor:

1. Check pipe for the following information which shall be clearly marked on each pipe section:
  - a. The legend "Type PSM" on SDR-35 PVC sewer pipe.
  - b. Nominal pipe size and DR or SDR rating.
  - c. The PVC cell classification, for example, 12454-B.
  - d. Name or trademark of manufacturer.
  - e. The ASTM specification designation.
2. Check fittings for the following markings:
  - a. The ASTM specification designation.
  - b. Manufacturer's name or trademark.
  - c. Nominal size.
  - d. The material designation PVC, PSM.
3. Inspect pipe for defects prior to placement in trench. The pipe and fittings shall be free from visible cracks, holes, foreign inclusions or other defects.
4. Assure that all materials are the type specified and are not defective. Unmarked pipe or pipe and materials not meeting specification requirements shall be removed from the site as directed by the Engineer.

501.6 PVC PIPE INSTALLATION

A. Excavation for trenches:

1. Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room.

- a. Maximum trench width to a point one foot (1') above the outside top of pipe shall be the pipe outer diameter plus sixteen inches (16").
  - b. Maximum trench width at ground surface shall be as required for depth of pipe.
2. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations.
  3. Trenches for pipes shall not be opened in advance of the linear feet of pipe that can be placed and backfilled in one (1) day.
  4. Grub roots and stumps within six inches (6") of outside surface of pipe bottom and sides to minimum depth of six inches (6") below bottom of trench.
  5. Install pipe bedding and material approved for initial backfill in accordance with the details shown on the plans and as specified herein.

B. Installation:

1. Lay pipe only in presence of Engineer. Engineer may order removal and relaying of pipe not so laid.
2. Fine grade trench bottom so that pipe is supported for its full length.
3. Lay pipe to lines and grades shown on plans. Face socket end of pipe in direction of pipe laying.
4. Do not lay pipe on unsuitable material, in wet trench, or in same trench with another pipe or utility.
5. Lower pipe into trench with ropes, machinery, or other means approved by Engineer.
6. General Procedure for Joining Pipe:
  - a. DO NOT USE EXCAVATING EQUIPMENT TO SHOVE PIPE SECTIONS TOGETHER.

- b. Hold pipe securely and in proper alignment when joining.
- c. Do not disturb previously made joints. Check completed piping to assure joints are intact. Insure placement of backfill over pipe is accomplished without disturbing pipe position.
- d. Do not allow earth, stones, or other debris to enter pipe or fittings.
- e. Method of installing joint materials and joining piping shall be in strict accordance with manufacturer's printed instructions as approved by the Engineer.

C. Backfill and Compaction:

1. Initial Backfill:

- a. Initial backfill material shall be stone crushings to conform with AASHTO Designation M45-70 (ASTM Designation 448-54), Size No. 8, 1/8" to 3/8" (2.36 mm to 9.25 mm) clean, free flowing and shall meet all ASTM C-33 requirements for quality and soundness.
- b. Install initial backfill material to twelve inches (12") above pipe.
- c. Material shall be placed under the pipe haunch to provide adequate side support. Material shall be installed entire trench width and shall be tamped and rodded to insure full contact with pipe at haunch up to the spring line.
- d. Little or no tamping of the initial backfill directly over the pipe should be done.

2. Final Backfill:

- a. Where required, complete backfilling with soil aggregate conforming to Section 901.09 of the NJDOT Standard Specifications for Road and Bridge Construction.

- b. Place backfill material in maximum six inch (6") lifts and compact to achieve the following dry densities:

Lawn/landscaped areas	90%
Paving/structure areas	95%

D. Testing:

- 1. Deflecting Testing: Maximum allowable pipe deflection (reduction in vertical inside diameter) shall be 7½".
  - a. Deflection tests shall be successfully performed on the complete installation by means of the following prior to the acceptance of construction.
    - 1) "Go-No-Go" mandrel properly sized.
    - 2) Calibrated television.
- 2. Lamping (Gravity Mains Only):
  - a. Engineer will lamp all installed pipe between manholes. Sewer lines shall meet the following standards to pass the lamping inspection.
    - 1) Barrel of pipe shall have no vertical deflection (not to be confused with the deflection test), and at least seventy-five percent (75%) of barrel shall be visible in the horizontal direction.
    - 2) Pipe not meeting this specification shall be relaid and relamped until compliance is achieved at no additional cost to Owner.
- 3. Air Testing:
  - a. Air testing shall conform to the requirements of the section of these specifications entitled "Low Pressure Air Testing of Sanitary Lines".

E. Appurtenance Installation:

- 1. Manholes:

- a. Precast manholes with connection ports shall have elastomeric seals precast into manhole walls.
- b. Precast manholes with connection posts shall have flexible boot of sleeve precast into manhole walls.
- c. All manholes shall incorporate removable, high density, polyethylene manhole inserts, 1/8" thick, between the manhole casting frame and lid to prevent surface water inflow into the sanitary sewer system. Inserts shall be constructed with a nylon strap to allow for one-person removal and replacement.

2. Laterals:

- a. All laterals shall be installed with the same construction procedure as the sewer main.
- b. Sewer laterals in streets and rights-of-way shall be a minimum of four inches (4") in diameter, with a minimum slope of 1/4"/foot slope.
- c. Laterals shall intersect the main at an angle 45 degrees from vertical.

All sanitary sewer lines must be installed in accordance with approved drawings, and all fittings are to be installed at the time the sanitary main is constructed. Saddles and repair clamps are not acceptable on new lines and will be used only with prior approval of the Authority or their representative, and shall be installed in strict accordance with their instructions. If and when saddles are approved, they will be of the strap on type; no bolt on saddles will be permitted in Evesham Township. See Section 501.4.J.4.

#### 501.7 MINIMUM GRADES AND VELOCITY OF FLOW

All gravity sewers shall be constructed of materials acceptable to the Authority and be designed with such hydraulic slope to result in a mean velocity of not less than two feet (2') per second when flowing either full or half full. This is based on Knutter's or Manning's formula with N = 0.013 for ductile iron or 0.010 for PVC pipe. Terminal runs of sanitary mains shall be designed and installed with a minimum slope at least double that which is required to produce a velocity of two feet (2') per second.

Grades producing velocities in excess of ten feet (10') per second are to be avoided. The minimum size of sewer mains will be eight inch (8").

## 501.8 PUMPING STATIONS

### A. General Requirements:

The construction of the pumping station and appurtenances shall meet all current OSHA standards, including ladders and safety railings where required.

Raw sewage shall be screened before pumping unless special pumping equipment approved by the Authority is used. Trash basket must be removable and a winch provided for removal of this basket for cleaning.

An auxiliary source of power shall be provided for electricity driven pumps, unless an alternate method is approved by the Authority.

A complete telemetering system shall be provided to monitor the pumping station status, and transmit data to the Authority central control panel.

An odor control system shall be provided for both the wet well and the force main.

The equipment provided to monitor the following shall be of the same make and manufacture as now in use by the Authority:

1. Intrusion alarm.
2. Smoke/fire alarm.
3. Phase failure relay.
4. Telephone line failure.
5. Emergency generator to be equipped to transmit normal and emergency power status.
6. Elapsed time running meters for each pump at station and at M.I.P.

7. Bubbler system with purge and flare type bubbler line for level control. Air supply shall be provided by duplicate air compressor with receiver tank.
8. High wet well alarm for wet well.
9. Power failure alarm.
10. Ventilation failure alarm with sign stating that explosive hazards exist ventilation system is not functioning properly.

Pumping stations shall not be subject to flooding during a one hundred (100) year frequency storm.

Adequate light and ventilation shall be provided at all pumping stations. Where operation or maintenance duties are required in enclosed areas or pits, forced ventilation by suitable means shall be provided with sufficient capacity to induce at least twelve (12) air changes per hour.

Ventilation shall be provided as detailed in "NFPA 820-Recommended Practice for Fire Protection in Wastewater Treatment and Collection Facilities", as amended to date, to reduce or eliminate requirement for explosion proof equipment.

A free-standing yard hydrant (frost-proof) shall be provided to permit routine washdown and cleaning operations at all pumping stations. Where a domestic water service connection is provided to a pumping station, the water supply shall be properly protected by an approved backflow prevention device. No connections between fresh water and sewage pumps or pipes shall be permitted.

#### B. Pumps:

Pumping station capacity shall be compatible with the ultimate capacity of the influent sewer. At least two (2) pumps, each designed to individually handle peak flows (2.5 x average flows) for ten (10) years hence, shall be provided. If more than two (2) pumps are provided, their capacities shall be such that upon failure of the largest pump, the other(s) will handle such peak flows. When ejectors are provided as the method of raising sewage, two (2) compressor units are required, and they shall be so interconnected that the duplicate unit will commence operation in the event of failure of the one in use.

Pumps shall be generally installed in dry wells and preferably should operate under a positive suction head. Submerged pumps for raw sewage will be approved only when deemed appropriate by the Authority. A means of flow measurement is required. Shutoff valves shall be provided on suction and discharge piping, which shall be flanged or otherwise removable, and check valves shall be provided on discharges.

Special repair tools and accessories required for maintenance shall be provided.

NOTE: The standard pump selected by the Authority for use in all lift stations within Evesham Township is Gorman-Rupp. Other models may be acceptable upon approval of the Engineer.

C. Dry Wells and Wet Wells:

Dry and wet wells shall be completely separated and shall be provided with adequate ventilation (NFPA 820) and drainage. Entrance and exit shall satisfy all applicable safety standards as determined by the Authority. Permanently mounted winches shall be provided for both the wet well and the dry well.

Dry wells shall provide sufficient accessibility for the repair and removal of pumps. Provision shall be made for the removal, if necessary, of pumps and motors. Dry wells are to be provided with a sump pump and flood alarm.

The capacity of a wet well should not exceed ten (10) minutes retention when flow is at the average dry weather rate. The floors of wet wells shall slope at least forty-five degrees toward pump suction to prevent solids accumulation.

D. Trash Basket:

A trash basket and guide rails, constructed of either aluminum or stainless steel must be provided in the wet well. A mechanical means, such as a winch, must be provided so this basket can be removed from the wet well for cleaning.



E. Electrical Equipment:

Electric motors shall be located so as to be protected from flooding.

Electric motors and electrical power equipment should not be installed in subsurface chambers; where installation in such location is necessary, the areas shall be ventilated in accordance with "NFPA 820" to eliminate the requirement for explosion proof equipment. Where this is not possible the motors and equipment shall be of the explosion-proof and damp-proof type.

All electrical equipment and work shall comply with Fire Underwriter's regulations for the location involved and to the National Electric Code.

F. Standby Emergency Power Engine/Generator:

1. General:

- a. Standby power for Authority facilities shall be provided by a complete diesel engine/generator set.
- b. Diesel engine/generator shall provide electric power during periods of failure of normal power supply.
- c. Unit shall be 3 phase, 60 hertz and be capable of delivering sufficient power to sequentially start and continuously run all equipment at the pump station site. Loads shall be calculated based on future conditions.
- d. All optional equipment, available from the manufacturer for sound attenuation purposes, shall be incorporated in the generator package.
- e. Automatic starting and stopping of the plant and switching of the load shall be provided by an automatic load transfer switch.
- f. The engine/generator control console shall be mounted on the generating set in a weatherproof housing.
- g. The engine/generator unit shall have a skid mounted fuel tank (minimum 75 gallon or 12 hours continuous operation) and shall be housed in a weatherproof,

insulated aluminum (Alloy 6061-T6, 0.04" thick) or 16 gauge painted steel housing with removable side panels.

- h. The electric generating equipment shall meet all requirements of NFPA 110.

2. Diesel Engine:

- a. The engine shall be a heavy duty compression ignition, cold starting diesel arranged for direct connection to and alternating current diesel generator.
- b. The engine shall operate efficiently on No. 2 fuel oil.
- c. A fuel supply pump with replaceable fuel filter shall be provided.
- d. The radiator shall be rated to operate the engine at full generator load at 120\_F.
- e. The water jacket heater shall be thermostatically controlled and a minimum of 1,000 watts.
- f. An oil cooler shall be provided if recommended by the manufacturer.
- g. Substitution of a natural gas powered engine may be requested by the Authority depending on the proximity of gas lines.

3. Generator:

- a. The generator shall be rotating field, engine driven, direct connected, synchronous type with amortisseur winding, rated for continuous service.
- b. Insulation shall be Class B or F in accordance with NEMA standards. The temperature rise shall be in accordance with NEMA standards for continuous duty at all output ratings.
- c. Fast acting fuses or other protective devices shall be incorporated where failure or regulator or exciter

components could result in damage to the generator field or exciter windings.

- d. Generator and exciter shall conform to all applicable NEMA standards.

4. Engine Electrical System:

- a. Electrical system shall include:

- 1) Lead-acid, heavy duty battery as recommended by the engine manufacturer.
- 2) Starting mortar.
- 3) Voltage and current-regulated charging generator or alternator and a separate battery charger with battery cables and rack.
- 4) Outside (GFI) electrical outlet for 120V power.

5. Control Panel:

- a. Engine and generator controls shall be mounted with vibration isolators at the generator end of the engine/generator set in a NEMA 4 enclosure.

- b. Engine controls/instruments required:

- 1) Three position run-stop-remote switch.
- 2) Manual start switch.
- 3) Full automatic start.
- 4) Auto engine shutdown for the following conditions:
  - a) Overcrank.
  - b) Overspeed.
  - c) Low lube oil pressure.

d) High engine temperature.

e) Low coolant level.

5) Indicator lamps as follows:

a) Run.

b) Overcrank.

c) Overspeed.

d) High engine temperature.

e) Low oil pressure.

f) Pre-high engine temperature.

g) Pre-low oil pressure.

h) Low engine temperature.

i) Switch in stop position (flashing).

j) Low fuel.

k) Low coolant level.

6) Fault reset switch.

7) Water temperature gauge.

8) Ammeter charging circuit.

9) Lubricating oil pressure gauge.

10) Running time meter.

11) Panel illumination.

6. Sound Attenuation:

Pump stations are to be located a minimum of 200' from nearest residential property line, and noise levels are to be not

greater than 60 dBA when measured at any residential property line. Only approved sound attenuation methods shall be used. Compliance shall be determined in conformance with NJDEP "Procedures for the Determination of Noise from Stationary Sources".

7. Appurtenances:

a. Paint:

- 1) Woodland Green oil and heat resistant paint shall be applied over thoroughly cleaned and prime coated surfaces.

b. Mechanical Governor:

- 1) Capable of maintaining engine speed within five percent (5%) of synchronous speed from no-load to full-load.

c. Sufficient spare parts for six (6) months operation.

- 1) Oil filters.
- 2) Gas filters.
- 3) Fuses.

d. Auto transfer switch:

- 1) The auto transfer switch shall include all necessary relays and component parts, together with U.L. listed and tested interlocked contactor. Switch shall conform with U.L. 1008.
- 2) The auto transfer switch shall perform as follows:
  - a) Automatically start the plant upon power line outage. Provide time delay start to avoid nuisance start-ups.
  - b) Disconnect the normal circuits from the main line and transfer them to the emergency plant's output. Provide timer

delay transfer to allow the engine-generator set to stabilize before application of load.

- c) Transfer the load back to the main line upon power return. Provide time delay retransfer to allow:
  - (1) Normal power to stabilize before retransfer.
  - (2) Staggered retransfer.
  - (3) Unloaded running for cool down before shutdown.
- d) Retransfer of the load from emergency source to the normal source if the emergency source fails when normal source is available.
- e) Control mode status indicators to allow operator to determine if controls are properly sequencing.
- f) "Normal" and "emergency" indicator lamps.
- g) Selector switch with "test", "normal" and "retransfer" positions.
- h) Exerciser clock.
- i) Battery charger for generator set.

8. Testing/Setup:

- a. Minimum two (2) hour full load test. Testing procedures shall be as described in NFPA 110 under installation acceptance.
- b. Ten (10) copies of generator/engine set operations and maintenance manuals, complete in all respects.

- c. Warranty on all parts comprising the complete standby electric power system for a period of five (5) years or 1,500 operating hours, whichever occurs first, from the date of initial startup. Multiple warranties will not be acceptable.
- d. The standby electric generating system, including all components, shall be tested, shipped and warranted by one source of supply who shall take full responsibility for warranty, supply of parts and servicing.
- e. Safety Signs:
  - 1) Danger - Diesel Fuel, #93-95-242 (3" x 5").
  - 2) Danger - Equipment Starts Automatically, #93-95-386 (3" x 5").
  - 3) Danger - 480 or 240 Volts, #93-95-233 (3" x 5").

9. Landscaping

Provide landscaping to effectively screen the pump station site from adjacent properties.

10. Fencing

Provide eight foot (8') high, nine (9) gauge, chain link fence with a minimum twelve foot (12') wide sliding gate and three foot (3') wide pedestrian gate. Fencing shall completely enclose the pump station site. Color to be Woodland Green and fence to have two inch (2") vinyl bonded mesh with heavy duty, industrial frame and posts.

11. Lighting

Provide low brightness type, horizontally mounted fixtures with a maximum mounting height of twelve feet (12'). Provide a average minimum one (1) foot candle illumination over the entire site. Spillover illumination shall be minimized to no more than 0.25 foot candles.

## 501.9 SANITARY FORCE MAINS

### A. General

The construction of a sanitary force main is necessary any time a lift station is required. The length of this line is dependent upon the distance to the nearest gravity manhole or wastewater treatment plant. The size of the line is dependent upon the quantity of sewage to be pumped from the lift station to its destination. Velocity in the force main shall be equal to or greater than 3 feet/second and less than 10 feet/second.

The pipe and fittings used in the construction of force mains shall be Class 52 ductile iron. No cement lining will be permitted. Prior approval, in writing, from the Authority must be obtained permitting the use of another material.

Force mains shall be laid as close as possible to a constant grade. When this is not possible, low and/or high points in the line may result. Manholes must be constructed at these locations. Cleanout manholes shall be constructed at the low points while air relief manholes are required at the high points. Six inch (6") diameter cleanout risers shall be provided at 400' intervals or as otherwise required by the Authority. These units will be constructed in accordance with the drawings provided as part of this specification. Energy dissipation manholes shall be constructed at the discharge point of all force mains.

The contractor will be responsible for supplying all equipment, tools and personnel to perform the necessary tests. He will also provide personnel, as required to assist the Authority inspector during his visual inspection. The Authority inspector must be present at all times during pressure testing of a force main.

Odor control facilities may be required by the Authority for force mains that retain sewage within the line for excessively long periods.

### B. Thrust Blocks

Thrust blocks will be installed or lines rodded at all bends greater than ten degrees (10\_), and at all valves, tees and plugs. This is to prevent movement of the lines or appurtenances under pressure.



The following is a list of requirements governing the construction of thrust blocks:

1. All thrust blocks will be constructed of poured concrete with a minimum twenty-eight (28) day compression strength of 4,000 psi.
2. The bearing area of the thrust blocks will be poured against undisturbed soil, and this area shall be sufficient to prevent any movement when lines are tested and again when they are put into operation. The thrust block size will vary with the size of the line and the soil bearing properties of the soil. In making this calculation, always use 150 psig as the internal line pressure. See nomograph included with this specification for determining thrust block size.

### C. Sanitary Force Main Inspection

#### 1. Construction Inspection

Prior to installation of any force mains or appurtenances, the Authority office and the Authority Engineer must be notified forty-eight (48) hours in advance. This will allow the Authority sufficient time to schedule an inspector on the job during the construction phase.

#### 2. Post Construction Inspection and Test

Once construction has been completed on the force main and all its appurtenances, the contractor may request preliminary inspection and test.

A visual inspection of all terminations and manholes will be performed to insure that construction on this force main system meets all the drawing and specification requirements, and in addition, all cleanup work has been completed.

All force mains and pressure lines shall be tested at 50 psi or two (2) times the operating pressure, whichever is greater or as required by specification.

Each section of pipe shall be slowly filled with water. Before applying the specified test pressure, all air shall be expelled

from the pipe through blowoffs or taps that may be required for the release of air at the highest points.

When the test pressure has been reached, the amount of makeup water to maintain the test pressure for two (2) hours shall be measured.

Installed pipe will not be accepted if the amount of leakage exceeds twelve (12) gallons per day per inch pipe diameter per mile of pipe.

Where sections of pipeline fail to meet this requirement, they shall be repaired, again maintained under pressure for two (2) hours and retested as necessary until these requirements are satisfied.

Any visible pipe leakage, regardless of the amount, shall be immediately repaired and the pipe shall be retested.

Calculations to determine loss per inch of pipe per day per mile shall be done as follows:

Gallons of makeup water x 12 = gallons loss/day

$\frac{\text{gallons loss/day}}{\text{feet of pipe being tested}} \times 5,280 \text{ ft/mile} = \text{gallons loss/mile/day}$

$\frac{\text{gallons loss/mile/day}}{\text{(pipe diameter in inches)}} = \text{gals/inch dia./mile/day}$

Allowable exfiltration rate is 12 gallons/inch dia./mile/day

## 501.10 INSPECTION AND TESTING OF SANITARY SEWER SYSTEM

### A. General Requirements:

The Authority requires that their representative inspect all sanitary sewer and appurtenances which tie into the Authority system. Inspection shall be initiated at the moment construction is commenced and will continue until all construction has been completed and the new sewer construction has been accepted by the Authority.

The Authority Engineer shall be notified forty-eight (48) hours in advance (Telephone No. 609/267-8310) that inspection is required. The request for inspection is the direct responsibility of the developer or builder and should they neglect to request same, all work accomplished without inspection will automatically be considered unacceptable. Extreme care should be taken to avoid this situation since all construction not accessible for complete visual inspection must be reestablished in such a manner as to allow for same before it will be accepted.

**B. Inspection During Sanitary Sewer Construction:**

Inspection during construction will insure the following:

1. All materials used during construction will meet the minimum requirements of the Authority and be in accordance with approved drawings. Supporting documentation shall be submitted upon request.
2. All construction is accomplished in accordance with approved drawings and Authority specifications, rules and regulations.
3. All permits have been obtained prior to initiating construction.
4. Trenches are dug and maintained in accordance with the requirements of this specification, and in addition that all requirements of State safety rules and regulations are being met.
5. All State and Federal safety rules and regulations are being observed by contractor personnel.
6. The bedding of pipe and appurtenances is in accordance with that prescribed in this specification.
7. Workmanship in general meets the requirements of the Authority and any additional requirements of other interested agencies imposed upon the Authority.
8. All materials used in the construction of sanitary sewage collection or treatment facilities are protected prior to, during and after construction.

9. Care is being exercised during construction to avoid the possibility of any water or other foreign matter entering the active sewer lines.
10. All lines are laid at the prescribed grades and are free of foreign material.
11. All joints are made in the prescribed manner for the particular pipe or fittings being used.
12. All lateral construction is in accordance with that prescribed in this specification.
13. All manhole, wet well, pump station and appurtenances are constructed in accordance with requirements of this specification.
14. All material used for backfill is Authority acceptable as required by physical location.
15. Proper repair is accomplished on roads that were cut or damaged during construction.
16. Cleanup and restoration of area after construction has been completed. This will include anything that is a direct or indirect result of the construction.
17. When necessary, proper signs, barricades, flashers, flagmen, etc., are being properly utilized or displayed to meet safety requirements.
18. During construction, that water is not pumped or diverted in such a manner so as to damage surrounding or downstream properties, and that excessive damage to trees, shrubs or plant life does not occur during the construction of sanitary lines or systems.

C. Testing and Inspection After Construction Has Been Completed:

All sanitary sewer construction within Evesham Township which ties into the existing sanitary sewage system for which the Authority has responsibility is required to meet the minimum requirements of inspection and testing as specified by the Authority.

Although visual inspection is performed by the Authority representative during sanitary sewer construction, additional inspection and testing, including remote televised inspection, must be performed prior to their becoming part of the active system. These tests and inspections are generally performed prior to the completion of road, curb and sidewalk construction and are referred to as preliminary inspection. Final inspection does not take place until all construction has been completed on a specific section or a complete development. Whether final inspection and/or test is performed by section or complete development is dependent upon the manner in which it was bonded.

Once final inspection has been completed and the Authority has accepted the new construction, the performance bond will be released for sanitary sewers upon receipt of the two (2) year, fifteen percent (15%) maintenance guarantee. This sum will be released in full at the end of that period, providing this money is not required by the Authority to correct deficiencies on the collector lines or system.

An Authority inspector must be present to inspect any repairs performed on a sanitary sewer line if this line is to be considered acceptable.

#### D. Retest and Inspection

Retest and inspection will be performed on sanitary lines at any time when, in the opinion of the Authority, the conditions which caused the failure of the previous test on the sanitary sewer system have been corrected to the point that retest and inspection is deemed necessary.

#### E. Sanitary Sewer Main and Manhole Inspection

After the construction has been completed on a sanitary sewer line, preliminary inspection and testing may be requested by the contractor. Inspection will consist of a general visual observation of pipe terminations in manholes, backfilling of manhole, rim elevations on manholes, manhole channel construction, sealing and finishing of manholes and general inspection to insure there is no infiltration occurring in the manhole.

#### F. Sanitary Sewer Main Testing

All sanitary mains are required to pass a pressure test to insure there will be neither infiltration or exfiltration, and a lamp test to insure there

are no bends in the lines that exceed allowable limits and a remote television inspection which will be performed by the Authority.

#### G. Lamp Test of Sanitary Lines

When a light of sufficient intensity is directed down the pipe from one end or the other, at least seventy-five percent (75%) of the pipe opening must be visible in the horizontal plane when viewing the pipe from the opposite end with line of sight being the center of the pipe. One hundred percent (100%) of the pipe barrel must be visible in the vertical plane. All lines that do not meet this requirement are considered unacceptable. Also any lines containing foreign material will be failed. When it is found that a line has a bend in excess of that allowed, the line must be dug up and relaid. Lines containing foreign materials must be cleaned. This must be done before the lamp test is satisfied.

#### H. Pressure Test of Sanitary Lines

Low pressure air tests are performed to insure there will not be any water infiltration into the sanitary lines in amounts greater than that allowed by the Authority, which is twelve (12) gallons per inch of pipe diameter per mile of pipe length for a twenty-four (24) hour period. Direct water infiltration testing is not accepted by the Authority since there is seldom water around the complete pipe or in sufficient amounts above the pipe to provide the head pressure required for testing.

Prior to performing infiltration tests, all fittings must be installed, and all laterals completed to just behind the curb line. In addition, all trenches must have been backfilled and rough graded.

#### I. Low Pressure Air Testing of Sanitary Lines

The Authority inspector is to be present at all times during this test. However, the contractor is responsible for all operations and tests. The inspector will observe the test and, in accordance with requirements provided herein, pass judgment as to whether or not the line has failed or passed.

The pressure gauge being used must have minimum divisions of .10 psi, and an accuracy of  $\pm 0.4$  psi. Cleaning of the pipe immediately prior to the test is recommended. The contractor shall furnish test plugs, an air compressor, test gauge, stop watch, personnel and supervisor.

After all lines and equipment have been properly connected and plugs installed, air shall be slowly introduced into the plugged pipe under testing. This will continue until the pressure reaches 5.0 psig. At least five (5) minutes shall be allowed for temperature and pressure stabilization. During the stabilization period, the pressure should not drop below 3.5 psig. If this should occur, it is an indication that the line is faulty and must be repaired.

When the line pressure stabilizes somewhere between 5.0 and 3.5 psig, this line is ready for acceptable testing. The time table below should then be reviewed, and the test time determined. The line pressure shall then be reduced to 3.5 psi and the test interval started. The interval shall be measured using a stop watch or timer. The total pressure loss must not exceed 0.5 psig if the line is to be acceptable. Should the pressure loss be greater than 0.5 psig during the test period, the leak must be located, repaired and the failing section retested. One (1) psi shall be added to the initial test pressure (3.5 psi) for each foot that the groundwater is above the pipe invert.

Prior to digging up or disturbing any pipe, it is advisable to use a soap solution to determine that there are not leaks at connections or around the pipe plugs.

*TIME REQUIREMENTS FOR AIR TESTING*

<i>PIPE SIZE (IN INCHES)</i>	<i>TIME MINUTES</i>
4	2.5
6	4
8	5.5
10	8
12	11.5
15	18
18	24

(For larger diameter pipe, use the following:  
 Minimum time in seconds = 960 x pipe diameter in feet)

J. Remote Television Inspection

The Authority shall perform a remote television inspection of the sanitary sewer system prior to the release of the performance bond. Construction or material deficiencies revealed during the inspection will be promptly repaired by the Contractor. The Authority reserves the right to charge the Contractor for remote television services. The Contractor may, at his discretion, have the sewer mains remotely televised by an independent contractor if preapproval is received from the Authority.



## 502: SANITARY SEWER STANDARD DETAILS

## SECTION VI

### AS-BUILT DRAWING REQUIREMENTS

601: MINIMUM REQUIREMENTS FOR AS-BUILT DRAWINGS

1. SUBMITTAL REQUIREMENTS

A. GENERAL

- 1) Submittals shall consist of utilizing the approved drawing set with the design information distinguished from the corresponding as-built information. Methods such as circling or drawing a thin line through the design information shall be utilized. The design and as-built information shall be legible.
- 2) Each submittal shall consist of three (3) blue line copies of each drawing included in the as-built transmittal.
- 3) If the alignment of the water main, sewer main or force main has been significantly revised during construction, the alignment shall be shown on the drawings.
- 4) Copies of required easements/agreements, as filed at the County Court House, shall be submitted, attached to the plan. The plan shall visibly show each easement and reference the filed deed book and page of the recorded easement.
- 5) The alignment of utility mains/structures within easements shall be verified.

B. WATER MAINS

- 1) Pipe diameter, pipe material and pipe lengths shall be noted. Lengths shall be measured between centers of tees/valves.
- 2) Approximate elevations of the top of pipe shall be provided at valves and where pipe is installed with other than four feet (4') cover.
- 3) All hydrant locations shall be shown.
- 4) All valve sizes shall be shown.
- 5) All valves and blowoffs shall be located using three (3) tie-down dimensions (i.e. measurement from a permanent object; catch basin, manhole, hydrant, road centerline, etc.).

- 6) All curb stops for water services shall be located by indicating the distance behind curb and distance as measured along centerline of road from nearest downstream sanitary manhole. Each shutoff shall be clearly identified as to the townhouse, condominium, house, office, store, etc. that it services.

C. SEWER MAINS

- 1) Manhole rim elevations shall be provided.
- 2) Invert elevation of all pipes penetrating each manhole shall be provided.
- 3) Pipe lengths measured from manhole center to manhole center shall be provided.
- 4) Pipe slopes shall be indicated.
- 5) Pipe diameter and pipe material shall be indicated.
- 6) The as-built length from each lateral connection to the downstream manhole shall be provided in the form of stationing (+73, +97, etc.). The distance from curb to first cleanout shall also be provided.
- 7) Each lateral shall be clearly identified as to the townhouse, condominium, house, office, store, building, etc. that it services.

D. FORCE MAINS

- 1) The as-built pipe length between bends shall be provided.
- 2) As-built pipe diameter and pipe material shall be provided.
- 3) All cleanouts and valves shall be located using two (2) tie-down dimensions.

E. PUMPING STATIONS

- 1) As-built drawings shall be submitted which highlight any changes from the original design, as approved, including type, location, size, and orientation of either structures or equipment.
- 2) Six (6) copies of manufacturer's operation and maintenance information shall be submitted for all installed equipment.

F. PLAN CERTIFICATION

- 1) A licensed New Jersey Professional Land Surveyor shall certify the accuracy of the plan in representing "visible" site conditions at the time of survey. Credit should also be given to the sources of information used to represent non-visible (i.e. underground) conditions.