SEWER MASTER PLAN UPDATE

Township of Pequannock

Prepared for:

Township of Pequannock 530 Newark-Pompton Turnpike Pompton Plains, NJ 07444

November 1, 2019



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NJ Certificate of Authorization 24GA27920500

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1.0 INTRODUCTION

1.1 Executive Summary

The Township's sewer flow measured by the Two Bridges Sewerage Authority was historically high in 2018 and the first half of 2019, which was a wetter than average period. This high measured sewer flow is due to inflow of stormwater and infiltration of groundwater into the sanitary sewer system in the Township. The annual cost incurred by the Township for the treatment of extraneous stormwater and groundwater in the sanitary sewer system ranges from \$70,000 to \$485,000 depending on weather conditions. An indirect result of the preparation of this report was the identification and correction of a major source of groundwater infiltration. This corrective action is estimated to have reduced inflow and infiltration by 20% and will save the Township an average of \$50,000 per year. The Department of Public Works is continuing to look for additional sources of inflow and infiltration.

Apart from inflow and infiltration, the flow of water in the Township's sanitary sewer system should be equal to non-irrigation water used by residences and businesses. Non-irrigation water usage is estimated from winter quarter water records (when there is no irrigation). Winter quarter water usage has decreased in the Township since 2010. Due to this decrease in non-irrigation water usage, there is sufficient reserve capacity to sewer the remainder of the Township provided that inflow and infiltration is addressed.

1.2 Background

The Township of Pequannock's Sewer Master Plan was last updated in 2003 by Crew Engineers, Inc. (Crew). That report evaluated available sewer capacity existing at that time and identified several priority projects for which that sewer capacity should be reserved based on public health, environmental, and commercial redevelopment factors.

Since that time, methods for determining available sewer capacity have changed. Additionally, the Township has extended the sanitary sewer system into several of the areas identified as being priorities in the 2003 Sewer Master Plan Update. These projects include the area of Farm Road and Munson Drive (Priority Area 13-1), the area of West Sunset Road (Priority Area 13-3), the area of Greenwood Avenue and Madison Street (Priority Area 14-1), the area of Village Road and Jackson Avenue (Priority Area 14-2), the area of Laurel Avenue and Willow Avenue (Priority Area 14-3), and the area of Newark-Pompton Turnpike and Evans Place (Priority Area 14-7), see Drawing E-6725. These projects have addressed all but one of the highest priority residential areas and have made redevelopment of the central business district possible.

Additionally, the Township is preparing to extend the sanitary sewer on Route 23 (Priority Areas 14-5 & 6). This project will have a positive impact for businesses in this commercial area and will allow for more water-intensive uses. Once that project is complete, the Township will have completed the sewering of most of the areas identified as priorities in the 2003 Sewer Master Plan Update.

1.3 Purpose and Scope of Study

The purpose of this current update to the Sewer Master Plan is to reevaluate the Township's reserve sewer capacity and plan for future sewer service expansions.

1.4 Existing Sewer System

Currently, approximately one half of the Township is served by sanitary sewers. The vast majority of the wastewater generated by these areas of the Township is treated by the receiving wastewater treatment facility in Lincoln Park, which is owned and operated by the Pequannock, Lincoln Park, and Fairfield Sewerage Authority. This sewerage authority, of which Pequannock is a member, is commonly known as the Two Bridges Sewerage Authority (TBSA). The remainder of wastewater is generated by several properties located between Route 23 and the Pompton River, which is pumped to the Township of Wayne for treatment through a temporary agreement (see Drawing G-957).

1.5 Measurement of Wastewater Flow

Wastewater leaving Pequannock on route to the TBSA wastewater treatment facility in Lincoln Park flows through two meters: M13 and M14, which are metered by TBSA (see Drawing G-957). Wastewater from the southwestern portion of the Township, which has the oldest sections of sewers, is conveyed through a TBSA 24-in. interceptor sewer in Greenview Park and Hillview Road to meter M13. Wastewater from areas of the Township east of the Boulevard and north of Arundel Road are conveyed through the TBSA 36-in. interceptor sewer, which is located on West Parkway, Sunset Road, and the Boulevard, to meter M14.

Additionally, wastewater generated by the Boroughs of Butler, Kinnelon, Bloomingdale, and Riverdale and a portion of the Township of West Milford flows through the TBSA 36-in. interceptor sewer. This interceptor sewer enters Pequannock at the northern border of Pequannock and Riverdale at Route 23. Wastewater in the interceptor sewer at this location is metered by TBSA at meter M15 (see Drawing G-957). The total flow attributable to Pequannock is, therefore, the difference between meter M14 and M15 added to meter M13.

2.0 EVALUATION OF RESERVE CAPACITY

2.1 TWA vs. Water Records

Before a sanitary sewer project is constructed, a Treatment Works Approval (TWA) permit must be obtained from the New Jersey Department of Environmental Protection (NJDEP) and endorsed by TBSA. The TWA permit application for each project must include an estimation of projected sewer flow. The projected flow criteria for various types of establishments is listed in N.J.A.C. 7:14A-23.3, e.g. each 3-bedroom home contributes 300 gallons per day (gpd) to the sewer system and each commercial building contributes 1 gpd per 10 sq. ft. of floor area. This calculated theoretical flow is used to determine the effect on downstream treatment and conveyance infrastructure. At the time of the 2003 update to the Sewer Master Plan, TBSA was using TWA numbers not only for endorsing permits but also for determining sewer usage for developing user charges.

On December 1, 2007, TBSA began using metered readings to determine sewer usage. This change is important for Pequannock because it effectively increased the Township's reserve capacity over time. This is due to the fact that the TWA numbers are highly conservative in Pequannock. One example of this is Cedar Crest. The theoretical flow from Cedar Crest was estimated using the NJDEP projected flow criteria to be 254,000 gpd, while in actuality the sewer usage is approximately 186,000 gpd. Another example is the Village Area Sewers with a theoretical flow of 158,000 gpd and actual usage of 63,000 gpd. The difference between the TWA numbers and the actual water records becomes reserve capacity once a project is complete and in service.

As the majority of the Township's priority projects have been completed, a reevaluation of the remaining reserve capacity is appropriate. For this evaluation, Crew used actual water records rather than theoretical TWA numbers. This is appropriate for a long-range planning period since the sewering of the remainder of the Township will take place over many years and will not be permitted as one project.

2.2 Current Sewer Allocation and Usage

In order to accommodate its sewer needs, the Township has acquired 1.25 million gallons per day (MGD) of wastewater allocation in the TBSA wastewater treatment facility. The allocation was acquired over many years and represents the maximum allocation available to the Township at this time.

The reserve capacity is the balance of the Township's allocation reduced by the average annual metered flows measured by TBSA (see section 1.5). The average annual flow metered by TBSA for 2018 (last complete year) was 1.03 MGD, which is substantially higher than previous years (see Figure 1). Through the end of September, 2019, the average flow was 0.93 MGD. Therefore, the reserve capacity is presently between 0.22 and 0.32 MGD. For comparison, the estimated sewer flow for the remaining priority areas, including the Route 23 sewer extension, is 0.135 MGD using NJDEP criteria.

Crew then compared the water usage of existing sewered properties with the total flow metered by TBSA to determine whether any discrepancies existed. To do this, Crew joined water and sewer billing records obtained from the Township's utility office with publicly available spatial tax parcel information. The records were on different platforms and not every record could be reconciled. However, after a substantial manual review, Crew was able to reconcile enough records to create a satisfactory analysis.

Using this joined information, Crew was able to compare winter quarter water and sewer billing records for the past few years with TBSA meter records. Winter quarter records were used for the comparison since water is not used for irrigation during this period and, thus, water usage should equal sewer usage. The two sets of data were fairly consistent except for unusually wet periods when there was a large difference, e.g. 2011 and 2018-2019 (see Figure 2). In response to an inquiry by Crew, TBSA indicated that their meters were calibrated quarterly and that the difference is attributable to Inflow and Infiltration (I&I).

2.3 Inflow and Infiltration

I&I is stormwater and groundwater entering the sanitary sewer system. Stormwater can enter the sanitary sewer system through sump pumps or roof drains directly connected to the house sanitary piping. Groundwater can enter the sanitary sewer system through cracks in sewer pipes or gaps in manholes. I&I affects the sewer utility in two ways: reduction of reserve capacity and increased costs.

By comparing the historical water and sewer billing records for individual properties with the TBSA metered flows for the entire Township, Crew was able to quantify the I&I entering the sanitary sewer system annually between meter M15 and meters M13 and M14. Due to the gaps in the reconciled water and sewer billing records (see section 2.2), the quantity of I&I could not be ascertained precisely; however, a high and low estimate were able to be determined for each year (see Figure 3). The average of the high and low estimates of I&I between 2007 and 2019 is 0.19 MGD. The average of the high and low estimates of I&I between 2012 and 2017, which were historically dryer years, is 0.13 MGD. The average of the high and low estimates of I&I for the years 2011, 2018 and 2019, which were historically wetter years, is 0.36 MGD.

While the I&I has been quantified, all of its sources have not been located. I&I may be entering Township sewers or could also be entering the two TBSA sewers in Pequannock (24-in and 36-in interceptor sewers). TBSA recently inspected all of their sewers and indicated that no I&I was observed; however, the inspection was made during a dry period of 2017 when I&I would be expected to be lower. While no I&I was observed by TBSA, they indicated that they will repair any areas found to have flaws.

Crew was able to estimate the cost associated with treating I&I for the past several years based on previous TBSA user charge determinations. The estimated cost for treating I&I ranged from a low of \$70,000 to a high of \$485,000 (see Table 1). An unanticipated benefit of updating the Sewer Master Plan was that a large source of I&I was discovered during field reconnaissance

work. Large quantities of groundwater were observed leaking through gaps between manhole walls and recently installed sewer pipes in several manholes, which installation was not inspected. The Department of Public Works (DPW) subsequently retained a contractor to grout the gaps between the pipes and manhole walls. Crew estimates that this corrective action reduced the total I&I by approximately 20% and will save the Township approximately \$50,000 per year on average (highlighted on Table 1).

2.4 Available Reserve Capacity

As previously mentioned, winter quarter water usage is assumed to enter the sanitary sewer system, as none of the water is used for irrigation (see section 2.2). Winter quarter water production, which is the total of the Township's well water production and water purchased from the City of Newark and Borough of Riverdale, has decreased in the Township since 2010. This may be due to water efficient plumbing fixtures and appliances. The winter quarter water usage has been below Pequannock's sewer allocation for the past several years and was 1.13 MGD for 2018 (see Figure 4). Based on this current water usage for the entire Township and methodology selected to determine reserve sewer capacity, i.e. actual water usage, there would be sufficient reserve sewer capacity to sewer the remainder of the Township, were it not for I&I.

As previously noted, the quantity of I&I varies annually based on weather and groundwater conditions. Aggressively estimating sewer capacity using the lower estimate of 0.13 MGD for I&I yields sufficient capacity to sewer the remainder of the Township, including the currently designed Route 23 Northbound and Southbound Sanitary Sewer Extension. Moderately estimating sewer capacity using 0.19 MGD for I&I yields adequate capacity to sewer approximately 75% of the unsewered properties. Conservatively estimating sewer capacity using the higher estimate of 0.36 MGD for I&I, which only occurs during historically wet years, yields enough capacity to sewer approximately 40% of the unsewered properties (see Figure 5). For these three scenarios, no additional allowance was made for I&I associated with future sewer extensions since, when properly installed and inspected, new sewers are less likely to be sources of I&I than older sections of the sanitary sewer system.

In conclusion, as the remainder of the Township will be sewered over many years, reserve capacity should not be an issue initially. Furthermore, as the Township continues corrective action to reduce I&I, additional reserve capacity will be created.

3.0 FUTURE SEWER SYSTEM EXPANSION

3.1 Existing and Future Sewer Service Areas

Since reserve capacity exists to sewer not only the priority projects, but other (and potentially all) areas of the Township, a plan for future sewer service areas needed to be developed. This plan will be used by the Township, developers, and residents as a guide for extending sewers to serve the remaining unsewered areas of the Township.

Crew worked in conjunction with the DPW to map the Township's existing sanitary sewer infrastructure using GIS technology and databases. This information was used to determine where future sewers could be extended from existing infrastructure.

Topography used for conceptual design was based on a limited number of topographic elevations obtained with a GPS receiver. This topographic information was supplemented with existing Township sanitary sewer construction drawings and valuable information obtained from the DPW.

In addition to topographic and existing sewer information, the following constraining features were also considered to the best of our ability in the conceptual design:

- the City of Newark Aqueducts
- the New York Susquehanna and Western Railroad
- the North Jersey District Water Supply Wanaque South Pipeline along the railroad
- several streams and waterbodies

Other utility information, including water mains, drainage pipes, gas mains, telecommunication ducts, etc. was not used for the conceptual design. This information would be gathered during final sewer design and may lead to the revision of the layout of sewers in some areas by changing sewer direction or by adding an occasional below-ground pumping station. Consequently, this Sewer Master Plan Update is considered a planning document and is not suitable for final design or construction.

3.2 Sewer Design Concept

The majority of the topography of the Township is relatively flat, with a substantial rise in elevation only in the westernmost portion of the Township. Past design concepts have attempted to use gravity sewers to the maximum extent possible to minimize the need for pump stations. However, in generally flat areas, this practice results in fairly deep construction. In wet or poor soil areas, this results in considerably higher construction costs. This report presents the consensus of the Township and Crew that a more balanced approach should be taken between sewer depth and the need for pump stations.

While the conceptual sanitary sewer design attempts to avoid deep construction, shallower depths at the end of several sewer runs that are a result of flat topography may necessitate the

occasional relocation of a water main. Also, as a general rule, gravity sanitary sewers will not be able to serve basements since sewers in many areas will be relatively shallow (<6 feet deep).

As shown on Drawing G-958, Conceptual Future Sewers, the majority of the Township can be served by gravity sewers without the need for additional pump stations. In many cases, however, the design requires pipe slopes that are at or just above the minimum slopes allowed by the NJDEP (N.J.A.C. 7:14A-23.6). The use of polyvinylchloride (PVC) pipe is necessary to successfully take advantage of these minimal slopes. Also, most areas to be sewered will require precise construction. Therefore, to ensure proper installation and long-term reliability, Crew highly recommends that full-time construction observation for sewer construction be performed by competent personnel.

A new 12-in. trunk sewer is conceptually shown within the unsewered portion of the Boulevard north of Sunset Road. This trunk sewer will provide connection points for 8-in. sanitary sewers on side streets.

A new 10-in. trunk sewer is conceptually shown within the unsewered portion of Newark-Pompton Turnpike between Pequannock Valley School and Jefferson Street and on Alexander Avenue. This trunk sewer will provide connection points for 8-in. sanitary sewers on side streets and will convey wastewater to a new areawide pump station at the DPW building. This pump station will pump to a new gravity sewer on Tilley Avenue.

Another areawide pump station is conceptually shown on Woodland Place by the railroad crossing. This pump station will receive wastewater from Newark-Pompton Turnpike north of Lockwood Avenue and side streets.

A third and smaller areawide pump station is conceptually shown at the end of Ridge Road. This pump station will receive wastewater from the surrounding side streets north of Mountain Avenue.

Several other pump stations are conceptually shown for short cul-de-sacs or streets that are two low to sewer by gravity. These pump stations would be much smaller in capacity, size, and cost. They would also require a smaller area for construction.

Other areas are primarily served by connecting to existing or proposed sanitary sewers as shown on Drawing G-958. As a general note, the Route 23 Pump Station and Jackson Avenue Pump Station were designed as areawide pump stations. These pump stations were designed to accommodate the future flows anticipated by previous Sewer Master Plan updates, and thus can also handle all flows presented in this report.

3.3 Priority Areas

Of the ten priority sewer construction projects identified in the 2003 Sewer Master Plan Update, six have been completed (Priority Areas 13-1, 13-3, 14-1, 14-2, 14-3, and 14-7). The remaining

four priority sewer construction projects, for which associated flows have been reserved and encumbered, include the area of Route 23 (Priority Areas 14-5 & 6), the area of Jacksonville Road (Priority Area 13-2) and the area of First Street, Second Street, Third Street, and Fourth Street (Priority Area 14-4). These four priority areas are identified on Drawing G-958 and their associated reserved flows are tabulated in Appendix B.

Additionally, the Township's Health Officer has indicated that there are currently no public health or environmental factors that would create additional sewer construction priority areas.

3.4 Sewer Extensions to Serve Existing Properties

Future expansions to the Township's sanitary sewer system to serve existing properties could be initiated by developers, by residents, or by the Township. In cases of sanitary sewer system expansion instituted by the Township, unsewered properties along the new sewer route are subject to mandatory connection as described by §152.02.050 of the Township's code.

- 1. Developer (or resident acting as developer) In this scenario, sewer extensions are constructed by the applicant and ownership vested in the Township as described by §152.03.150 of the Township's code.
- 2. Resident Residents desiring that the Township extend the sanitary sewer to serve their properties may petition the governing body as described by §152.03.190 of the Township's code. In this scenario, sewer extensions to serve existing properties are constructed by the Township but paid for by the residents.
- 3. Township The Township may initiate extensions of the sanitary sewer system, such as to serve priority areas.

3.5 Sewers for Subdivisions

In the case of new development, sewer extensions are required for each lot in a subdivision when the Township's sanitary sewer system is reasonably accessible (see §163.04.150 of the Township's code). Furthermore, dry sewers are required for each lot in a subdivision when the Township's sanitary sewer system is not reasonably accessible but a sewer plan has been adopted by the Township (see §163.04.170 of the Township's code).

3.6 House Service Connections

In general, properties will be connected to the sanitary sewer system by a gravity sewer lateral that connects the house service connection to the sewer main in front of the respective property (see §152.03.060 of the Township's code). However, in areas where existing utilities prevent extensions of the sewer main, e.g. City of Newark Aqueducts, private force mains may be allowed to be constructed in the street to connect the house service connection to a sanitary sewer manhole (see §152.03.090 of the Township's code).

3.8 Cost

There are currently approximately 2,300 properties in the Township that are not connected to the sanitary sewer system. Excluding the cost of full-width roadway paving, the average construction cost per property would be approximately \$22,000 to \$29,000. This opinion of probable construction cost was developed without the benefit of final design and is only meant to provide a rough order of magnitude of what the construction cost would be for the 2,300 properties when taken on the whole. The actual construction cost per property will vary based on the scope of the respective sewer extension project, the depth of the sewer, and the need for pump stations. Additionally, any water main replacements were assumed to be paid for by the water utility.

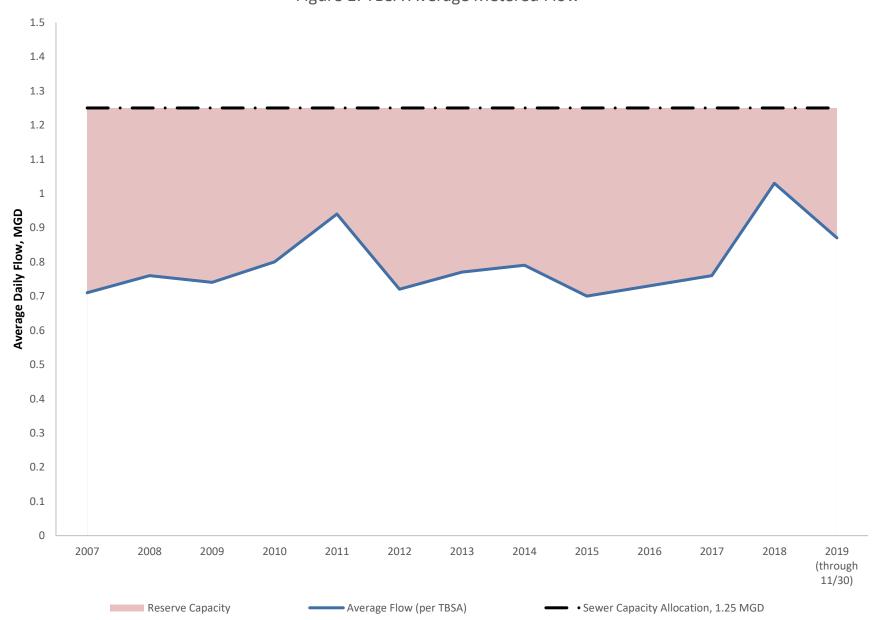


Figure 1: TBSA Average Metered Flow

Crew Engineers, Inc.

Butler, NJ

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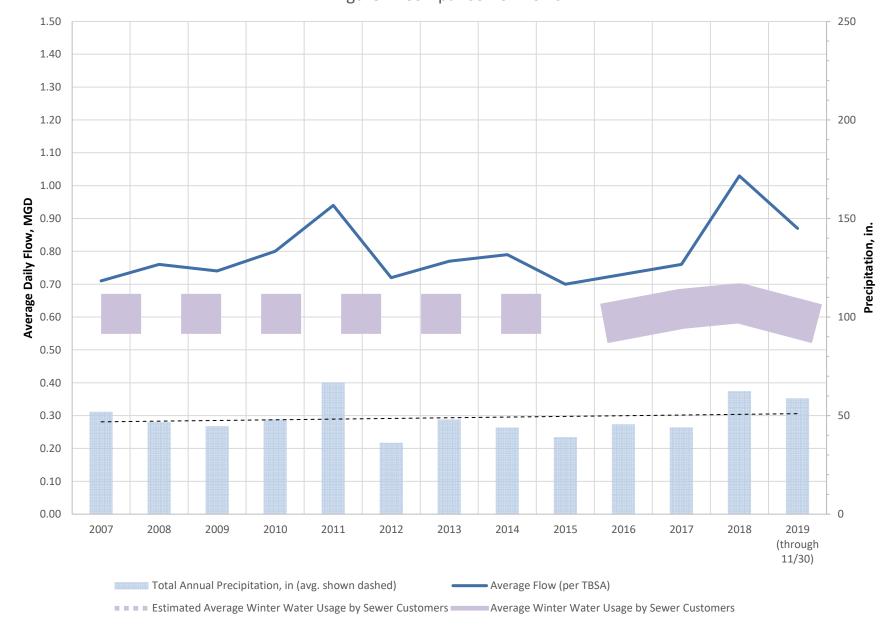


Figure 2: Comparison of Flows

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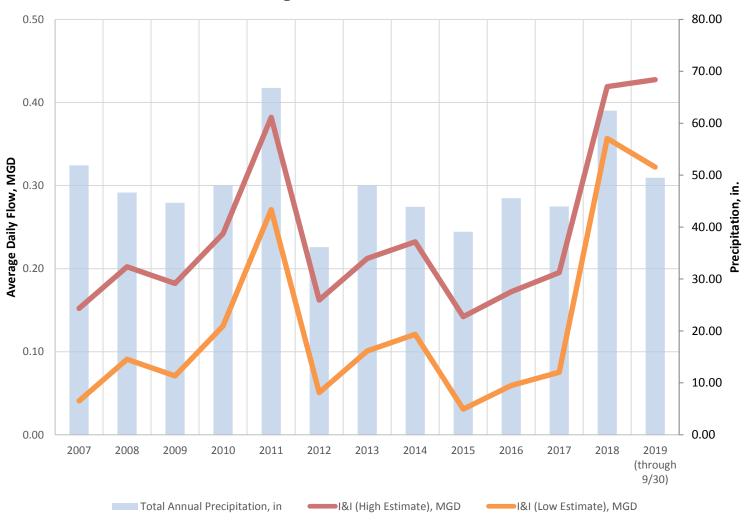


Figure 3: I&I Quantification



Figure 4: Decrease in Winter Quarter Water Usage

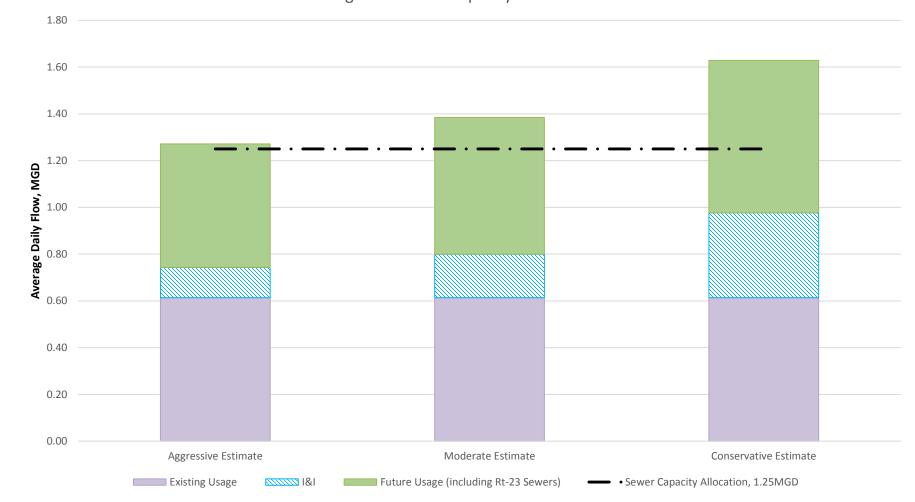


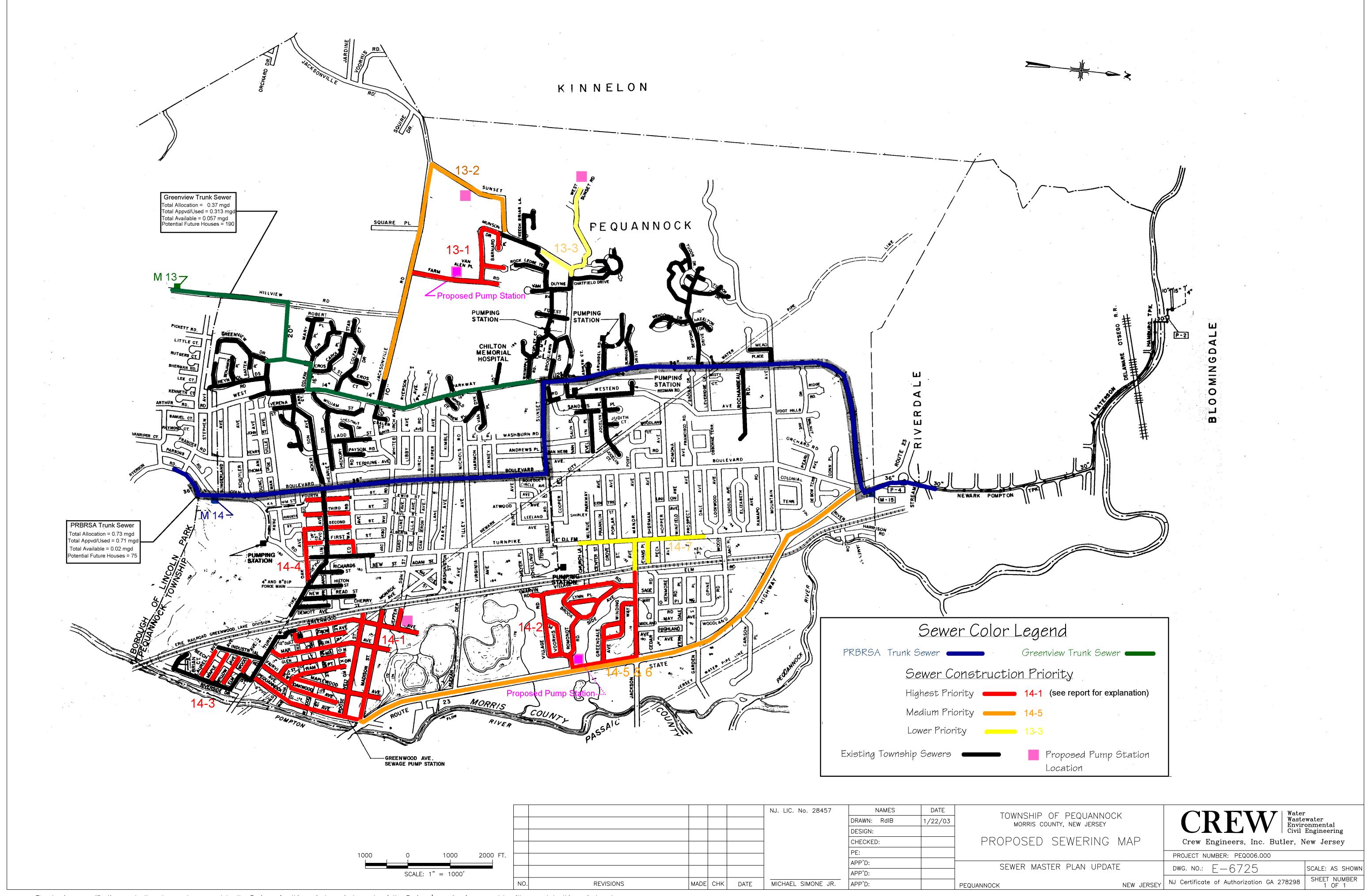
Figure 5: Sewer Capacity Evaluation

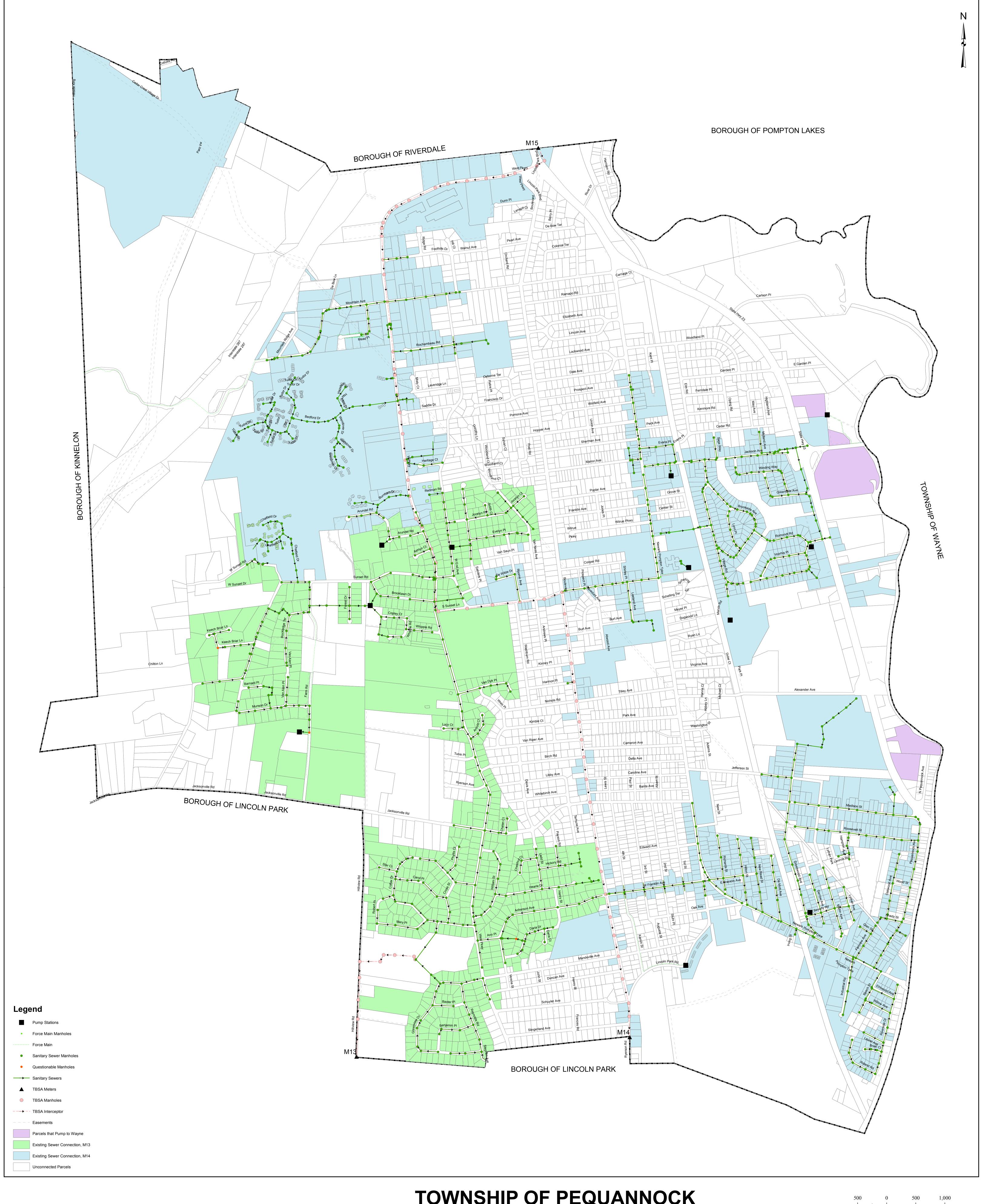
Table 1: Potential I&I Reduction Cost Savings

Low Estimate of Savings												
Fiscal Year	Estimated I&I,	User Charge Associated w		Reduction in I&I								
	MGD	1&1		10%		20%*	25%		50%		75%	
2016	0.06	\$ 71,00	00	\$ 7,000	\$	14,000	\$	18,000	\$	35,000	\$	53,000
2017	0.09	\$ 102,00	00	\$ 10,000	\$	20,000	\$	25,000	\$	51,000	\$	76,000
2018	0.36	\$ 364,00	00	\$ 35,000	\$	69,000	\$	87,000	\$	177,000	\$	269,000

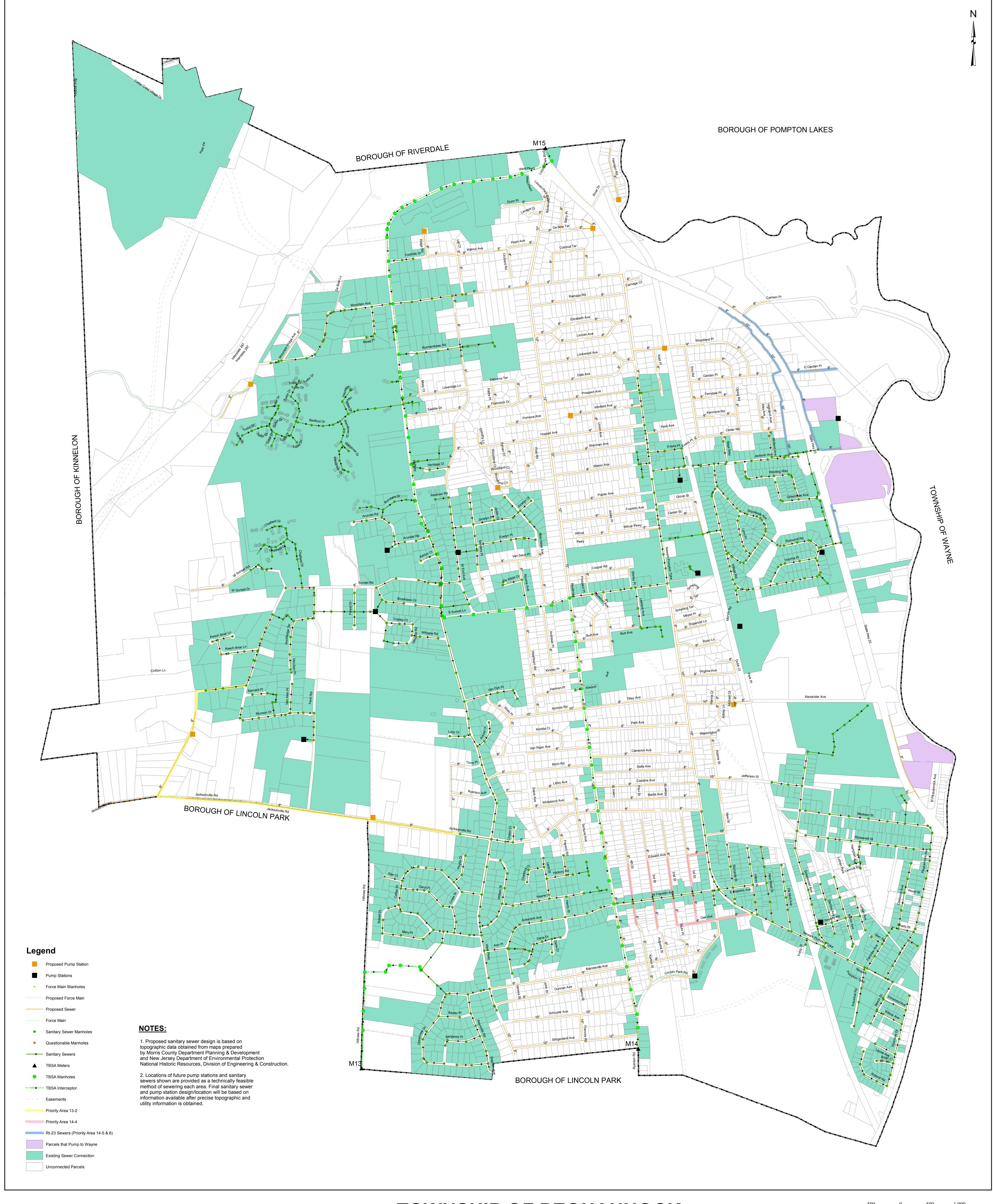
High Estimate of Savings													
Fiscal Year	Estimated I&I,	User Charges Associated with	ו	Reduction in I&I									
	עטואו	I&I		10%		20%*		25%		50%		75%	
2016	0.17	\$ 205,000	\$	20,000	\$	40,000	\$	50,000	\$	101,000	\$	152,000	
2017	0.20	\$ 233,000	\$	22,000	\$	45,000	\$	56,000	\$	114,000	\$	173,000	
2018	0.47	\$ 485,000	\$	45,000	\$	91,000	\$	114,000	\$	233,000	\$	356,000	

^{*}Estimated reduction in I&I associated with West Franklin Ave













APPENDIX A

Township of Pequannock Sanitary Sewer System Construction Standards and Testing Requirements

TOWNSHIP OF PEQUANNOCK

SANITARY SEWER SYSTEM CONSTRUCTION STANDARDS AND TESTING REQUIREMENTS

Prepared for:

Township of Pequannock 530 Newark-Pompton Turnpike Pompton Plains, NJ 07444

February 1, 2020



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1.0 INTRODUCTION

1.1 Summary

These Standards outline procedures, materials, installation, and testing requirements for the approval and acceptance of sanitary sewerage facilities instituted by developers and other applicants to be installed in the Township of Pequannock, Morris County, New Jersey.

These Standards do not provide an exhaustive list of required permits for every project, which may include New Jersey Department of Environmental Protection (NJDEP) Treatment Works Approval (TWA), Morris County Road Opening Permit, Township of Pequannock Road Opening Permit, and Township of Pequannock Construction Permit, all of which may have additional requirements to those listed herein. All permitting is the responsibility of the Developer/Applicant.

When used in this document or the corresponding drawings, references to "Engineer" shall mean the Township Engineer or the Township's appointed Sewer Engineer.

When used in this document or the corresponding drawings, references to "contractor" shall mean the Developer/Applicant or his contractor.

2.0 INFORMATION TO BE SUBMITTED FOR REVIEW

2.1 Preliminary Submission

Preliminary plans for projects within the Township of Pequannock shall be submitted by Developer (or his representative) through the Planning Board to the Engineer after approval of the street plan. Projects that do not require Planning Board approval or that are outside the Township of Pequannock but connected to the Pequannock sewer system shall be submitted by Developer/Applicant through the Department of Public Works to the Engineer. All submitted plans shall include the following:

- 1. Two (2) hard copies and one (1) PDF set of Plans showing preliminary layout of the sanitary sewers and appurtenances.
- 2. Plans shall be prepared on a sheet size of at least 22" x 34".
- 3. All Plans shall be consecutively numbered, and the total number of Drawings submitted shall be indicated on each Drawing.
- 4. Plans shall show at least the following:
 - a. Existing topography.
 - b. Proposed topography.
 - c. Existing pavement grades.
 - d. Proposed pavement grades.
 - e. Existing lot lines.
 - f. Proposed lot lines.
 - g. Location of existing water, sewer, gas, underground telephone, and electric utilities.
 - h. Location of proposed sanitary sewers, size, material, and class.
 - i. Location of proposed manholes.
 - j. Location of proposed water, gas, underground telephone and electric utilities.
 - k. First-floor and basement floor elevations of proposed buildings.
- 5. Existing conditions survey shall be prepared by a Professional Land Surveyor licensed to practice in the State of New Jersey.
- 6. All elevations shall be based on NAVD88 Datum, US Survey Feet. All horizontal control shall be based on New Jersey State Plane Coordinate System NAD83.
- 7. Plans shall be drawn to a scale of 1" = 40' or larger.
- 8. Profiles shall be drawn to a vertical scale of 1" = 4', and a horizontal scale of 1" = 40' or larger.

- Plans shall be prepared by a Professional Engineer licensed to practice in the State of New Jersey.
- 10. The Developer/Applicant's engineer is responsible for the design of the sanitary sewerage facilities to ensure the proper depth and location of the sanitary sewers to serve the lowest elevation of the residence or building.
- 11. The sanitary sewerage facilities shall be designed in accordance with the Township's Sewer Master Plan to ensure the proper depth and location of the sanitary sewers to serve additional properties in the future as shown on the Conceptual Future Sewers plan.
- 12. One permanent benchmark should be shown within the construction area for every 1,000 feet of proposed sanitary sewer. Benchmark tie sheets shall be submitted to the Planning Department.

2.2 Preliminary Review

The Engineer will review the preliminary plans for conformance with Section 3.0 - DESIGN CRITERIA and make recommendations on the preliminary submission to the Township. The Township will review the recommendations and, if it concurs with the Engineer's findings, will approve the preliminary Plans.

2.3 Final Submission

Upon approval of the preliminary Plans, all corrections shall be made and the following shall be submitted to the Engineer:

- 1. Two (2) hard copies and one (1) PDF set of plans marked "Final for Sanitary Sewers".
- Two (2) copies of NJDEP TWA application (including TWA-1 Form, WQM-003 Form, WQM-006 Form, notifications, and check for Plan review). For sanitary sewer systems that are to be owned and operated by the Township, the application shall be prepared on behalf of the Township for signature by an authorized representative of the Township.
- 3. Final Plans shall include the following in addition to the items required for preliminary submission:
 - a. Plans and Profiles showing sanitary sewer grades, stationing between manholes, manhole identifying numbers. Elevations of inverts and top of manholes.
 - b. Location of all sewer laterals, including cleanouts, plumbing elevations and slopes.
 - c. Engineer's Report (NJDEP Form WQM-006).
- 4. The Engineer's Specifications required by the NJDEP to be submitted with the application will meet these Sanitary Sewer System Construction Standards and Testing Requirements.
- 5. Structural computations and loads for all pipes greater than 20 feet in depth (as measured from invert to ground surface).

- 6. Design computations for all special structures.
- 7. Hydraulic computations substantiating the size of all sewer pipes and wastewater facilities.
- 8. A note indicating that the sanitary sewer shall be constructed in conformance with the Township of Pequannock Sanitary Sewer System Construction Standards and Testing Requirements, dated February 1, 2020, as may be amended from time to time.
- 9. Other information pertinent to the design, such as soil boring samples that have been collected or that are required.
- 10. Final Plans and other supporting information shall bear the signature and seal of the Professional Land Surveyor who prepared the survey and the Professional Engineer who prepared the design, and shall show the date of the preparation.

2.4 Final Review

Subject to the satisfactory completion of all final data, the Engineer will recommend approval of the data by the Township.

The Township will review the recommendations and, if it concurs with the Engineer's findings, will approve the Final Plans, execute the application to the NJDEP, and return it to the Developer/Applicant's engineer for transmittal to the Two Bridges Sewerage Authority (TBSA), if applicable, and the NJDEP for approval. All correspondence to or from the TBSA and NJDEP shall be copied to the Township Engineer and the Engineer. Construction of sewerage facilities shall be subject to the approval of the Plans and application by the NJDEP.

3.0 DESIGN CRITERIA

3.1 General

The design shall comply with the latest regulations of the NJDEP Pollutant Discharge Elimination System, NJAC 7:14A 1 through 4, 6 through 23 promulgated pursuant to NJSA 58:10A 1, et seq; 58:11A 1, et seq; 58:11 49, et seq; 58:10 23.11, et seq; 58:11 64, et seq; ; 13:1D 1, et seq; 13:1E 1, et seq; and 58:12A 1, et seq; 13:1B 3, et seq and 26:2C 1, et seq , except as otherwise indicated or modified in these Standards. In addition, where appropriate, the sanitary sewer facilities shall comply with the Residential Site Improvement Standards, NJAC 5:21 6, Sanitary Sewers; and Chapter 152, Sewers, of the Code of the Township of Pequannock, as amended.

The slope of the upper portions of all dead-end sewers, where possible, shall be 0.008 feet per foot to minimize maintenance problems.

The sewer lateral shall provide for sewer service to the basement of the house or building, if applicable. The first-floor elevation should be consistent with the topography of the lot and the requirements of the Township with respect to the elevation above the road surface.

3.2 Manholes

Manhole spacing for sanitary sewers with a diameter of 12 inches or smaller shall be 300 feet, but may be exceeded to avoid spacing closer than 200 feet on a straight run. Maximum manhole spacing shall be 400 feet.

Except where otherwise specified by the Township, sanitary sewer manholes that are located within the right-of-way shall be at or near the center line of the paved cartway, but at a minimum of 5 feet from the edge of the pavement. Additionally, sanitary sewer mains shall be a minimum of 10 feet from the right-of-way line.

3.3 Sewer Laterals

Sewer laterals shall be constructed from the sanitary sewer in the street to the property line of each lot, and shall meet the following requirements:

- 1. Minimum diameter shall be 4 inches.
- 2. Minimum slope shall be 1/4 inch per foot.
- 3. Watertight plugs or caps shall be provided at all dead ends.
- 4. A cleanout shall be provided as shown on the Details under Section 3.4.

When in the opinion of the Engineer, the sanitary sewers will be deep, deep sewer lateral connections, as shown on Construction Detail Drawing 10, shall be constructed by the contractor to eliminate excessive depth of the sewer lateral.

All existing sewer laterals on a site that are permanently taken out of service as a result of the building being demolished, new sewer lateral being constructed, or for any other reason must be abandoned. Sewer laterals must be abandoned by removing the entire sewer lateral in the right of way including the cleanout. The sewer lateral connection tee or tee-wye to the sanitary sewer must be plugged with a cap or plug. Other methods of abandonment may be approved at the discretion of the Engineer.

3.4 Construction Details

The following construction details are appended hereto as part of these Standards:

<u>Drawing</u>	<u>Title</u>
1	Sewer Bedding Details
2	Standard Sanitary Manhole Detail
3	Interior Drop Connection Detail
4	Shallow Manhole Detail
5	Connection to Existing Manhole Joint Detail
6	Flexible Compression Joint Detail
7	Manhole Frame and Cover Detail
8	Standard Sewer Lateral Connection Detail
9	Sewer Lateral Cleanout Detail
10	Deep Sewer Lateral Connection Detail
11	Concrete Encasement Detail

4.0 MATERIAL SPECIFICATIONS

4.1 Pipe

All sewer pipe shall meet the following specifications. Two (2) copies of Certificates of Compliance with these specifications shall be furnished by the pipe manufacturer for the Engineer's approval with each shipment of pipe.

1. Polyvinyl Chloride Sewer Pipe

Polyvinyl chloride sewer pipe shall conform to Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Plastic Piping Systems ASTM D-3034. Minimum Class SDR35 shall be used for depths up to 14 feet (as measured from invert to ground surface). Minimum Class SDR26 is required where trench depths are greater than 14 feet (as measured from invert to ground surface). Pipe with a diameter larger than 12 inches will be evaluated on a case-by-case basis. Joints shall be sealed with rubber gasket so assembly will remain watertight under all conditions of service, including movement resulting from expansion, contraction, settlement, and deformation of pipe. Gaskets shall be elastomeric and conform to ASTM F477.

Ductile Iron Pipe

Ductile iron pipe, shall conform to "Ductile Iron Pipe Centrifugally Cast in Metal or Sand-Lined Molds for Water or Other Liquids", AWWA C151. Joints for ductile iron pipe shall be the "push-on" type. Ductile iron pipe shall be asphaltic-coated, minimum Class 52, and lined with Protecto 401 ceramic epoxy lining, as manufactured by Induron Protective Coatings. Gaskets shall conform to AWWA C111.

3. Sewer Laterals

See Construction Detail Drawings 8, 9, and 10 of these Standards. Sewer laterals shall be constructed of the same material as the sanitary sewer. Cleanout risers and tee wyes shall be the same material as the sanitary sewer.

Provide wye-type building sewer saddles, as manufactured Harrington Corporation, or approved equal for connecting sewer laterals to existing sanitary sewers. Saddle base shall be molded and be suitable for SDR35 PVC pipe connection. All bolts and straps shall be stainless steel.

4.2 Manholes

All manholes shall be precast concrete constructed in accordance with Construction Detail Drawings 2, 3, 4, 5, 6, and 7 of these Standards.

Cast-in, push-fit, compression pipe to manhole connectors shall be A-LOK X-CEL as manufactured by A-Lok Products, Inc., Tylox WT+ as manufactured by Hamilton Kent, or approved equal. Boots and other connectors that rely on clamps and bands will not be acceptable.

Preformed flexible joint sealants shall be butyl rubber or flexible plastic. Butyl rubber joint sealant shall be Kent Seal (as manufactured by Hamilton-Kent, Inc.), Rubr-Nek (as manufactured by Henry Company), Butly-Lok (as manufactured by A-Lok Products, Inc.), or approved equal. Flexible plastic joint sealant shall be Ram-Nek, as manufactured by Henry Company, or approved equal.

Coal tar epoxy for exterior coating shall be Targuard or approved equal. Trowel grade bituminous coating for exterior coating shall be 793 Premium Foundation Coating, as manufactured by Henry Company, or approved equal.

Manhole steps shall be made out of solid aluminum or plastic-coated steel. Embedded portion of steps shall be deformed and grouted to withstand specified live loading.

- 1. Solid aluminum steps shall be manufactured of extruded aluminum. Hollow steps will not be permitted. Steps shall be 7/8-in. riser x 13/16 in. tread, and project into manhole wall 4 3/4 in.
- 2. Plastic-coated steel manhole steps shall be manufactured of gray iron in accordance with ASTM Specification A48 83, Class 30B or ASTM A615 Gr 60 steel rebar and coated with copolymer polypropylene plastic. Solid plastic steps will not be permitted.

Heat shrinkable sleeve for encapsulation of upper portion of manhole shall be WrapidSeal as manufactured by CCI Pipeline Systems, Riser-Wrap as manufactured by Pipeline Seal and Insulator, Inc., or approved equal.

Drop manholes will be constructed in accordance with Construction Detail Drawing 3 where the difference between the inlet and outlet pipe elevations is 2 feet or greater.

If a force main will connect to a manhole, the interior of the manhole shall be lined with Dura Plate 100 Liner System, as manufactured by A-Lok Products, Inc., or approved equal. Any areas of concrete not covered by the liner shall be coated with epoxy as manufactured by NeoPoxy International, Dura-Plate 235 epoxy as manufactured by Sherwin Williams, or approved equal.

4.3 Miscellaneous

1. Flexible Connectors

Synthetic rubber base compound formulated to resist acids, alkalis, solvents, and greases encountered in sanitary or storm sewers and contain no reclaimed rubber, as

manufactured by FERNCO, Inc., Clow, or approved equal. All hardware shall be stainless steel.

Material specifications for other special sewerage system facilities, such as pump stations and force mains, will be furnished by the Engineer when necessary.

5.0 INSTALLATION

5.1 General

See Trench Detail Drawing 1 of these Standards.

No facilities shall be constructed until the Township has received the approved TWA Permit for the Construction of the Facilities from the NJDEP, the applicable road opening permit has been secured, and approval to begin construction has been granted to the Developer/Applicant by the Township of Pequannock.

Prior to the ordering and delivery of materials required for construction of the sanitary sewer facilities, the Developer/Applicant or his contractor shall submit to the Engineer one copy (either hard copy or PDF) of shop drawings for the various components for review and approval. Materials that do not comply with these Standards will be rejected and revised shop drawings shall be submitted. Any materials ordered by the contractor prior to receiving approval from the Engineer, will be at the contractor's risk.

For large projects (as determined by the Township), prior to commencement of the construction of the sanitary sewers, the Developer/Applicant and his contractor will be required to attend a preconstruction meeting to review and discuss the various aspects for the construction of the sanitary sewers. The contractor will be required to furnish a detailed schedule showing the proposed sequence of construction for the sanitary sewers with time table of dates.

All manholes and sewer lateral cleanouts shall be properly staked in the field by the Developer/Applicant's licensed land surveyor. The Developer/Applicant's licensed land surveyor is responsible for furnishing and installing grade stakes for the construction of the facilities. Submit surveyor's grade calculation sheets for proposed construction of sanitary sewer to the Engineer prior to beginning sewer construction.

The Developer/Applicant shall notify the Township Engineer and the Engineer at least 72 hours prior to the start of construction.

The Engineer will perform full-time observation of the construction performed by the Developer/Applicant or the Developer/Applicant's contractor (see Section 6.0 of these Standards). All construction work performed on private property for installation of the house service connection is under the jurisdiction of the Township of Pequannock Construction Official. The Developer/Applicant shall be responsible to secure the necessary permit and provide notice to the Construction Official as required.

The Developer/Applicant's contractor that performs the work shall be experienced in the construction of sewerage facilities. It is the responsibility of the Developer/Applicant to engage qualified contractors and subcontractors to perform the work whose workers have received training in construction site safety and are familiar with Federal, State, and local regulations applicable to the project. The contractor is responsible for the complete safety of his workers,

pedestrians, travelling public, Township representatives, and others at the construction site, and shall comply with applicable provisions of the Federal Occupational Safety and Health Act (OSHA) and applicable provisions of State, County, and local safety regulations. When on site, the Engineer and Township representatives will comply with the Health and Safety Plan established by the contractor for the project site. The Developer/Applicant's contractor is responsible to furnish a copy of the Health and Safety Plan to the Engineer and Township prior to beginning construction.

If the Engineer or Township determines that the contractor's safety plans, programs, and procedures do not provide adequate protection for the Engineer or Township representatives, the Engineer or Township may direct its employees or representatives to leave the project site or implement additional safeguards for his employees' or representatives' protection. If taken, these actions will be in furtherance of the Engineer's or Township's responsibility to its employees and representatives only, and neither the Engineer nor Township will assume responsibility for protection of any other persons affected by the work.

If the Engineer or representative of the Township observes situations which appear to have potential for immediate and serious injury to persons, Engineer or representative of the Township may warn persons who appear to be affected by such situations. Such warnings, if issued, shall be given based on general humanitarian concerns, and Engineer or representative of Township will not, by issuance of any such warning, assume any responsibility to issue future warnings or any general responsibility for protection of persons affected by work.

5.2 Pipe

All pipe shall be laid in a dry trench with the trench bottom providing proper support.

Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, all types of refuse, vegetable or other organic material or large pieces of inorganic material, the contractor shall excavate and remove such unsuitable material to the depth required and replace it with a thoroughly compacted foundation of 1 1/2 –inch stone.

In areas where rock or boulders occur, the trench shall be excavated so that no rock or boulder is closer than 8 inches to the outside barrel of the pipe.

Where groundwater conditions exist, the contractor shall provide dewatering operations as necessary to dewater the trench a minimum of 12 inches below the invert of the sewer pipe. The Developer/Applicant will be responsible to obtain any required permits for dewatering operations.

Lateral Pipe connection to existing sewers shall be made by carefully cutting, coring, or drilling an opening in the existing pipe wall, dimensionally equal to that recommended by the manufacturer of the sewer saddle.

The bedding and initial backfill shall be granular material free from frozen earth and stones larger than 1 inch in diameter, and shall be thoroughly tamped on each side and under the pipe and, insofar as practicable, in layers not exceeding 6 inches in thickness.

Backfill in the upper portion of the trench shall be free from wet or frozen earth, unsuitable material or refuse, and stones larger than 6 inches in diameter. The backfill shall be compacted to eliminate any subsequent settlement of the pavement, sidewalk, or lawns to be constructed over the pipe. Where sufficient satisfactory backfill material is unavailable on the site, or where excavated material has been determined by the Engineer to be unsuitable, the contractor is required to provide select fill material.

1. Under Existing or Future Roadways, Sidewalks, and Driveways

All backfill more than 1 foot above the top of pipe in roadways or where sidewalks, driveways, utilities, fences, or curbing exist or will be constructed over the area to be backfilled, shall be compacted as follows:

- a. By approved vibratory soil compactors if the backfill material is preponderantly sand or sand and gravel and contains less than 12 percent by weight of materials that will pass a 200 mesh sieve.
- b. By approved flat-faced mechanical tampers, if the backfill material is preponderantly cohesive.

In (a) above, approved flat-faced mechanical tampers may be substituted for the vibratory soil compactors where the sheeting and bracing of trenches or other special conditions make the use of vibratory compactors impractical.

The backfill shall be placed and compacted in layers not more than 6 inches thick when using mechanical tampers and not more than 12 inches thick when using vibratory compactors, loose measurement, unless the contractor can demonstrate through soil compaction testing that the required compaction can be achieved when backfilling in greater thickness layers.

Jetting, flooding, puddling, or vibroflotation of trench materials to achieve compaction or trench settlement will not be permitted.

2. In Open Areas That Will Remain as Open Areas

Backfilling trenches more than 1 foot above the top of pipe in areas where roadways, sidewalks, driveways, utilities, fences, or curbing do not exist or will not be constructed, may be done with bulldozer or power shovel if recommended by Developer/Applicant's engineer. Where backfilling is permitted with bulldozer or power shovel, the contractor shall provide supervision in addition to the machine operator at the point of backfilling to carefully supervise this operation. Backfill material must not be dropped directly in the

open trench, but the trench shall be backfilled by sliding the backfill down the inclined face of the material in the trench.

5.3 Manholes

Manholes shall be installed in a dry trench in a plumb position and properly supported by a layer of thoroughly tamped bedding, as shown on Construction Detail Drawing 2 of these Standards.

The joints and preformed flexible joint sealants of the precast sections to be placed together shall be thoroughly cleaned prior to jointing, and shall be checked for proper jointing subsequent to placing the sections together. The manhole steps in each section shall be aligned to form a continuous ladder to the top of the manhole. Lift holes in precast sections shall be plugged with a rubber stopper, and then filled with mortar and made watertight. The pipe connections to the manholes shall utilize flexible joints, as shown on Construction Detail Drawing 6 of these Standards.

Backfill around manholes shall be placed in 6 inch layers and thoroughly compacted to eliminate settlement. Backfill within 2 feet of the structure walls shall be free of stones larger than 3 inches in diameter.

5.4 Miscellaneous

Installation requirements for other special sewerage system facilities, such as pump stations and force mains, will be established by the Engineer when necessary.

6.0 INSPECTION AND TESTING

6.1 General

All proposed sewerage facilities shall be subject to the approval of the Engineer. The Engineer is responsible for observing the construction of the sanitary sewers and appurtenances for conformance with the Township Standards, inspecting the constructed sanitary sewer, and witnessing the testing of the sanitary sewer.

6.2 Full-time Observation

The Engineer will perform full-time observation of the construction performed by the Developer/Applicant or the Developer/Applicant's contractor. The detailed observation of construction by the Engineer will include observation of the excavation of the trench, the trench prior to pipelaying, the installation of all sewerage facilities, the backfilling and compacting of all trenches, and paving of all trenches. This observation will be performed by a responsible, qualified representative of the Engineer.

6.3 Final Inspection

Following installation of the sanitary sewerage facilities by the Developer/Applicant, he shall clean out all of the sewers and manholes and notify the Engineer that the facilities are ready for a final inspection. The Developer/Applicant shall notify the Township Engineer and the Engineer, at least 72 hours prior to the start of final inspection and testing.

The Developer/Applicant will be responsible to perform a televised video inspection of the constructed sewers upon their completion. The televised inspection must be witnessed by the Engineer. In conjunction with the televised video inspection, the Developer/Applicant shall aid the Engineer or his designated representative in making an internal visual inspection of each section of the constructed sewer from manhole to manhole. A copy of the digital recording for the televised inspection shall be furnished to the Engineer.

The pipe shall be true to line and grade, shall show no leaks, shall be free from cracks and protruding materials, and shall contain no deposits of sand, dirt, or other materials which will reduce the full cross-sectional area of the pipe and reduce the flow.

6.4 Testing

After a satisfactory visual inspection of the facilities, pipes shall be tested by deflection testing and either air testing or infiltration testing, and manholes shall be tested by either exfiltration testing or vacuum testing. The testing shall be made by the Developer/Applicant's contractor and the tests must be observed by the Engineer or his designated representative. The Engineer will prepare a written report on the results of the testing.

1. Deflection Testing

Deflection testing will be required for 8 inches or greater PVC pipe but not DIP pipe. Deflection testing shall be performed by the contractor using a cylindrical mandrel. For testing pipelines having an inside nominal diameter of 8 inches, the test mandrel shall have 8 evenly spaced arms or runners. For testing pipelines having an inside nominal diameter of 10 inches or greater, the test mandrel shall have 12 evenly spaced arms or runners. Such mandrels shall be a manufactured product approved by the Engineer. The allowable deflection limit shall be 5 percent. The deflection testing shall not begin until the sewer pipe has been installed for at least 30 days, or as approved by the Engineer.

The contractor shall thoroughly clean the pipeline by a high-velocity water jet stream or an inflatable sewer cleaning ball prior to pulling the test mandrel through the pipeline. If the mandrel cannot pass through the pipe section being tested, the contractor shall replace said pipeline at the point of blockage. Upon completion of the replacement or repair, the pipe section shall be retested (including televised video inspection) until a satisfactory result is obtained.

The initial deflection testing shall be completed and approved prior to commencement of low-pressure air testing or infiltration testing.

2. Air Testing of Sewer Pipe

Furnish all labor, materials, and equipment necessary to perform the test as follows:

- a. Clean pipe to be tested with water or by high-pressure water jet.
- b. Plug all pipe outlets with suitable test plugs. Brace each plug securely.
- c. At no time shall the test pressure exceed 5 psig. A regulator or relief valve set no higher than 5 psi shall be included on all pressurizing equipment.
- d. Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig (5.0 psig if groundwater is present above top of pipe).
- e. If any failures are observed, bleed off air and make necessary repairs.
- f. After an internal pressure of 4.0 psig (5.0 psig if groundwater is present above top of pipe) is obtained, allow at least 2 minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.
- g. After the 2 minute period, disconnect air supply.
- h. When pressure decreases to 3.5 psig (4.5 psig if groundwater is present above top of pipe), start stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig (3.5 psig if groundwater is present above top of pipe). This time interval should then be compared with the time required below.

TABLE 1 Minimum Specified Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe Indicated for Q = 0.0015

Note 1-See Practice UNI-B-6-90.

Non: 2-Consult with pipe and appurtenance manufacturer for maximum test pressure for pipe size greater than 30 in. in diameter.

Pipe	Minimum	Length	Time for	Specification Time for Length (L) Shown, min:s							
Diameter, in.	Time, mincs	Minimum Time, ft	Longer Length, s	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46

Sewer laterals shall be included in the test.

3. Infiltration Testing of Sewer Pipes

As an alternative to air testing, infiltration testing of sewer pipes can be performed by the contractor. The maximum allowance for infiltration shall be 50 gallons per 24 hours per inch internal diameter per mile of sanitary sewer, including all sewer lateral connections and manholes.

Sanitary sewers shall not be tested for infiltration until at least 2 weeks after all backfilling over the sewers has been completed. The Developer/Applicant's contractor shall furnish all weirs, labor, and apparatus necessary to perform the tests. The duration of the tests shall be a minimum of 24 hours.

Infiltration tests shall only be performed when the groundwater is more than 2 feet above the top of the sanitary sewer pipe as determined by water level measurement. Developer/Applicant will be responsible for installing piezometers for water level measurement and removing same after successful testing.

Exfiltration Test for Manholes

Supply all water, plugs, and all labor and equipment for the test. The exfiltration test shall be made by filling the manhole with water to the bottom of the cone section. After sufficient allowance for absorption of the water in the concrete walls, the amount of exfiltration will be obtained by observing the water level in the manhole for a minimum period of 4 hours. The allowable drop in water level in 4 hours for a 4 foot diameter manhole is 1/8 inch per foot of water depth and for a 5-foot-diameter manhole is 3/16 inch per foot of water depth.

5. Vacuum Testing for Manholes

As an alternative to exfiltration testing, vacuum testing of manholes can be performed by the contractor.

- a. Test manhole immediately after assembly and prior to backfilling.
- b. Plug all lift holes with an approved nonshrink grout.
- c. All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.
- d. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendation.
- e. A vacuum of 10 in. of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 in. The manhole will pass if the time is greater than 60 sec for 48-in.-dia, 75 sec for 60-in.-dia, and 90 sec for 72-in.-dia manholes.
 - i. A vacuum test will be disallowed on manholes greater than 72 in. in dia.
- f. If the manhole fails the initial test, necessary repairs shall be made with a nonshrink grout. Retesting shall proceed until a satisfactory test is obtained.

7.0 RECORD DRAWINGS

Prior to acceptance of the facilities by the Township, the Developer/Applicant shall submit Record Drawings of the completed facilities to the Engineer for review and approval and, once approved, file with the Township Engineer one hard copy and one PDF of the approved Record Drawings of the sewerage facilities installed. The Record Drawings shall be revisions of the Final Plan submission with Profiles, and they shall accurately show the following information:

- 1. Location, size, class, and type of all sanitary sewers and sewer laterals; data will be furnished by the Engineer.
- 2. Location of all manholes and sewer lateral connections by stationing along the sewers which are installed; data will be furnished by the Engineer.
- 3. Tie-in measurements from the ends of every sewer lateral (cleanout) at the property line to permanent physical features so that the sewer laterals may be located at any time subsequent to their installation; data will be furnished by the Engineer.
- 4. The depth of the sewer lateral below the surface of the finished ground at the property line, and depth of deep sewer lateral connections below the surface of the road; data will be furnished by the Engineer.
- 5. Pipe invert and rim elevations of each manhole to within 0.01 feet of their true elevation; data shall be furnished by the Developer/Applicant's engineer or licensed surveyor.
- 6. Distance between manholes measured to within 0.10 feet of their true distance together with the pipe slope calculated to within 0.01%; data shall be furnished by Developer/Applicant's engineer or licensed surveyor.
- 7. The location and extent of any concrete encasement or other special construction used in the construction of the facilities; data will be furnished by the Engineer.
- 8. Each Plan and Profile sheet of the Record Drawings shall bear the following certification by the Developer/Applicant's engineer:

"The undersigned certifies that the sewers were designed and constructed to serve the lowest elevation of the structures to be connected to the facilities, and that the record elevations, and the distances between manholes are accurate and correct."

Firm Name	
By_	
•	Name (Signature)
P.E. License No.	
Date	

8.0 APPROVAL OF SEWERAGE FACILITIES

Subject to the satisfactory completion of all of the sewerage system facilities and the performance of all required tests, and filing of test reports and Record Drawings, the Engineer will issue a letter of recommendation of approval; and the Township, if it concurs, will approve and accept the facilities. The approval and acceptance of the facilities will be subject to all special terms and conditions for the specific installation. Upon acceptance of the facilities and prior to the activation of the sanitary sewers, the Developer/Applicant's engineer shall make the required certification submission to the Township, the TBSA, and the NJDEP.

9.0 ENGINEERING SERVICES

The cost of all services provided by the Engineer for reviewing Plans, for full-time observation of construction, and for inspections and approvals shall be paid by the Developer/Applicant. The cost of all engineering expenses incurred by the TBSA for review of plans, and inspection or final testing of the sanitary sewers shall be paid for by the Developer/Applicant. The TBSA and NJDEP application fees shall be paid by the Developer/Applicant.

10.0 SEWER CONNECTION FEES

The Developer/Applicant will be responsible to pay for all sewer connection fees to the Township of Pequannock and must contact the Tax Collector during the application period to determine the appropriate charges.

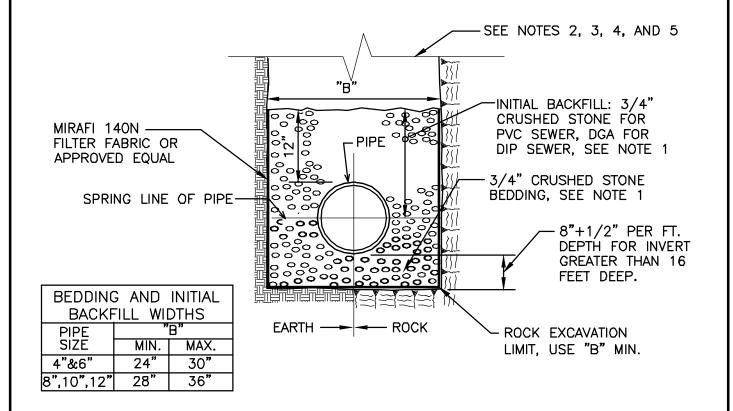
11.0 GUARANTEE

The constructed sanitary sewer facilities shall be guaranteed to the Township of Pequannock against all defects in materials and workmanship for the specified period established in the executed Developers' Agreement. Where such agreement has not been created, the Developer/Applicant shall furnish a Maintenance Bond in the amount of 100% of the value of the constructed sanitary sewer facilities, as approved by the Township of Pequannock, guaranteeing the constructed sewers against defects in materials and workmanship for a period of two years.

Prior to expiration of the guarantee period, an anniversary inspection of the constructed sanitary sewer facilities will be made by the Engineer together with the Developer/Applicant's contractor. This will include the following:

- Visual inspection of all manholes.
- Observation of all exposed sewer lateral cleanouts caps.
- Visual inspection of each section of sanitary sewer pipe, manhole to manhole, by televised video. Provide one digital copy of the televised video to the Engineer.

The Developer/Applicant will be responsible to coordinate the inspection work with the Engineer and the Township of Pequannock one week in advance, and pay for all related contractor and subcontractor costs, including the televised inspection.



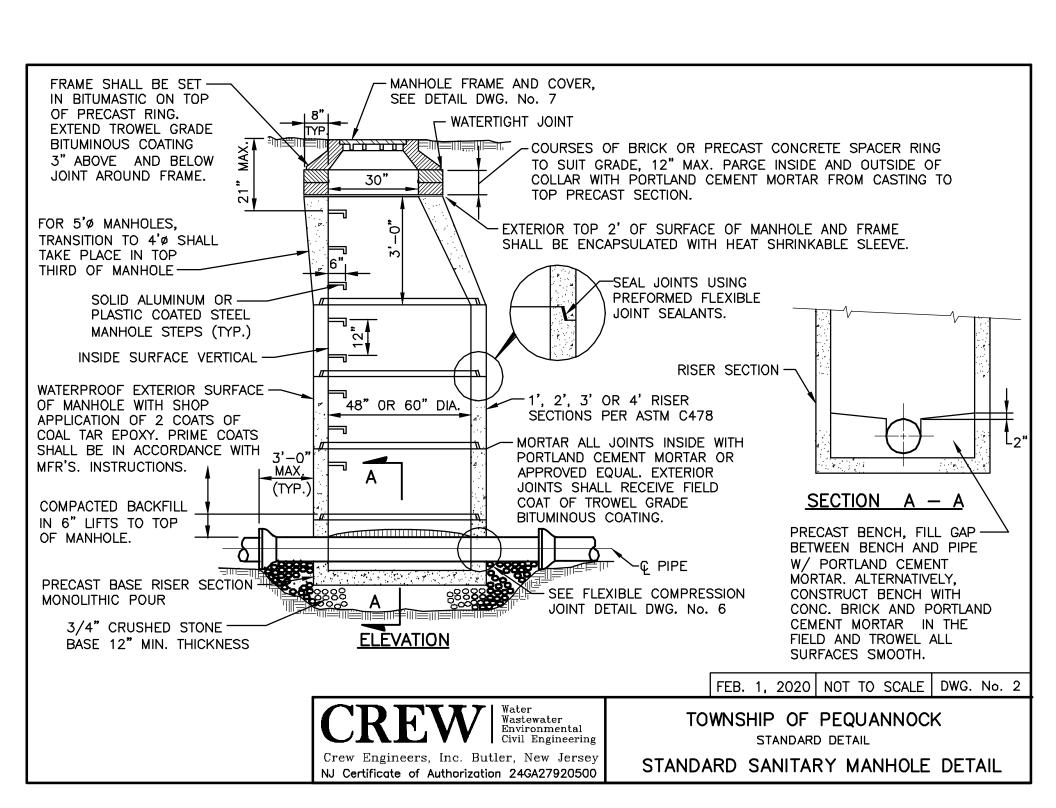
- 1. TWO LINEAR FEET OF BEDDING AND INITIAL BACKFILL SHALL BE DGA OR CLAY WHERE DIRECTED BY ENGINEER ("CLAY DAM").
- 2. IN LOCAL ROADS, BACKFILL WITH SUITABLE EXCAVATED MATERIAL (AS DETERMINED BY ENGINEER) OR SELECT BACKFILL, IN 6" LIFTS, COMPACTED TO 95% PROCTOR DENSITY IN ACCORDANCE WITH ASTM STANDARD SPECIFICATION D1557. EXCAVATED MATERIAL MUST BE DEWATERED PRIOR TO USE AS BACKFILL MATERIAL.
- 3. IN COUNTY ROADS, BACKFILL WITH DGA.
- 4. DISPOSE OF ALL EXCESS EXCAVATED MATERIAL AT A SUITABLE LOCATION. DO NOT STORE EXCESS EXCAVATED MATERIAL IN A FLOOD PLAIN.
- 5. SUBBASE, BASE, AND SURFACE COURSE PAVEMENT SHALL BE CONSTRUCTED IN ACCORDANCE WITH TOWNSHIP REQUIREMENTS FOR LOCAL ROADS AND COUNTY REQUIREMENTS FOR COUNTY ROADS.

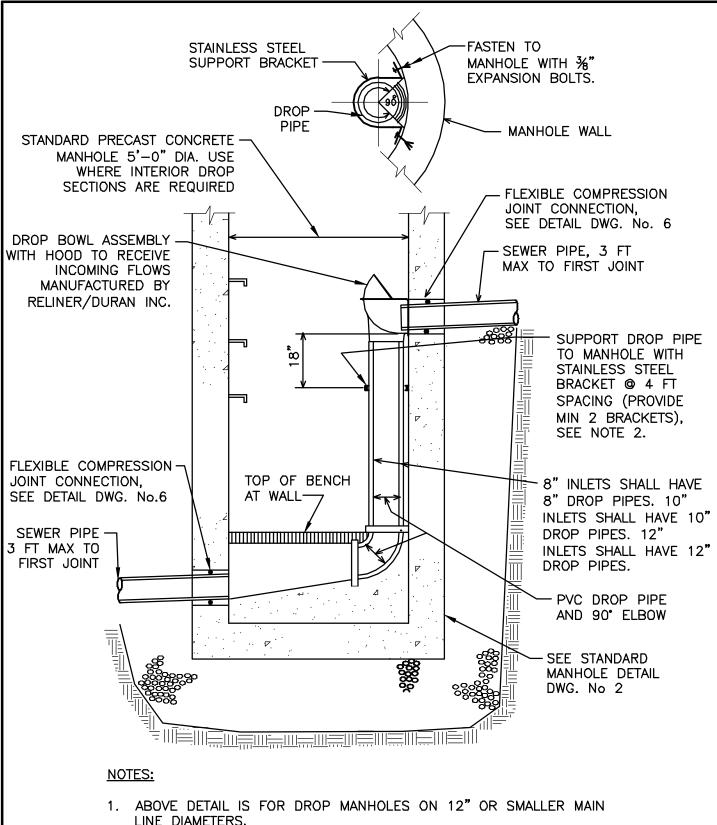
FEB. 1, 2020 NOT TO SCALE DWG. No. 1



TOWNSHIP OF PEQUANNOCK
STANDARD DETAIL

SEWER BEDDING DETAILS





- LINE DIAMETERS.
- 2. HILTI FASTENING SYSTEM # 5500035 S.S., KWIK-BOLT, OR ITT PHILIPS, S.S., TRIBOLT STUD ANCHOR OR EQUAL.

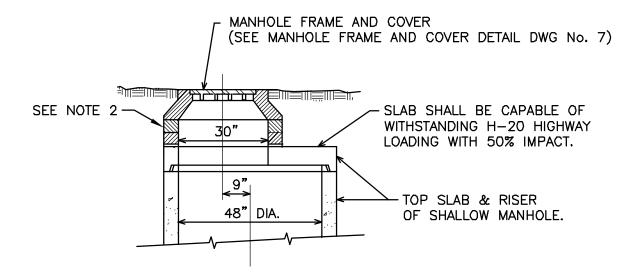
DWG. No. 3 FEB. 1, 2020 NOT TO SCALE

Water Wastewater Environmental Civil Engineering

Crew Engineers, Inc. Butler, New Jersey NJ Certificate of Authorization 24GA27920500

TOWNSHIP OF PEQUANNOCK STANDARD DETAIL

INTERIOR DROP CONNECTION DETAIL

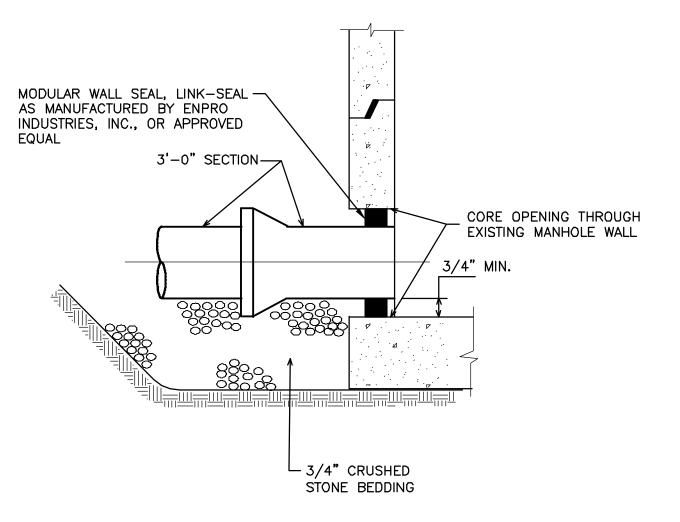


- 1. PROVIDE FOR MANHOLES HAVING 7'-9" DEPTH OR LESS.
- 2. SEE STANDARD MANHOLE FOR ADDITIONAL DETAILS, DWG, No. 2

FEB. 1, 2020 NOT TO SCALE DWG. No. 4



TOWNSHIP OF PEQUANNOCK
STANDARD DETAIL
SHALLOW MANHOLE DETAIL

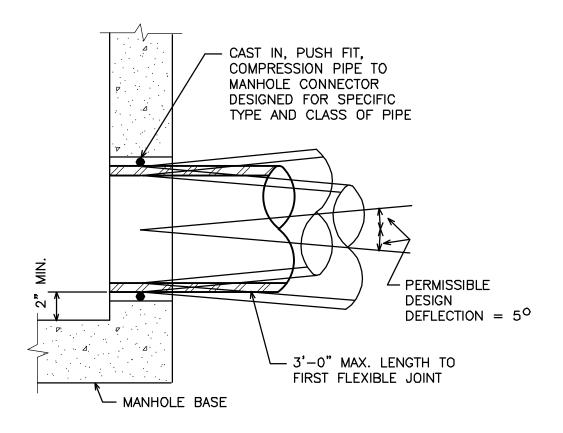


- 1. DETAILS NOT SHOWN ON THIS MANHOLE SHALL BE AS SHOWN ON THE STANDARD MANHOLE DETAIL, SEE DWG No. 2.
- 2. MORTAR INSIDE JOINT WITH PORTLAND CEMENT MORTAR OR APPROVED EQUAL TO ENSURE THE CHANNEL REMAINS SMOOTH WITH NO LIP AT THE PIPE.

FEB. 1, 2020 NOT TO SCALE DWG. No. 5



TOWNSHIP OF PEQUANNOCK
STANDARD DETAIL
CONNECTION TO EXISTING
MANHOLE JOINT DETAIL



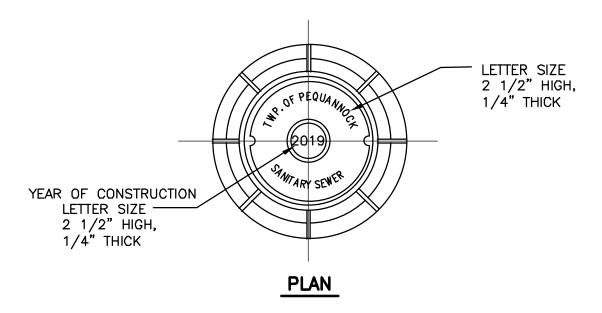
- 1. USE FOR NEW MANHOLE CONNECTION.
- 2. DETAILS NOT SHOWN ON THIS MANHOLE SHALL BE AS SHOWN ON THE STANDARD MANHOLE DETAIL, SEE DWG NO. 2

FEB. 1, 2020 NOT TO SCALE DWG. No. 6



TOWNSHIP OF PEQUANNOCK
STANDARD DETAIL

FLEXIBLE COMPRESSION JOINT DETAIL



MANHOLE COVER SCHEDULE						
PLAN/PROFILE DESIGNATION	DESCRIPTION	CAMPBELL FOUNDRY CO. PATERSON No. (OR EQUAL)				
(WT)	WATERTIGHT	6552				
(S)	STANDARD	1203B				

- 1. SEAT OF FRAME AND EDGE OF COVER SHALL BE MACHINED.
- 2. PROVIDE LABELS ON ALL COVERS SIMILAR TO THAT SHOWN ON PLAN ABOVE.
- 3. THE TYPE OF MANHOLE FRAME AND COVER SHALL BE AS DESIGNATED IN ABOVE SCHEDULE.

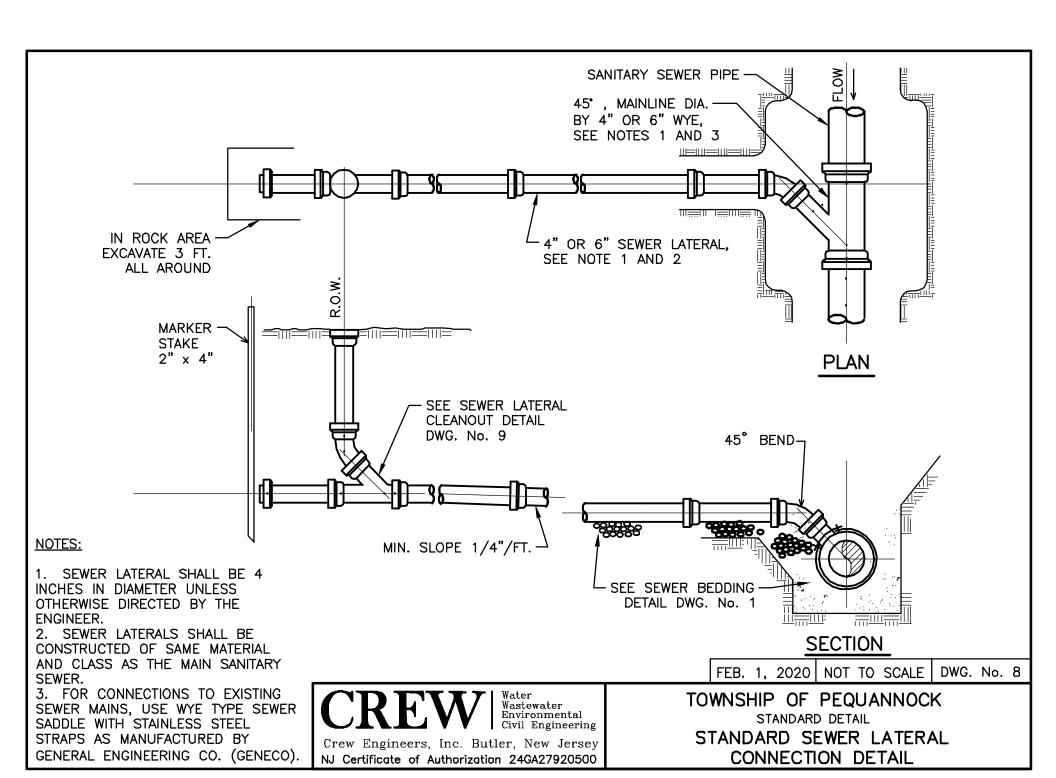
FEB. 1, 2020 NOT TO SCALE DWG. No. 7

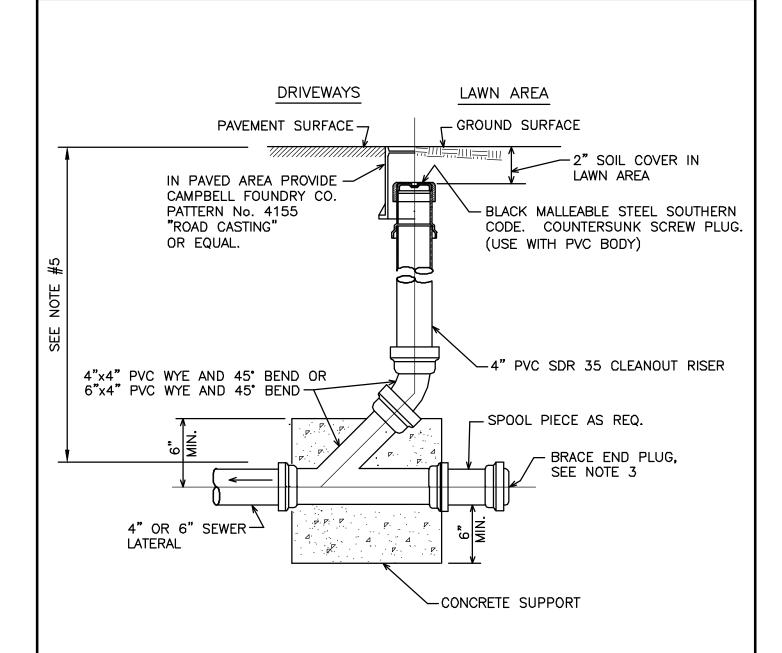
CREW Water
Wastewater
Environmental
Civil Engineering
Crew Engineers, Inc. Butler, New Jersey

NJ Certificate of Authorization 24GA27920500

TOWNSHIP OF PEQUANNOCK
STANDARD DETAIL

MANHOLE FRAME AND COVER DETAIL





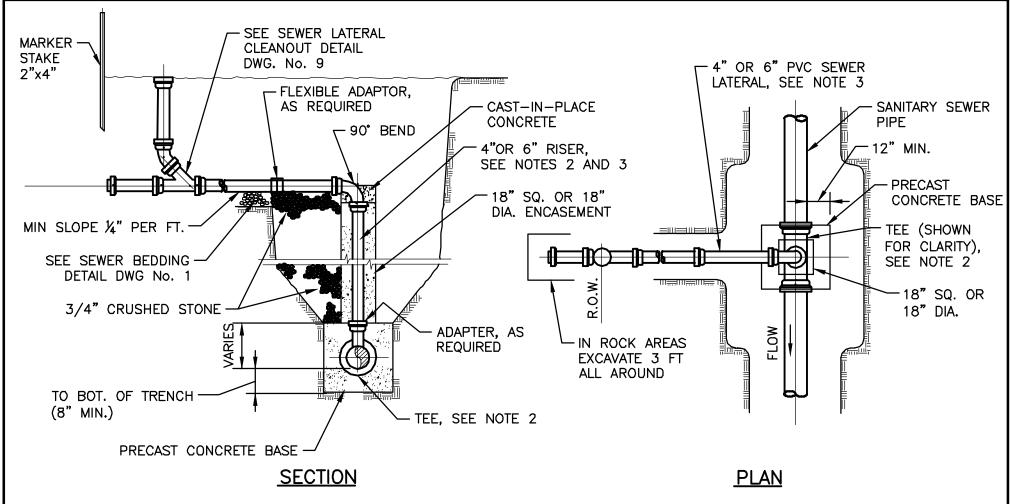
- 1. FLEXIBLE ADAPTERS SHALL BE FERNCO, OR APPROVED EQUAL.
- 2. TRENCH DETAILS FOR SEWER SHALL APPLY TO SEWER LATERALS.
- 3. END CAP SHALL BE SECURED TIGHTLY TO THE PIPE AND PROPERLY BRACED TO ELIMINATE LEAKAGE AND MOVEMENT.
- 4. LOCATE CLEANOUT AS SHOWN ON STANDARD SEWER LATERAL DETAIL.
- 5. MIN. DEPTH AT CLEANOUT SHALL BE 7' OR AS APPROVED BY ENGINEER.

FEB. 1, 2020 NOT TO SCALE DWG. No. 9

CREW Water Wastewater Environmental Civil Engineering

Crew Engineers, Inc. Butler, New Jersey NJ Certificate of Authorization 24GA27920500

TOWNSHIP OF PEQUANNOCK
STANDARD DETAIL
SEWER LATERAL CLEANOUT DETAIL



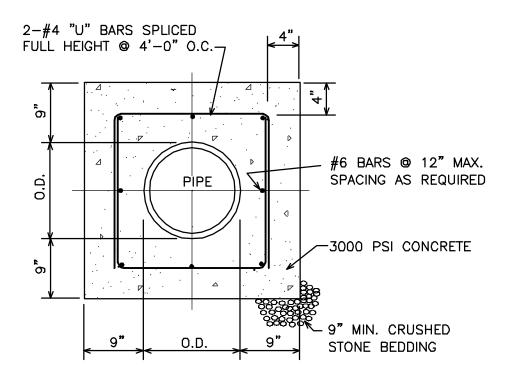
- 1. ALL CONCRETE SHALL BE 3,000 PSI STRENGTH.
- 2. DEEP SEWER LATERAL CONNECTIONS AND RISERS SHALL BE CONSTRUCTED OF THE SAME MATERIAL AS THE MAIN SANITARY SEWER.
- 3. SEWER LATERALS SHALL BE 4" IN DIA. UNLESS OTHERWISE DIRECTED BY ENGINEER.

FEB. 1, 2020 NOT TO SCALE DWG. No. 10



TOWNSHIP OF PEQUANNOCK
STANDARD DETAIL

DEEP SEWER LATERAL CONNECTION DETAIL



- 1. USE CONCRETE ENCASEMENT WHERE INDICATED ON THE PLANS OR AS DIRECTED BY ENGINEER.
- 2. PROVIDE A MECHANICAL JOINT A MINIMUM OF ONE FOOT FROM EACH END OF THE ENCASEMENT.

FEB. 1, 2020 NOT TO SCALE DWG. No. 11



NJ Certificate of Authorization 24GA27920500

TOWNSHIP OF PEQUANNOCK
STANDARD DETAIL

APPENDIX B

Township of Pequannock Encumbered Sewer Capacity Tabulation

Township of Boguennock Sower Allegation:	Gallons per day
Township of Pequannock Sewer Allocation:	1,250,000
Township of Pequannock Average Daily Sewer Usage (2019)*	870,000
Township of Pequannock Current Reserve Capacity	
(difference between allocation and usage)	380,000
*Information per Two Bridges Sewerage Authority 2019 Plant Operations Report	
Encumbered Reserve Capacity	
 Route 23 Northbound and Southbound Sanitary 	
Sewer Extension (Priority Areas 14-5&6)	78,000
Jacksonville Road (Priority Area 13-2)	19,000
First Street, Second Street, Third Street, and	. 5,555
,	20.000
Fourth Street (Priority Area 14-4)	38,000
Subtotal of encumbered reserve capacity	135,000
Current Reserve Capacity Surplus (difference between current	
reserve capacity and encumbered reserve capacity)	245,000
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