WARWICK TOWNSHIP MUNICIPAL AUTHORITY

DEVELOPERS' MANUAL

July 21, 2015

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INTRODUCTION

It is the intent of the Warwick Township Municipal Authority (the "Authority") to require that each Developer be completely responsible for the installation of all water and sewer extensions and/or modifications which are necessary to serve any proposed development or change in use of property. The facilities which are constructed by the Developer to extend the Authority's Water and/or Sewer Systems are intended to serve the public for many years and, therefore, the technical requirements contained in this Manual set forth the minimum requirements in terms of materials, installation and testing procedures. The technical requirements and administrative procedures contained in this Manual must be properly and fully followed in order for the Authority to: (I) approve the dedication of any and all water and sewer facilities constructed by a Developer; and/or (ii) approve connection of any and all water and sewer facilities constructed by a Developer to the Authority's Water and/or Sewer Systems. In addition, the facilities must be constructed in such a manner as to minimize any detrimental impact upon the environment (such as wetlands and streams). The facilities, upon final acceptance, will become the property of the Authority, and the Authority will own, maintain and operate them for the benefit of the public.

For some types of construction or equipment, the Authority will require shop drawings and/or product information to be submitted to and approved by the Authority as an integral part of the overall approval process. Therefore, the Developer should consult with the Authority during initial planning of the project in order to establish such requirements.

The Developer should advise his Contractor of record keeping requirements for preparation by the Developer's design consultant of record drawings at the completion of the project. The responsibility for maintaining detailed field records is that of the Developer and his Contractor. The inspections made by the Authority are not for the purpose of data collection for the preparation of record drawings.

If Developer's construction requires special facilities such as, but not limited to, meter pits, sewage pumping stations, force mains, water booster stations, water storage facilities or valving stations, such facilities must be designed by the Authority Engineer at the sole cost of the Developer (unless otherwise directed in writing by the Authority). Although the financial responsibility for the installation of such facilities remains that of the Developer, the Authority at its sole discretion may elect to have the facilities constructed by the Authority's contractor with the costs paid from an escrow fund established with the Authority by the Developer.

With the exception of facilities which require a permit from DEP, the Developer shall obtain and comply with all permits required for the

installation of the water and sewer facilities. With regard to facilities which require a permit from DEP, the Authority will prepare the required documentation and obtain the permit in the name of the Authority. The Authority will utilize plans prepared by the Developer's design consultant or the Authority Engineer, as appropriate. The Developer shall be responsible for all design costs, including fees of the Authority Engineer, and all other costs and permit fees associated with the preparation, submittal and prosecution of the application.

This Manual is intended to provide you with an easy to understand explanation of the Authority's administrative procedures and technical requirements. These procedures and requirements will be periodically updated. The information included is valid as of the date noted on the title page. It is the sole responsibility of the Developer to establish that the most current edition of this Manual, or any part thereof, is being utilized for the design and construction of the required facilities. The Authority will not be financially responsible for any rework required resulting from the use of any requirement that has been superceded. The Manual summarizes only the key features and does not include the complete details. These may be found in the official documents and specifications which you may review at the Authority's office. This Manual should not be considered an exhaustive resource of all the requirements for every situation. If there is any discrepancy between the contents of this Introduction and the official documents and specifications, the documents and specifications always govern. The Authority reserves the right to amend its official documents and specifications at any time and for any reason. This Manual should not be considered the provision of legal advice and is not intended to convey legal opinions.

PART I

ADMINISTRATIVE PROCEDURES

SECTION 1. DEFINITIONS

The following terms and phrases shall have the following meanings:

"Agent" means an individual or firm acting on behalf of the Developer.

"Authorities Act" means the Municipality Authorities Act, as amended and supplemented.

"Authority" means the Warwick Township Municipal Authority, a Pennsylvania Municipal Authority.

"Building Sewer" means the extension from the sewage drainage system of any structure to the Lateral of a sewer.

"Building Water Connection" means the extension from the Water System of any structure to the service connection of the water line.

"Capacity Approval" means that, at the time the capacity request is made, sufficient capacity is available in the Authority's system(s) to serve the development. Capacity Approval does not guarantee capacity.

"Commercial Establishment" means any structure or any portion thereof intended to be used wholly or in part for the purpose of carrying on a trade, business or profession or for social, amusement, religious, educational, charitable or public uses, and which contains plumbing for kitchen, toilet, water fountain or washing facilities.

"Contractor" means an Agent of the Developer.

"DEP" means the Pennsylvania Department of Environmental Protection.

"Developer" means the party or parties constructing improvements to a tract of land and/or existing units or his Agent.

"Development" means the creation of a subdivision or land development as such terms are defined in the Pennsylvania Municipalities Planning Code or any man-made change to improved or unimproved real estate, including but not limited to the erection of buildings, placement of mobile homes or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or the enlargement of a structure to add an additional domestic

establishment or establishments or to expand a Non-domestic establishment or establishment in such a manner that the need for public water and/or sewer service shall be increased.

"Domestic Establishment" means any room, group of rooms, apartment, house trailer,
building or other enclosure connected, directly or indirectly, to the Authority's Sewer System or Water System and occupied or intended for occupancy as a Separate Living Unit by a family or any other group of Persons living together or by a Person or Persons living alone, excluding Non-domestic Establishments such as institutional dormitories, hotels, motels, boarding houses, and other Commercial Establishments and Industrial Establishments.

"EDU" means an equivalent dwelling unit. With regard to the Authority's Water System, the amount of water consumed by an average Domestic Establishment in a day shall be calculated and established by the Authority in accordance with the Authorities Act. Non-domestic Establishments shall be assigned a number of EDUs based upon the estimated or actual water consumption, with such consumption determined by the highest quarterly consumption. The Authority reserves the right to increase or decrease, by resolution or otherwise as provided by law, the EDU calculation. With regard to the Authority's Sewer System, the amount of sanitary sewage discharged by an average Domestic Establishment in a day shall be calculated and established by the Authority in accordance with the Authorities Act. Non-domestic Establishments shall be assigned a number of EDUs based upon the estimated or actual sanitary sewage discharged, with such discharge determined by the highest quarterly discharge, or such other estimation of flow acceptable to the Authority. The Authority reserves the right to increase or decrease, by resolution or otherwise as provided by law, the EDU calculation.

"Engineer" means the Engineer of the Warwick Township Municipal Authority.

"Improved Property" means any property upon which there is erected a structure intended for continuous or periodic habitation, occupancy or use by human beings or animals and from which structure Sanitary Sewage and/or Industrial Wastes shall be or may be discharged.

"Industrial Establishment" means any structure or any portion thereof intended to be used wholly or in part for the purpose of manufacturing, fabricating, processing, cleaning, laundering or assembly of any product, commodity or article.

"Industrial Wastes" means any solid, liquid or gaseous substance,

waterborne water or form of energy discharged or escaping in the course of development, recovering or processing of natural resources, but not Sanitary Sewage.

"Landowner" means the legal or beneficial owner or owners of land, including the holder of an option or contract to purchase (whether or not such option or contract is subject to any condition), a lessee if he is authorized under the lease to exercise the rights of the landowner, or other persons having a proprietary interest in land. The word owner means the same as landowner and may be used interchangeably.

"Lateral"means that part of the Sewer System extending from a sewer to the curb line, or if there shall be no curb line, to the property line, or if no such Lateral shall be provided, then Lateral shall mean that portion of or place in a sewer which is provided for connection of any Building Sewer.

"Lititz Water System" means the water distribution system constructed and/or acquired by the Authority to serve areas of the Township where water is obtained from the Borough of Lititz.

"Non-domestic Establishment" means any establishment or use connected, directly or indirectly, to the Sewer System and/or Water System which does not constitute a Domestic Establishment.

"PennDOT" means the Pennsylvania Department of Transportation.

"Person" means any individual, partnership, association, society, estate, trust, corporation, municipality, municipal authority, or other legally recognized group or entity.

"Reservation Agreement" means a legally binding agreement entered into by a Landowner or Developer and the Authority setting forth the terms and conditions of any reservation of water service capacity within the Authority's Water System and/or sewer service capacity within the Authority's Sewer System.

"Reservation Fee"means a payment made by a Developer upon or after execution of an "Application to Extend and/or Connect with the Water System and/or Sewer System and Request for Capacity".

"Reservation of Capacity" means a program by which capacity must be reserved in the Authority's Water and/or Sewer System(s) by applying for and making payments according to the Rules and Regulations and Developers' Manual of the Authority.

"Rothsville Water System" means the Water System constructed and/or

acquired by the Authority to provide service in and around the Village of Rothsville.

"Sanitary Sewage" means normal water-carried household and toilet wastes from any Improved Property.

"Service Connection" means that part of the Water System extending from the water line to the curb line, or if there be no curb line, to the property line, or if no such water connection shall be provided, the "Service Connection" shall mean that portion of, or place in, a water line which is provided for connection of any building water connection.

"Sewer Service" means provision by the Authority for the collection, conveyance and/or treatment of sanitary sewage as a commodity, or readiness to supply such collection, conveyance and/or treatment for any purpose, and of any service related thereto.

"Sewerage System" or "Sewer System" means all facilities as of any particular time, for collecting, pumping, transporting, treating, or disposing of Sanitary Sewage and Industrial Wastes, to be owned by the Authority.

"Solicitor" means the Solicitor of the Warwick Township Municipal Authority.

"Tapping Fee" means a fee imposed under the authority of the Authorities Act to enable the recovery of the Authority's equity in the Water and/or Sewer System, as appropriate, which shall be composed of a capacity part and a distribution or collection and conveyance part, as appropriate, and may, in the future, if warranted, include for some customers a special purpose part and/or a reimbursement part. A Tapping Fee shall be considered the fee referred to as a "tapping fee" in the Authorities Act.

"Township" means the Township of Warwick, Lancaster County, Pennsylvania, acting by and through its Board of Supervisors or, in appropriate cases, by and through its authorized representatives.

"Water Service" means provision by the Authority of water as a commodity, or readiness to supply water for any purpose, and of any service related thereto.

"Water System" means all facilities, as of any particular time for storage, pumping, transporting and/or treating water and owned by the Authority and shall include the Lititz Water System, the Rothsville Water System, and any other Water System which may be owned by the Authority.

SECTION 2. PLAN PREPARATION AND PROCESSING

A. DESIGN STANDARDS

1. All facilities shall be designed in accordance with: (I) the DEP Public Water Supply Manual, Part II, Community System Design Standards; (ii) the DEP Domestic Wastewater Facilities Manual; or (iii) the Authority specifications, as appropriate. In case of conflict between the DEP and Authority requirements, the Authority requirements shall take precedence except as otherwise required by law.

2. All designs shall be in accordance with all applicable Federal, State and local laws, ordinances and regulations.

3. Design Parameters

   a. Water. The amount of water consumed by an average Domestic Establishment in a day shall be calculated and established by the Authority in accordance with the Authorities Act. Non-domestic Establishments shall be assigned a number of EDUs based upon the estimated or actual water consumption, with such consumption determined by the highest quarterly consumption. The Authority reserves the right to increase or decrease, by resolution or otherwise as provided by law, the EDU calculation.

   b. Sewer. The amount of sanitary sewage discharged by an average Domestic Establishment in a day shall be calculated and established by the Authority in accordance with the Authorities Act. Non-domestic Establishments shall be assigned a number of EDUs based upon the estimated or actual sanitary sewage discharged, with such discharge determined by the highest quarterly discharge. The Authority reserves the right to increase or decrease, by resolution or otherwise as provided by law, the EDU calculation.

4. The use of grinder pumps and pressure sewer systems shall not be allowed for new development. Exceptions to this policy will be considered only as a last resort. Furthermore, exceptions will require review and approval by the Authority and adherence to the conditions placed upon the approval and the lot, including proof of full disclosure to the potential buyer and recorded notice to all future owners.

5. All water and sewer mains shall extend to the far property line of the last property proposed to be served by a given extension or addition to the Authority system.

6. The Authority shall have the exclusive right to determine the type, size, alignment, materials and specifications for all water and sewer facilities.

7. All water and sewer lines shall be installed in Township or State roads or road rights-of-way. Installation in rights-of-way over private property will only be considered for approval when the Authority determines such installation is in the best interests of the Authority and the Authority is provided with an easement and/or right-of-way agreement acceptable to the Authority Solicitor.

8. The Developer shall provide connections and/or laterals for existing structures and/or properties along the route of any extension of existing water and/or sewer lines to the Developer's project. Such service locations shall be identified by the Authority and the required service(s) shall be noted and detailed on the plans. Reimbursement of costs of such service(s) shall be noted and detailed on the plans. Reimbursement of costs of such service(s) shall be based upon the Authorities Act.

9. Standard forms and agreements required for processing a subdivision are available at the Authority office. Some forms may need to be adapted to specific circumstances. It is the responsibility of the Developer to ascertain whether or not the standard form is appropriate for the project. Changes to the forms will be made at the Developer's expense.

10. A list of fees is provided in Part II of this Manual. A list of standard forms is provided in Part V in addition to the application required for the initial submission.

11. Due to certain hydraulic and topographical conditions of the Authority's service area, certain portions of the Authority's Water System have been designed as pumped or "high service" districts. Those facilities have a specific design capacity which limits the number of connections within the district. Unless the Developer obtains the prior approval of the Authority Board, connections to the Authority's Water System shall only be made to the portions of the Authority's Water System which are not served by a pumped system. Such a request shall be considered only when Developer demonstrates by clear and convincing evidence that connection to the Authority's gravity system is not technically feasible, as determined by the Authority Board in its sole discretion.

B. SKETCH PLANS

Sketch Plans are not required by the Authority; however, should a Sketch Plan be submitted for review by the Authority, it should show the proposed location and point of connection of water and/or sewer facilities. Preliminary water consumption and sewage flow estimates must be included for non-domestic, commercial or industrial uses. Sketch

Plans will be reviewed for obvious deficiencies only and a comment letter will be provided to the Developer.

C. PRELIMINARY PLANS

Two copies of the plans and specifications for all proposed extensions and/or modifications to the Authority's facilities shall be submitted to the Authority and one copy to the Authority Engineer. All plans and specifications shall be prepared by a professional engineer registered in Pennsylvania, or other professional registered in Pennsylvania authorized by law to prepare such plans and specifications. The plans shall clearly show the location of all water and sewer facilities, including all appurtenances, required for the completion of the work, as well as the field verified location of all of the Authority's existing facilities impacted by the proposed project. This submission must also include:

1. An Application to Extend and/or Connect with the Water System and/or Sewer System and Request for Allocation and Reservation of Capacity along with the applicable reservation of capacity fees, administrative fee, and escrow fund/initial review deposit as set forth in Part II hereof.

2. A Sewage Planning Module Application or Sewage Planning Module Exemption Form. The requirement to file a full Sewage Planning Module will be waived for projects of 10 residential lots or less, except where a line extension is required or when required by DEP. The requirement to file a full Sewage Planning Module remains in effect for all commercial and industrial projects. Waivers will be considered on a case by case basis depending on the necessity for line extension and/or the projected flows.

3. If the proposed construction includes modification of any existing facilities, the submission must contain a description of the construction procedure to insure that continuous service will be provided to the Authority's current customers.

The Authority recognizes that some construction will require temporary interruption of service; however, such interruption must have prior written approval by the Authority. The conditions of interruptions of service shall be at the sole discretion of the Authority.

The Developer shall be solely responsible for the costs of the design of the facilities associated with the extension and/or modifications of the Authority's facilities as required by the Authority. In situations where modifications to the Authority's existing facilities or where major facilities, as defined by the Authority, are required, the Authority reserves the right, at its sole discretion, to have the design completed by the Authority Engineer at the Developer's expense.

1. Submission

Original plans requiring water and/or sewer service and all other documents and

fees called for herein must be received at least twenty-one (21) days prior to the Authority meeting at which the plans are to be considered to enable prior review by the Authority and its Engineer. Subsequent submittals or plans which will not require water and sewer service from the Authority's systems must be received no less than fourteen (14) days prior to the Authority meeting by the Authority and its Engineer. Documentation received after this deadline will be considered at the following Authority meeting. Subsequent submittals in the form of revised plans must indicate revisions by highlight. If plan documentation is insufficient and the review has not been completed, the plan will not be placed on the meeting agenda for review.

In the case of plans and specifications which are clearly incomplete or which are significantly non-responsive to the Authority's requirements, the Authority will reject the proposed plans and specifications without extensive review, pending the receipt of plans which address the Authority's requirements. It shall not be the responsibility of the Authority or its Engineer to design or redesign such extensions or additions.

If any part of a main extension intended to be dedicated to the Authority is to be installed anywhere other than in publicly dedicated streets, before the Authority gives its final approval of the plan, the Developer shall provide the Authority with easements and/or rights-of-way in form and substance satisfactory to the Authority and its Solicitor, evidencing the right of the Developer and the Authority to install, maintain and reconstruct lines across private property.

Original submissions must include the following:

a. A completed Application for Consideration of a Request to Extend and/or Connect with the Water System and/or Sewer System and Request for Allocation and Reservation of Capacity and applicable reservation of capacity fees, administrative fee and escrow fund/initial review deposit as set forth in Part II hereof.

b. Two complete sets of plans to the Authority Office.

c. One complete set of plans to the Authority Engineer.

d. Application for Sewage Planning Module or Sewage Planning Module Exemption.

e. If the proposed construction includes modification of any existing facilities, the submission must contain a description of the construction procedure to insure that continuous service will be provided to the Authority's current customers.

2. Review

The Authority will review the capacity requirements of the plan and the plans and

specifications for obvious deficiencies. The Authority reserves the right to require changes to the plans and specifications at Final Plan review, should the changes be in the best interest of the Authority.

As a result of the Preliminary Plan review process:

a. A Developer's Escrow shall be established during the initial review and must be submitted to the Authority prior to subsequent review.

b. Water and/or Sewer Extension Agreements, Easement Agreements, Grinder Pump Agreements, if applicable, and a Letter of Credit form will be forwarded to the Developer.

c. Highway Occupancy Permit Applications must be filed, if required.

d. The Authority's section of Sewage Planning Module will be completed and forwarded to the Developer or his consultant.

e. The Authority will notify the Township Board of Supervisors and Planning Commission of Capacity Approval provided sufficient capacity exists, and further provided that the Developer has submitted to the Authority all necessary applications, agreements and fees with regard to reservation of capacity.

f. Upon approval of the capacity request by the Board, the Developer will receive a notice of the approval which must be executed by all parties and returned to the Authority office. This document will serve as the Reservation Agreement.

D. FINAL PLANS

1. Submission

Final Plans may be submitted in phases and must be received by the Authority and its Engineer at least twenty-one (21) days prior to the Authority meeting. Revised Final Plans must indicate revisions by highlight and must be received at least fourteen (14) days prior to the Authority meeting by the Authority and its Engineer. Final Plans received after these deadlines will be considered at the following Authority meeting.

The Final Plan Submission must include the following:

a. Two complete sets of the plan to the Authority Office.

b. One complete set of plans to the Authority Engineer.

c. Completed Water and/or Sewer Extension Agreements.

d. Completed Easement Agreements to be recorded.

e. Cost estimates for the installation of water and/or sewer facilities. Cost estimates shall include all facilities to be offered for dedication to the Authority. Estimates shall be certified to be fair and reasonable and sealed by a registered Professional Engineer.

f. Sewage Planning Module Approval from the DEP.

g. Completed Grinder Pump Agreements (if applicable).

h. Developer's Escrow (if not previously submitted).

I. If the Final Plan was not preceded by a Preliminary Plan, all information, documents and other submissions required for Preliminary Plans as set forth in Part I, Section 2, hereof.

2. Review

The Authority will complete a thorough review of the Final Plan documents relative to the water and/or sewer facilities. Final Plan approval will not be communicated until the Authority Board has had an opportunity to review the Plan and approve it at a public meeting. Approvals may be contingent on the receipt of fees or any other items which the Authority deems appropriate.

Authority Staff will notify the Township Board of Supervisors of Final Plan approval and any contingencies which may exist. All contingencies must be satisfied prior to final approval. The Developer will receive a copy of this notification.

SECTION 3. RESERVATION OF CAPACITY PROGRAM

A. REQUEST FOR RESERVATION OF CAPACITY

Any Developer in the Township who expects to require water service and/or sewer service for the development of his land shall request the Authority to reserve capacity in the Water System and/or Sewer System for the proposed Development. This request shall be made in writing to the Authority, shall be accompanied by any plan review fee or funds required to be posted to reimburse the Authority for expenses incurred in the review of plans in effect when the request is made, and shall provide the following:

1. Location of the land proposed for development.

2. Proposed type of development.

3. The number and type of Domestic Establishments and/or Non-domestic Establishments to be constructed and the estimated gallons per day

required by each such Domestic Establishment and/or Non-domestic Establishment.

The request for reservation of capacity shall be made and acted upon by the Authority before the Authority shall approve a plan for any development. Review, approval and/or rejection of a request for reservation of capacity shall be made at a public meeting of the Authority in general conformity to the guidelines set forth herein. Each request will be evaluated by the Authority based upon the characteristics of the request, the capacity available in the Water System and/or Sewer System, and the guidelines set forth herein.

After capacity has been allocated to an owner, it shall be not be reserved for the tract of land set forth in the application until the Developer has executed and submitted a *Reservation Agreement*, in accordance with the provisions of the Rules and Regulations and this Manual.

The Authority shall not be obligated to notify the Township or any other entity that capacity within the Water System and/or Sewer System has been reserved until the *Reservation Agreement* and Reservation Fees have been paid for the year in advance.

All reservations of capacity for a tract of land shall remain valid for a period of five (5) years from the date the Authority approves the initial allocation and reservation of the capacity for the tract of land, provided the owner pays the required fee per year, per EDU on or before the annual anniversary dates of the Authority's approval of such reservation.

If the owner fails to pay the required annual fee by the reservation anniversary date for the next year in advance, then the reservation shall expire on the day after the anniversary date of the Authority's approval of such reservation and the capacity shall become available for reallocation to other Developers. The Developer who has defaulted by not making any payment due shall not be entitled to a refund of any Reservation Fees previously paid.

At the end of each five year period, the Developer may request an extension of the capacity reservation for any unused capacity and, if the extension is approved by the Board of the Authority, the Developer will be required to pay an increased annual fee for the extended-term reservation. These fees shall be established through resolution of the Authority and shall be payable for the year in advance. After ten years, requests for capacity must be renewed on an annual basis.

The reservation of capacity by the Authority does not constitute approval of the proposed Development or a guarantee that such approvals will be forthcoming from any other governmental entity. All proposed Development within the Township is required to comply with the provisions of the Township Zoning Ordinance and the Township Subdivision and Land Development Ordinance, and Developers are solely responsible for obtaining any permits or approvals required under those ordinances. Developers are also required to comply with all other ordinances of the Township and state and federal laws and regulations which may be applicable to the proposed development, and the reservation

of water capacity and or sewer capacity by the Authority shall in no way relieve any Developer from such responsibilities and shall in no way constitute any guarantee that such approval shall be forthcoming.

All reservations of capacity in the Water System shall be contingent upon the Authority having rights to continue to connect users to the Water System and (if necessary) to increase the amounts of water (i) obtained from another municipality or authority with which the Authority has contracted, (ii) pumped from the applicable well or spring and/or (iii) treated by the applicable treatment facility. Should the United States Environmental Protection Agency, the Pennsylvania Department of Environmental Protection, the Susquehanna River Basin Commission or the owner or operator of any public water supply or treatment facility impose a moratorium upon new connections or impose any type of permit allocations or limitations, Developers to whom capacity has been allocated shall have no rights against the Authority for any damages which may be suffered through an inability to connect to the Water System.

All reservations of capacity in the Sewer System shall be contingent upon the Authority having rights to continue to connect users to the Sewer System and (if necessary) to increase the flows through the applicable conveyance system and/or applicable wastewater treatment plant. Should the United States Environmental Protection Agency, the Pennsylvania Department of Environmental Protection, the Susquehanna River Basin Commission or the owner or operator of any wastewater conveyance or treatment facility impose a moratorium upon new connections or impose any type of permit allocations or limitations, Developers to whom capacity has been allocated shall have no rights against the Authority for any damages which may be suffered through an inability to connect to the Sewer System.

The Authority shall not issue any letter or other notification to any governmental entity, including but not limited to the Warwick Township Board of Supervisors, indicating that it has approved the plan of any Development until the Developer has submitted an executed a Reservation Agreement and has paid the applicable fees.

B. ADDITIONAL TERMS AND CONDITIONS OF RESERVATION OF CAPACITY.

1. The Developer shall pay all Reservation Fees, in accordance with the fee schedule in part II of the Developers Manual, based upon the number of EDUs proposed by the Development. If Reservation Fees are not paid in accordance with the provisions of this Manual, the reservation of capacity shall become void, and the Developer will have no right to connect to the Water System and/or Sewer System. The Authority shall have the right to inform the Township that the Developer is not in compliance with Authority regulations.

2. Fees for the reservation of capacity shall be equal to an amount established by the Authority's Rates, Rules and Regulations, per EDU or per gallon of flow per day, which shall reserve capacity for one year. This fee shall in no

case exceed 60% of the then-current sewer rental rate established under the Authority's Rates, Rules and Regulations and shall in all respects be consistent with PA Act 57 (Authorities Act, 53 Pa.§ 5601 et seq.) Capacity shall be reserved by paying the fees listed in Part II, Fee Schedule.

3. The Developer must pay an initial review fee as listed in the fee schedule for reimbursement of actual expenses incurred in the engineering review of the request for reservation of capacity. This fee may be deducted from any escrow funds which were posted by the Developer at the time a request for reservation of capacity was submitted or from any other escrow funds posted by the Developer.

4. Reservation of capacity in the Water System and/or Sewer System does not constitute or guarantee subdivision or land development approval required by the Township Subdivision and Land Development Ordinance or zoning approvals required under the Warwick Township Zoning Ordinance or any other approvals required by Township or state or federal regulations.

5. If any federal or state governmental unit or agency or any owner or operator of a public water supply or treatment facility imposes a restriction on the Authority that would prohibit the Authority from fulfilling its obligation to a Developer under the Reservation Agreement, then in that event the Developer would be entitled to a one hundred (100%) percent refund without interest of all Reservation Fees paid on a pro rata basis for the water service and/or sewer service that the Authority cannot provide. This refund shall be the only liability the Authority shall bear as a result of the lack of available capacity.

6. The rights and responsibilities of the Reservation may be transferred to another Person (but not another property) if such Person's proposed capacity, land parcel, and land use are identical to or a smaller portion or phase of those of the original Developer. The transferee must agree in writing to assume the terms and provisions of the Reservation and to be bound by all actions of the Developer in the undertaking of the Development prior to the transfer of the Development, including but not limited to agreeing to the imposition of conditions upon approvals or determinations to file or not file appeals.

7. Reimbursement of Authority expenses and the payment of the Reservation Fees required are not Tapping Fees, connection fees or water rates, sewer rates, or other fees or charges as may be required under other Authority resolutions but are separate payments made by a Developer to the Authority for the purpose of reserving capacity within the Water System and/or Sewer System.

8. The Developer shall hold harmless the Authority from any liability or costs

incurred by the Landowner or the Developer.

9. Payment of Reservation Fees is required prior to approval by the Authority of any Preliminary Subdivision and/or Land Development Plan (or the Final Plan if no Preliminary Plan is required).

10. The Developer shall pay an annual fee to continue reservation of capacity in the Water System and/or Sewer System in accordance with the schedule set forth in Part II hereof. In general, Reservation Fees shall be nonrefundable. Under exceptional circumstances, a Developer may request a refund of Reservation Fees which shall be considered by the Authority in accordance with the terms hereof.

11. Reservation Fees paid by a Developer shall not be credited by the Authority toward the payment of future Tapping Fees. Tapping Fees may be increased by the Authority in accordance with the Authorities Act during the term of the Reservation Agreement. The Tapping Fee required to be paid for each Domestic Establishment or each EDU required by each Non-domestic Establishment shall be determined in accordance with the resolutions of the Authority in effect on the date connection of the Domestic Establishment or Non-domestic Establishment is made to the Water System.

C. RESERVATION CHARGES

If a Developer fails to pay any installment of the Reservation Fee as required by this Manual or the Reservation Agreement within thirty (30) days of the date required by the Reservation Agreement, all capacity which has been reserved for such Developer shall lapse and shall become available for reallocation to other Developers. The Developer who has defaulted by not making any payment due under the Reservation Agreement shall not be entitled to a refund of any Reservation Fees previously paid.

Reservation fees may be refunded, without interest, under the following conditions:

1. If the Board of Supervisors of the Township denies approval of the Preliminary Plan or Final Plan (and any appeals from such denial are unsuccessful) and the Developer demonstrates to the satisfaction of the Board of the Authority that the Developer acted in good faith throughout the proceedings and actively and consistently sought approval of the Development.

2. If the Board of Supervisors of the Township, through changes in the governing ordinances or the exercise of the power of eminent domain, prevents full buildout of the Development indicated on the approved Preliminary Plan or Final Plan and the Developer demonstrates to the satisfaction of the Board of the Authority that the Developer acted in good faith throughout the proceedings and actively prosecuted completion of the

Development to the fullest extent possible.

3. If the Commonwealth of Pennsylvania or other governmental agency, through enactment of statutes, adoption of regulations or the exercise of the power of eminent domain, prevents full buildout of the Development indicated on the approved Preliminary Plan or Final Plan and the Developer demonstrates to the satisfaction of the Board of the Authority that the Developer acted in good faith throughout the proceedings and actively prosecuted completion of the Development to the fullest extent possible.

4. Under such other circumstances as the Authority, in its sole and absolute discretion, shall determine prevented the Developer from completing the development and were outside of the Developer's control.

It is the responsibility of the Developer making a request for a refund of Reservation Fees to present clear and convincing evidence to the Board of the Authority in support of the request for a refund. Refunds shall be granted only in exceptional circumstances in the sole and absolute discretion of the Authority in situations where it would be inequitable for the Authority to retain Reservation Fees. The refund shall be limited to the amount necessary to correct the inequity and shall not be made until it is clear that the Development will not be able to proceed in accordance with the plan upon which fees were paid. No refund shall be made which would be inconsistent with the purpose and intent hereof. Reservation Fees shall not be refunded in the event that a revised final plan which shall utilize fewer EDUs is approved.

D. ALLOCATION OF RESERVED CAPACITY

In reserving capacity, the Authority shall consider applications for reservation of capacity in the order in which they are received. The Authority shall allocate all capacity requested by a Developer on a first come, first served basis, based upon the date of complete application for reservation of capacity. The Authority reserves the right to change the manner in which capacity is allocated in the future if the Authority believes it is in the best interest of the residents of the Township to do so.

E. PROCEDURES SUBSEQUENT TO RESERVATION OF CAPACITY

The Developer, upon execution of a Reservation Agreement and payment of the Reservation Fee, may proceed with obtaining all necessary approvals for the construction of the proposed Development. The Developer shall provide the Authority with proof that all required approvals have been obtained in accordance with the Authority's regulations and policies.

The Developer shall construct extensions of the Water System and/or Sewer System in accordance with the Authority's regulations and shall enter into an agreement(s) with the Authority concerning the construction of all extensions of the Water System and/or Sewer System. Developers shall be required to provide financial security to guarantee the

completion of all extensions of the Water System and/or Sewer System in accordance with the Authority's policies and resolutions and with applicable Township, state and federal laws and regulations. Dedication of any extension of the Water System and/or Sewer System to the Authority shall be made in accordance with the Authority's regulations, and the execution of any Reservation Agreement shall not require the Authority to accept dedication of any facilities constructed by a Developer. Connections to the Water System and/or Sewer System shall be made in accordance with the Authority's policies and regulations, and all applicable tapping and connection fees shall be paid prior to any connection.

SECTION 4. FINANCIAL REQUIREMENTS

A. ESCROW FUND

Upon submittal of the Plan, the Developer shall establish an escrow fund/initial review deposit with the Authority in accordance with Schedule II of this Manual. During the first review of the Plan, the Authority's Engineer may direct that the escrow account be increased to an amount sufficient to cover the estimated costs of review, construction observation, engineering expenses, administrative expenses, legal expenses and other charges the Authority may incur in the furtherance of the design, installation or dedication to the Authority of the proposed municipal facilities for the Project. Any required increase in the amount of the escrow account shall be paid by the Developer to the Authority prior to, or with, the next submission of the Plan. In the event said sum deposited is in excess of such costs, Authority shall refund such excess money without interest to the Developer upon completion of the work and acceptance of dedication of said mains, with the exception of a final inspection fee.

The Authority is irrevocably authorized to withdraw from time to time any monies deposited by Developer in escrow in order to pay expenses and fees, including legal and engineering fees, incurred by Authority pursuant to or in connection with the Project. Should the escrow account become depleted, the Developer will be required to deposit additional funds at the Authority's request. The Authority shall have the right to suspend work pending receipt of the sum billed.

B. LETTER OF CREDIT FOR CONSTRUCTION

Prior to seeking Final approval from the Warwick Township Board of Supervisors, the Developer shall submit to the Authority an irrevocable Letter of Credit in a format provided by the Authority or other form of financial security, in a format approved by the Authority, in the amount of 110% of the estimated construction cost estimate approved by the Authority during the Final Plan review process.

The Authority, at its sole option, may consider reducing the amount of the Letter of Credit or other form of financial security as construction progresses. The Developer should present a written request to the Authority for a drawdown and the installation will be inspected by the Authority based upon that request. If recommended by Authority Staff, the

request will be presented to the Authority Board for consideration at a regularly scheduled Authority meeting.

C. MAINTENANCE GUARANTY LETTER OF CREDIT

At acceptance of construction, the Developer shall submit an Eighteen-Month Maintenance Guaranty Letter of Credit or other approved form of Maintenance Guaranty. The amount of the Maintenance Guaranty shall be 10% of the original construction cost unless the Developer is otherwise notified in writing by the Authority. The Authority shall have the sole discretion in establishing the amount of the Letter of Credit based upon the nature of the construction.

The Maintenance Guaranty for the work in PennDOT rights-of-way is currently 24 months. The Authority reserves the right to delay acceptance of the water and sewer lines to coincide with the expiration of the PennDOT Maintenance Guaranty.

D. PERMIT FEES

The Developer shall be responsible for all permit and/or processing fee of any agency, firm or bureau having jurisdiction over the project.

E. INSPECTION FEES

The Developer shall be responsible for all inspection, testing or approval costs of any agency, firm or bureau having jurisdiction over the project.

F. MAINTENANCE OF SERVICE

The Developer shall be solely responsible for all costs to provide continuous service to the Authority's existing customers as directed by the Authority. Such costs shall include those borne directly by the Developer or incurred by the Authority. The Developer shall be responsible for all inspection, testing or approval costs.

G. OPERATING COSTS

The Developer shall be solely responsible for operating costs of new or modified facilities constructed until acceptance by the Authority or some earlier date approved in writing by the Authority. If the system modifications include existing facilities required to maintain service, this responsibility will be defined in the Developer's Agreement.

H. INSPECTION AND TESTING COSTS

The Developer shall be solely responsible for all costs incurred by the Authority for inspection and testing of the facility installed by the Developer. These costs shall include Authority Staff costs, engineering fees, inspection fees, testing costs, and the cost of the water used for flushing lines. Testing costs referenced in this paragraph shall be in addition

to the Developer's costs defined by the technical specifications.

I. WATER USED BY DEVELOPER FOR TESTING, FLUSHING AND CHLORINATING

Whenever the use of unmetered water is required by a Developer or Developer's contractor for the testing, flushing, chlorinating or other use of water or sewer lines, the Developer or Developer's contractor must apply for and obtain prior written approval from the Authority or the Authority's Engineer. The Authority's Engineer will finish the Developer with an estimate of all unmetered water used and such usage shall be paid for by Developer from the escrow fund established wit the Authority by the Developer.

SECTION 5. GRINDER PUMP UNITS

A. GENERAL STATEMENT

Use of grinder pump units will be approved on a case-by-case basis. The Authority reserves the right to require gravity installations wherever physically possible, including installation of special facilities by the Developer to facilitate gravity service.

B. SPECIFIC REQUIREMENTS

1. In order to provide uniformity throughout the system, all grinder pump systems must be of the size and type specified by the Authority.

2. Simplex (single) grinder pump units shall be used at residential property locations, while either simplex or duplex (double) grinder pump units shall be utilized at commercial and industrial properties.

3. The Authority shall maintain in its possession, at all times, one spare grinder pump for every ten (10) grinder pumps connected to its Sewer System. Any person seeking approval to use grinder pumps shall pay to the Authority (1/10th) of the then current cost of a grinder pump for each grinder pump to be installed by or on behalf of such person. The current cost of a grinder pump shall be as determined from time to time by the Authority, in the Authority's sole discretion. Prior to the installation of any grinder pumps, the person desiring to install the grinder pump or pumps shall be required to enter into a Grinder Pump Agreement with the Authority and shall make payment to the Authority as aforesaid upon execution of the Grinder Pump Agreement.

4. The owner of the property served by a grinder pump shall have the responsibility for maintaining, operating, repairing, and replacing grinder pumps. Each homeowner of the lots to be served by the grinder pumps shall be put on notice of such intended sewer service no later than the execution of the sales agreement, which sales agreement shall advise the prospective homeowner of his or her obligations pertaining to the grinder pump and

which sales agreement shall also refer to and incorporate by reference a copy of the Authority's specifications and resolutions regarding grinder pumps.

5. Each Subdivision requiring grinder pumps shall include in its plan notes a notification regarding grinder pumps. At the time of settlement, the Developer must include in all deeds for the lots to be serviced with grinder pumps a provision imposing on the homeowner, his or her heirs, assigns and successors in interest, the ongoing duty of maintenance, and replacement if necessary, of the grinder pump servicing the homeowner's individual lot.

6. Except for the spare grinder pump referred to in paragraph 3 of this section, the Authority shall have no responsibility for the purchase, operation, repair or replacement of grinder pumps or associated facilities.

7. If the use of grinder pumps is approved, the Developer must obtain the Grinder Pump Agreement, grinder pump specifications and homeowner information packets at the Authority office.

SECTION 6. FIRE SUPPRESSION AND SPRINKLER SYSTEMS

A. GENERAL STATEMENT

The following sets forth Authority policy with regard to the installation of fire sprinkler systems ("System" or "Systems") for new single family dwellings and two-family dwellings and connection to the Authority's Water System.

B. SPECIFIC REQUIREMENTS

1. Developer shall utilize a one (1) inch water line (service lateral) and water meter. Upon receipt of prior Authority approval for good cause shown, Developer may utilize a larger diameter water line and meter.

2. Developer shall not install a separate supply line to service the System but rather shall utilize the domestic service line to provide water to the System. The System shall be installed in accordance with Part IV (Exhibit/Sheet W23) of this Developers' Manual. All System design information and requirements shall be submitted by the Developer to the Authority with the land development plan (or upon submittal of a building permit application in the case of a single family dwelling).

3. Developer may need to install a pressure pump to meet the pressure needs of the System and the property owner / customer shall be responsible for ownership, maintenance, testing and repair of the pressure pump.

4. All connections of Systems to the Authority's Water System shall be in

accordance with this Developers' Manual, the Authority's Rates, Rules and Regulations, and any applicable municipal, state or federal statutes, ordinances, rules, regulations, specifications or other requirements. Without limiting the foregoing, Developer shall install Systems which meet industry standards (currently N F.P.A.- 1 3D). Developer shall provide evidence satisfactory to the Authority of such compliance and shall provide independent verification that the pipe used in the Systems is designed to withstand a working pressure of not less than 200 psi.

5. The Authority is not responsible for the design of the Systems and does not guarantee the function of any System. Although the Authority provides specifications for the water line and water meter between the curb stop and the wall of the dwelling, the Authority's obligations end at the curb stop.

6. By providing Water System water pressure information or other information to Developer, and/or by providing water service for the Systems, the Authority does not:

   a. Insure or guarantee that any System (I) is adequate to suppress a fire, (ii) complies with all applicable municipal, state or federal statutes, ordinances, rules, regulations, specifications or other requirements for a fire suppression or sprinkler system, and / or (iii) will operate with the existing water service, capacity and pressure provided by the Authority's Water System; or

   b. Assume any liability for personal injury, property damage or any other claim arising out of or caused by the failure of any System to operate properly or adequately suppress a fire; or

   c. Guarantee any particular water service, capacity or pressure; or

   d. Waive any governmental immunity afforded the Authority.

7. By connecting to the Authority's Water System, Developer, for itself, its successors and assigns (including all homeowners within the Development), specifically releases, indemnifies and holds the Authority harmless from any and all claims, demands, costs, obligations or liabilities of any nature whatsoever, including claims for personal injury or property damage, in any way relating to a System or the Systems.

8. By connecting to the Authority's Water System, Developer agrees and covenants for itself, and on behalf of its successors, assigns and insurers (including all homeowners within the Development), that as a condition of being supplies water for the Systems by Authority, Developer will bring no suit against Authority which shall, in any way whatsoever relate to the amount, quantity, quality, pressure or sufficiency of the water supplied by Authority for use in the Systems.

9. Developer specifically acknowledges that it has been advised by Authority that:

   a. The pressure in the Authority's Water System may not be capable of meeting the requirements to start and maintain any System in the event of a fire;

   b. The minimum pressure requirements for fire suppression or sprinkler systems is higher than that which the Authority maintains for domestic water supply.

   c. The water supplied by Authority may not provide adequate and continued flow volume (gallons/minute) to any System;

   d. A pressure pump or holding tank may have to be installed by Developer to meet the pressure needs of a System;

   e. Backflow prevention devices shall be required to prevent contamination of the domestic water supply;

   f. The Authority is in no way guaranteeing an adequate supply, volume or pressure of water to the Systems, and the supply of water may not reach the Systems due to line flushing, line break, air-lock, drought, pumping system failure, contamination or termination of service by Authority due to non-payment of water bills by a customer.

10. The Authority agrees to provide water to the Systems solely in accordance with the terms of this Developers' Manual, and on the specific condition that Authority shall have no liability whatsoever as a result of providing or failing to provide water to the Systems.

11. Each homeowner of the lots to be served by a System shall be put on notice of the Authority's terms and conditions relating to such System no later than the execution of the sales agreement, which sales agreement shall advise the prospective homeowner of his or her obligations pertaining to the System and which sales agreement shall also refer to and incorporate by reference a copy of the Authority's Developers' Manual and Rates, Rules and Regulations regarding fire suppression and sprinkler systems. Developer shall advise all homeowners within the Development that: (I) such homeowners must obtain annual inspections of the System to ensure the System remains in good working condition, receives adequate pressure and is not subject to failure due to sediment in the line or sprinkler valves; and (ii) the Authority shall not be responsible for any malfunction of a System or damage caused to a System.

12. At the time of settlement, Developer shall include in all deeds for the lots to be serviced with a System a provision imposing on the homeowner, his or

her heirs, assigns and successors in interest, the ongoing duty of maintenance and replacement, if necessary, of the System servicing the homeowner's individual lot.

13. Developer shall duly execute the Authority's form Agreement Regarding Water Service for Fire Suppression and Sprinkler Systems and, to insure the binding effect of this Agreement on successors in interest to Developer, the Agreement shall be recorded in the Recorder of Deeds' Office in and for Lancaster County, Pennsylvania, at Developer's cost.

C. DEVELOPMENTS HAVING RECEIVED FINAL PLAN APPROVAL PRIOR TO JANUARY 1, 2011

1. Certain residential developments within the Township may have received final plan approval prior to January 1, 2011, but have not completed any or all dwellings within the development (an "On-Going Pre-2011 Development").

2. With regard to any On-Going Pre-2011 Development utilizing water laterals smaller than one (1) inch in diameter, the Developer may continue to use such nonconforming water laterals provided Developer provides clear and convincing evidence satisfactory to the Authority, in its sole discretion, that the existing water laterals will provide sufficient flow and pressure to the Systems in compliance with all applicable municipal, state or federal statutes, ordinances, rules, regulations, specifications or other requirements for a fire suppression or sprinkler system.

3. In the event that the Developer is unable to satisfy the requirements of Subsection C.2 above, Developer shall, at its option, either:

   a. Replace the existing non-conforming laterals with one (1) inch laterals; or

   b. Install a holding tank which will provide sufficient flow and pressure to the Systems in compliance with all applicable municipal, state or federal statutes, ordinances, rules, regulations, specifications or other requirements for a fire suppression or sprinkler system.

SECTION 7. PERMITS

A. STATE HIGHWAY AND TOWNSHIP ROADS

The Developer performing the extension, or acting through its contractor, shall secure the necessary state highway and municipal permits for working within state highway and township streets. The Developer and/or his Contractor shall comply with all PennDOT and municipal laws, rules, regulations, and ordinances including, but not limited to, furnishing bonds and insurance required and costs of inspection of the work. All PennDOT inspection fees and/or other PennDOT fees or costs associated with the work shall be paid

by the Developer.

Where the Authority is required, by PennDOT regulations, to apply for a highway occupancy permit and to post bonds and provide insurance for an extension, the Developer constructing the extension shall be responsible for paying for or reimbursing the Authority for the costs of such bonds and insurance. Furthermore, before the Authority shall execute and file any application for highway occupancy permit with PennDOT, the Authority shall have received from the Developer and/or Contractor an agreement of indemnity from the Developer and/or Contractor, wherein the Developer/Contractor shall agree to indemnify and hold harmless the Authority and its agents from any and all liability incurred in connection with the Project and from all costs and expenses imposed on the Authority by PennDOT in connection with such application and naming the Authority and its Engineer as additional insureds on the Contractor's general liability policy. It is the intent of such agreement that any and all costs and expenses incurred by the Authority as a result of the PennDOT application process for a highway occupancy permit shall be paid in full by the Developer. The Developer shall carry contractual liability insurance in an amount and form satisfactory to the Authority, insuring the indemnification.

B. DEP

The Developer shall be responsible for all costs of filing for a DEP Part II Construction Permit, should such permit be required for the construction. All DEP permits shall be issued in the name of the Authority. The Authority will cooperate with the Developer in providing data required for the filing and execute the application form. If the Authority is preparing the design, the Authority Engineer shall prepare the application data required. However, this does not relieve the Developer from being totally financially responsible.

SECTION 8. CONSTRUCTION

A. GENERAL REQUIREMENTS

Prior to the start of construction, the Developer shall submit two copies of shop drawings and/or material specifications to the Authority, unless otherwise directed by the Authority, for all materials to be utilized and receive approval of such material(s). The equipment and materials described by the Shop Drawings and material specifications submitted shall not be incorporated into the work until approved by the Authority or its Engineer. The Authority reserves the right to request additional work and materials where, in its opinion, conditions warrant such work and materials.

The Developer, acting through its contractor, shall notify the Authority at least three (3) working days prior to the commencement of construction to facilitate the scheduling of inspections of the water and/or sewer installation(s). No work may be undertaken without construction observation, and any work performed without construction observation shall be re-excavated, exposed and observed by the Authority's representatives. Any defective work, or any work not conforming to the plans and specifications approved by the Authority, shall be replaced to the satisfaction of the Authority at the Developer's cost and expense.

B. INSURANCE

Prior to the initiation of any construction activities, the Developer and/or Contractor shall have submitted to the Authority an approved Certificate of Insurance outlining the required insurance coverages. The Certificates shall contain a provision that coverages will not be canceled, materially changed or renewal refused unless at least thirty (30) days' prior written notice has been provided to the Authority.

Insurance coverages are required to be written on an "occurrence basis" and be written through an insurance company rated as A- or better by AM Best. The policies of insurance shall include the Authority, the Authority Engineer and the Township as additional insureds. The insurance coverages and minimum limits of liability shall be as follows:

1. Worker's Compensation:

   a. All State requirements for Workers' Compensation coverage shall be met including:

   b. Employer's liability:

Bodily Injury by Accident	"As required by law."
Bodily Injury by Disease	"As required by law."
Bodily Injury by Disease	"As required by law."

2. Comprehensive General Liability:

The Comprehensive General Liability Policy shall satisfy the following requirements:

   a. The aggregate limits of insurance shall be on a "per project" basis (ISO Endorsement CG 2503 or its equivalent shall be included).

   b. Coverage shall be provided for completed operations and products liability.

   c. The exclusion with regard to property under the care, custody and control of the Developer and/or Contractor shall be eliminated.

   d. Coverage shall include contractual liability insurance.

   e. Coverage shall include explosion, collapse and underground insurance.

   f. Coverage shall include personal and advertising injury insurance.

   g. The minimum limits of liability shall be as follows:

Each Occurrence (Bodily Injury and Property Damage)	$1,000,000
General Aggregate	

(except Products-Completed Operations)	$2,000,000
General Aggregate (Products - Completed Operations)	$1,000,000
Personal and Advertising Injury	$1,000,000

3. Comprehensive Automobile Liability:
Bodily Injury and Property Damage: $1,000,000 each accident (combined single limit.)

4. Owner's and Contractor's Protective Liability: (Separate policy)
$2,000,000 each occurrence
$4,000,000 aggregate

5. Excess Liability - Umbrella Form: $2,000,000 each occurrence $4,000,000 aggregate

6. Property Insurance
Developer and/or Contractor shall purchase and maintain property insurance upon the work at the site in the amount of the full replacement cost thereof subject to a deductible amount of $1,000. This insurance shall be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss and damage to the work, temporary buildings, false work and work in transit and shall insure against at least the following perils: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of laws and regulations, and water damage.

SECTION 9. RECORD DOCUMENTS

A. GENERAL REQUIREMENTS

The Authority shall inspect and maintain records of all water facility and sewer facility improvement installations during construction. Within two (2) months from the date of completion of the water facility and sewer facility installations, but prior to submission of final record drawings, the Developer's contractor shall contact the Authority's Engineer to arrange for a review of said contractor's draft record drawings and a comparison with the Authority's record drawings. Any inconsistencies between the contractor's draft record drawings and the Authority's record drawings shall be resolved to the satisfaction of the Authority's Engineer prior to submission of final as-built plans by Developer. If necessary, site visits shall be scheduled between the Developer's contractor and the Authority's Engineer to correctly locate all water facility and sewer facility installations. All costs and expenses incurred by the Authority relating to the record drawings, including, but not limited to, inspection fees and expenses, record keeping fees and expenses, engineering and legal fees and expenses, shall be borne by the Developer and shall be paid from the escrow fund established with the Authority by the Developer.

Within one (1) month from the date of review and approval of the draft record drawings, the Developer shall submit to the Authority final record documents of the facilities. Record documents shall include drawings, manufacturer's information and instructions, Contractor field notes, and records of tests performed while demonstrating compliance with the Authority's Rates, Rules and Regulations. The Authority shall review the final record documents, and approval is required prior to consideration of acceptance of the facilities.

In the event that the Developer fails to submit draft record drawings within the aforesaid two (2) month period or final record documents within the aforesaid one (1) month period, the Authority's Engineer will prepare final record documents at Developer's expense and all related fees and expenses shall be borne by Developer and shall be paid from the escrow fund established with the Authority by the Developer.

All record plans shall include the following information:

1. Road or Street names and route numbers as required.
2. Lot lines and approximate house location.
3. Curb lines and right-of-way lines.
4. North Arrow.
5. Depth to service at end of service line or Lateral.
6. Finished first floor elevation of structure being served.
7. Location of Lateral or service line.

B. WATER SYSTEM RECORD PLANS

The record plans shall show the following facilities and include the following information:

1. All water mains and service lines, with notations indicating materials installed and depth.

2. All appurtenances, including valves, fire hydrants, bends, fittings, blow offs, air relief valves and service connections.

3. All other facilities constructed, including booster stations and meter pits.

4. All service lines and appurtenance locations shall be identified by measuring from street intersections starting at station 0+00, which should be a visible valve in line with the direction of the extension, and noting the running distance to the connection or appurtenance.

5. All water line profiles, including utility crossings with separation distance.

C. SEWER SYSTEM RECORD PLANS

The record plans shall show the following facilities and include the following information:

1. All gravity sewer lines, including laterals, and force mains. Each lateral shall show distance from main to vent and clean out.

2. All appurtenances, including manholes, lateral connections, and air release/ vacuum valves. Lateral locations shall be measured from lower manhole by giving distance from that manhole to the service or connection point. Manholes with watertight covers must be identified.

3. All other facilities constructed, including pumping stations.

4. Profiles of all gravity sewer lines shall include:
   a. Sanitary sewer lines and manholes.
   b. Elevations - surface and invert.
   c. Manhole to manhole distance.
   d. Percentage of slope.
   e. Type of material and size.
   f. Utility crossings, including separation distance.

D. SUBMISSION REQUIREMENTS

The Record Document submission shall comply with the following requirements:

1. Only provide water and sewer sheets for facilities constructed.
2. All drawing sizes shall be not larger than 24" x 36"
3. Drawing submission shall consist of one (1) set of 24" x 36" mylars, one (1) set of 24" x 36" prints, one (1) set of 18" x 24" prints, and one (1) set of 18" x 24" mylars.
4. One (1) set of 8 ½" x 11" or 8 ½" x 14" exhibits for inclusion with the Bill of Sale.

All drawings shall also be submitted on a CD in a .dwg and .pdf format.

SECTION 10. ACCEPTANCE PROCEDURE

When the installation of water and/or sewer lines is complete, Developer shall provide written notification to the Authority's Engineer/Authority Staff. If required by the Authority, Developer shall perform the following final testing prior to acceptance by the Authority:

Water Lines

Within 60 days of final dedication or prior to the placement of final paving, whichever comes first, Developer shall hire the services of a leak detection firm to inspect the water lines for potential active leaks. The Authority reserves the right to approve the leak detection firm selected by the Developer prior to the start of the work. Results of the testing shall be provided to the Authority prior to the installation of the final paving.

Sewer Lines

Once road sub-base is completed and before the initial installation of paving base course, Developer shall hire the services of a pipeline televising firm to conduct televising of the sewer lines. The Authority reserves the right to approve the pipeline televising firm selected by the Developer prior to the start of the work. Results of the televising shall be provided to the Authority prior to the installation of the paving base course.

If leak detection and/or televising is required and the Developer fails to conduct and provide the results of the required testing, the Authority shall conduct such testing at the Developer's expense. The cost of such testing shall be paid for by Developer from the escrow fund established with the Authority by the Developer. Any and all deficiencies in the water and/or sewer lines shall be corrected by the Developer to the satisfaction of the Authority. Once the construction has been inspected and finally approved by the Authority, the following procedure will be completed for consideration of acceptance by the Authority:

1. The Developer shall notify Authority, in writing, that installation of water and/or sewer facilities has been completed and request that the Authority begin the process of acceptance.

2. The Developer shall notify the preparer of the plan that record documentation and exhibits
should be prepared according the Authority's procedures.

3. The Authority staff or Authority Engineer will perform an inspection to certify that the work has been completed and will provide a letter to that effect.

4. After all documentation has been received, including the certification from the Authority Engineer/Authority staff that the work has been properly completed and approved, the Authority will:

a. Authorize the drawdown of the Letter of Credit to an Eighteen Month Maintenance Guaranty based on the Engineer's recommendation, except as modified by PennDOT requirements, pending receipt of a Maintenance Guaranty Letter of Credit.

b. Provide the Developer with a copy of the Drawdown Authorization along with a Maintenance Guaranty Letter of Credit form to present to his lending institution.

c. Authorize the Authority Solicitor to prepare the Bill of Sale and Maintenance Guaranty which will be forwarded to the Developer for execution.

d. Have the water and sewer record drawings copied to a disc to archive the project.

5. Acceptance will be scheduled at the meeting following the receipt of the executed Bill of Sale and Maintenance Guaranty and the Maintenance Guaranty Letter of Credit.

6. Once all legal, engineering and inspection fees have been paid, the balance remaining in the Developer's escrow account will be refunded with the exception of the Final Inspection fee.

7. The Subdivision will be inspected one month prior to the expiration date of the Maintenance
Guaranty and the Maintenance Guaranty Letter of Credit. If the extension fails inspection, the Developer will be notified by the Authority to correct deficiencies or it will draw on the Maintenance Guaranty Letter of Credit. Surface appurtenances damaged during construction will remain the responsibility of the Developer until such time as the roadway is accepted by the Township for dedication.

SECTION 11. REPEALER

All resolutions, parts thereof and amendments thereto previously adopted by the Authority are hereby repealed to the extent they are inconsistent herewith. Except to the extent inconsistent herewith, each and every other provision of the resolutions of the Authority shall remain in full force and effect as previously adopted and amended.

PART II

FEE SCHEDULE

"Application to Extend and/or Connect with the Water System and/or Sewer System and Request for Reservation of Capacity"

SUBDIVISION PROCESSING FEES

Administrative Fee (three (3) residential lots or less) $100.00
Administrative Fee (all other applications) $250.00

Escrow Account / Initial Review Deposit.....$750.00 or such other amount as may be determined by the Authority from time to time

W.T.M.A. Plan Review Fees

Authority Superintendent ..... $75.00 per hour
Maintenance Personnel ..... $60.00 per hour

Administrative Note:
Any charges incurred to conduct a feasibility study required to supply water or sewer capacity or to address any specific site need(s) will be invoiced to the Developer or applicant in accordance with the standard rate schedule in effect at the time this work is completed. The review document letter will indicate an amount to be placed in escrow by the Developer or applicant with the Authority to cover the expenses of the study.

RESERVATION OF CAPACITY FEES

Water:

Residential: Per EDU of capacity upon submission of an executed *Application to Extend and/or Connect with the Water System and/or Sewer System and Request for Reservation of Capacity* and, upon each annual anniversary of the approval of the capacity request by the WTMA Board thereafter, the then current reservation fee per EDU of reserved capacity for which a tapping fee has not already been paid. After 10 years, requests to extend the reservation of capacity must be made annually.

Years 1 - 5:	$25.00 per EDU
Years 6 -10:	$50.00 per EDU - Upon approval of a request for extended reservation
10 or more years:	$100 per EDU - Upon approval of a request for extended reservation.

Commercial: Per EDU of capacity upon submission of an executed *Application to Extend and/or Connect with the Water System and/or Sewer System and Request for Reservation of Capacity* and, upon each annual anniversary of the approval of the

capacity request by the WTMA Board thereafter, the then current reservation fee per EDU of reserved capacity. *(Commercial capacity is purchased per gallon. The valuation of the EDU is according to PA Act 203.)* After 10 years, requests to extend the reservation of capacity must be made annually.

Years 1 - 5	$25.00 per EDU
Years 6 -10	$50.00 per EDU - Upon approval of a request for extended reservation
10 or more years	$100 per EDU - Upon approval of a request for extended reservation

Sewer:

Per EDU of capacity upon submission of an executed *Application to Extend and/or Connect with the Water System and/or Sewer System and Request for Reservation of Capacity* and, upon each annual anniversary of the approval of the capacity request by the WTMA Board, the then current reservation fee per EDU of reserved capacity. After 10 years, request to extend the reservation of capacity must be made annually.

Years 1 - 5	$25.00 per EDU
Years 6 -10	$50.00 per EDU - Upon approval of a request for extended reservation
10 or more years:	$100 per EDU - Upon approval of a request for extended reservation

Assignment of Water System Capacity Reservation Agreement $25.00
Assignment of Sewer System Capacity Reservation Agreement $25.00

Final Inspection Fees
Ten or Fewer Residential Lots $125.00
Over ten Residential Lots $250.00
Commercial/Industrial $250.00
Document Archive Fee$25.00

FEE SCHEDULE - WATER SYSTEM

Item Number	Description	System Wide Fee
1	Cost of Permit	$50.00
2	Connection Fee Escrow Deposit	$1,500. 00
3	Tapping Fee - Domestic Establishment (a) Capacity Part (b) Distribution Part Total	 $1,450.69 $949.31 $2,400.00
4	Tapping Fee - Non-domestic Establishment (a) Capacity Part (b) Distribution Part Total	***per gallon per day*** $8.65 $5.66 $14.31
5	Special Purpose Fee	$0.00
6	Reimbursement Fee	per individual Developer Extension Agreement
7	Re-Connection Fee	$50.00
8	Quarterly Charges - Minimum (for usage up to 6,000 gallons per quarter)	$32.00
9	Each additional 1,000 gallons	$3.28
10	Private Fire Protection Facilities Fee (non-domestic)	$32.00
11	Hydrant Tax	$50.00
12	Service Call Fee	$75.00 per hour
13	Collection Fee	based on cost
14.	Use of Unmetered Water	Based upon cost as estimated by Authority's Engineer/Authority Staff using then current rate

FEE SCHEDULE - SEWER SYSTEM

Item Number	Description	System Wide Fee
1	Cost of Permit	$50.00
2	Connection Fee Escrow Deposit	$1,500.00
3	Tapping Fee - domestic Establishment (a) Capacity Part (b) Distribution Part Total	 $3,246.79 $ 953.21 $4,200.00
4	Tapping Fee - Non-domestic Establishment (a) Capacity Part (b) Distribution Part Total	***per gallon per day*** $13.98 $ 4.11 $18.09
5	Special Purpose Fee	$0.00
6	Reimbursement Fee	per individual Developer Extension Agreement
7	Re-Connection Fee	$50.00
8	Quarterly Charges - Minimum (for usage up to 12,000 gallons per quarter)	$77.00
9	Each additional 1,000 gallons (over 12,000 gallon minimum)	$4.30
10	Flow Meter	$2,500.00
11	Service Call Fee	$75.00
12	Collection Fee	$75.00 per hour

PART V

FORMS

APP-1	Application for Consideration of A Request to Extend and/or Connect with the Water System and/or Sewer System and Request for Allocation and Reservation of Capacity.
ROC-1S	Assignment, Acceptance & Acknowledgment - Sewer Capacity
ROC-1W	Assignment, Acceptance & Acknowledgment - Water Capacity
EXT-APP	Application to Extend Water and/or Sewer Lines
EXT-LW	Lititz Water Extension Agreement
EXT-RW	Rothsville Water Extension Agreement
EXT-S	Sewer Extension Agreement
LOC-W	Letter of Credit Form - Water System Only
LOC-S	Letter of Credit Form - Sewer System Only
LOC-COM	Letter of Credit Form - Water and Sewer
LOC-MG	Maintenance Guarantee Letter of Credit Form
GP-1	Developer Grinder Pump Agreement
GP-2	Grinder Pump Buyer Acknowledgment Form
GP-3	Grinder Pump Checkout Form
GP-4	Grinder Pump Loan Agreement
GP-	info Grinder Pump Packet
DE1	Agreement Providing for Grant of Easements Water, Sewer, Stormwater (Permanent to Authority)
DE2	Agreement Providing for Grant of Water and/or Sewer Easement (Permanent to Authority) DE3S Declaration of Easement - By Developer. Lot __ in favor of___ (Permanent Private) Sewer
DE3W	Declaration of Easement - By Developer. Lot __ in favor of___ (Permanent Private) Water
DE3C	Declaration of Easement - By Developer. Lot __ in favor of___ (Permanent Private)Water & Sewer
ROE	Right of Entry Agreement - For Construction.

Section 1.	Application for Consideration of a Request to Extend and/or Connect with the Water System and/or Sewer System of Warwick Township Municipal Authority Relative to a Proposed Subdivision and/or Land Development and Request for Allocation and Reservation of Capacity
Section 2.	List of Standard Authority Forms.

SECTION 1 – CONSTRUCTION SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Submittal procedures.

B. Action on submittals.

C. Construction progress schedules.

D. Proposed products list.

E. Shop drawings.

F. Product data.

G. Samples.

H. Manufacturers' instructions.

I. Manufacturers' certifications.

J. Shop Drawing Work.

1.02 SUBMITTAL PROCEDURES

A. When requested by AUTHORITY (also referred to in this Developers' Manual and these Developer Specifications as "WTMA"), Developer shall submit three copies of complete schedule of all anticipated submittal dates.

B. Developer shall transmit each submittal to AUTHORITY in accordance with the schedule.

C. Developer shall sequentially number the transmittals. All resubmittals shall have the original number with an alphabetic suffix.

D. Developer shall identify the Project, contractor, subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate. Developer shall clearly mark models, sizes, features, options, accessories, electrical characteristics and controls.

E. Developer shall apply Developer's Contractor's stamp, signed or initialed, certifying that his review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the Work. Submittals not containing Developer's Contractor's stamp shall be returned. The stamp shall have the following format:

Approved for Authority Requirements

The Developer's Contractor's signature below indicates that he has checked this Submittal with the approved plans, WTMA Developer Specifications, and site conditions and found it to meet all requirements of same including dimensions.
Re: [Project Name]

Drawing Sheet_____

Specification Section_____ Paragraph_____

Deviations from Approved Plans and/or WTMA Developer Specifications:
No_____ Yes____
(letter attached)

By_____
Signature (Developer's Contractor)

F. Developers shall schedule submittals to expedite the Project and shall deliver submittals to AUTHORITY. Developer shall coordinate submission of related items.

G. Developer shall check Submittals for conformity with the requirements of the approved plans and WTMA Developer Specifications; verify dimensions, conditions, features, options, accessories, electrical characteristics, and controls; and cause his Contractor to stamp his approval on each Submittal prior to submitting.

H. Developer shall organize Submittals by systems, if applicable, and group together in a binder with tabs defining each group.

I. **Failure to comply to these requirements will be reason for the AUTHORITY to reject and return your submission.**

J. AUTHORITY's review of Submittals is for conformance to design intent and should not be misconstrued as an approval.

K. AUTHORITY's review does not relieve the Developer's Contractor from the responsibility for the proper fitting and construction of the work, or from furnishing all appurtenances, devices, material and labor required for the installation which may not be indicated on the Approved Plans, in the WTMA Developer Specifications or on the Submittals.

L. Developer shall submit a letter which specifically identifies deviations from Approved Plans and/or WTMA Developer Specifications. Developer shall identify variations from Approved Plans and Product or system limitations which may be detrimental to successful performance of the completed Work.

M. Developer shall revise and resubmit submittals as required and clearly identify all changes made since previous submittal.

N. Developer shall distribute copies of reviewed submittals to concerned parties and instruct parties to promptly report any inability to comply with provisions.

O. Developer shall be and shall remain responsible for all Construction Submittals and compliance with all WTMA Developer Specifications notwithstanding the fact that submissions may be made by his Contractor.

1.03 ACTION ON SUBMITTALS

A. AUTHORITY Action: Where action and return is required or requested, AUTHORITY will review each submittal, mark with the action taken, and where possible return within two weeks of receipt. Where submittal must be held for coordination, Developer and his Contractor will be so advised by AUTHORITY.

B. Submittals returned with "NO EXCEPTION TAKEN" action indicates that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the approved plans and/or WTMA Developer Specifications. The Developer and his Contractor remain responsible for work related errors, deviations, and discrepancies in the submittal, but may proceed with performance of the work covered by the submittal.

C. Submittals returned with "MAKE CORRECTIONS NOTED" action indicates that the information submitted was found to be in conformance with the design concept and in compliance with the requirements of the approved plans and/or WTMA Developer Specifications, provided the noted clarifications or corrections are incorporated in the submitted information for Record Document purposes. The Developer and his Contractor remain responsible for work related errors, deviations, and discrepancies in the submittal, but may proceed with performance of the work covered by the submittal. Resubmission of information is not required.

D. Submittals returned with "AMEND AND RESUBMIT" action indicate that: (1) information submitted is at least partially not in conformance with the design concept, (2) information submitted is at least partially not in compliance with the requirements of the approved plans and/or WTMA Developer Specifications, (3) submittal is incomplete and does not include all items required by the individual specification sections, or (4) certifications or computations required by the individual specification sections have not been included with the shop drawings and product data. AUTHORITY will note the deficiencies or corrections required and return the submittal to the Developer and his Contractor. Performance of the work covered by the submittal shall not proceed until corrected information is submitted and approved.

E. Submittals returned with "REJECTED - SEE REMARKS" action indicates that the AUTHORITY interprets the information submitted to be not in conformance with the design concept or not in compliance with the approved plans and/or WTMA Developer Specifications. This action may also indicate non-compliance with the Developer's and his Contractor's responsibility to review information and submit notification of deviations and discrepancies for the AUTHORITY's review. Performance of the work shall not proceed until new information is submitted and approved.

1.04 CONSTRUCTION PROGRESS SCHEDULES

A. If required by AUTHORITY, Developer shall submit three copies of initial progress schedule to AUTHORITY for review and comment. Developer shall submit revisions

monthly, or when requested by the AUTHORITY, to reflect changes to the initially submitted schedule.

1.05 PROPOSED PRODUCTS LIST

A. If requested by AUTHORITY, Developer shall submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product. Developer shall submit number of copies DEVELOPER requires plus three copies to be retained by AUTHORITY.

B. For products specified only by reference standards, Developer shall give manufacturer, trade name, model or catalog designation, and reference standards.

1.06 SHOP DRAWINGS

A. Developer shall submit the number of opaque reproductions which DEVELOPER requires, plus three copies which will be retained by AUTHORITY.

B. Each submission of shop drawings must be accompanied by a letter of transmittal listing the items in the submission. Each shop drawing must be marked with the name of the project and numbered consecutively.

1.07 PRODUCT DATA

A. Developer shall submit the number of copies which DEVELOPER requires, plus three copies which will be retained by AUTHORITY.

B. Developer shall mark each copy to identify applicable products, models, options, and other data. Developer shall supplement manufacturers' standard data to provide information unique to this Project.

1.08 SAMPLES

A. Developer shall, if applicable, submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Developer shall coordinate sample submittals for interfacing work.

B. Developer shall submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for AUTHORITY's selection.

C. Developer shall include identification on each sample, with full project information.

1.09 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, Developer shall submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

B. Developer shall identify conflicts between manufacturers' instructions and Drawings.

1.10 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, Developer shall submit manufacturers' certificates to AUTHORITY for review, in quantities specified for product data.

B. Developer shall indicate material or product conforms to or exceeds specified requirements. Developer shall submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product, but must be acceptable to AUTHORITY.

1.11 SHOP DRAWING WORK

A. All work which is related to the required shop drawing review process shall not be initiated until all shop drawings have been received, reviewed and accepted by the AUTHORITY.

B. All work initiated by DEVELOPER prior to receipt of reviewed and accepted shop drawings shall be at the sole risk of DEVELOPER. Any and all rework, modifications or reinstallations necessitated by changes in the Work due to changes required by subsequently approved shop drawings will be done by DEVELOPER at his expense.

END OF SECTION

SECTION 2 – TRENCHING, BACKFILLING AND COMPACTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavating trenches for utilities

B. Backfilling and compaction

1.02 RELATED WORK

A. Boring and Jacking

B. Approved DEVELOPER Drawings.

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 99, Moisture-Density Relations of Soils, Using a 5.5-lb. Rammer and a 12-inch Drop.

2. AASHTO T 191, Standard Method of Test for Density of Soil In-Place by the Sand Cone Method.

B. American Society for Testing and Materials:

1. ASTM D698 - Test methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using a 5.5-lb. Rammer and a 12-inch Drop.

2. ASTM D2167 - Test method for density and unit weight of soil in place by the rubber balloon method.

3. ASTM D2321 - Practice for underground installation of flexible thermoplastic sewer pipe.

4. ASTM D2922 - Test method for density of soil and soil-aggregate in place by nuclear methods (shallow depth).

C. Occupational Safety and Health Administration:

1. OSHA 29 CFR, Part 1926, Subpart P, Construction Standards for Excavation

D. Commonwealth of Pennsylvania Department of Transportation (PennDOT)

1. Publication 408 - Specifications

a. PDT Section 703 Aggregates.

E. State Code: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67. Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities, as supplemented or revised (PennDOT Chapter 459).

F. State Publication: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 203, Work Zone Traffic Control (PennDOT Chapter 203).

G. Warwick Township

1. Roadway Requirements

2. Blasting Requirements

1.04 DEFINITION

A. Definitions:

1. Subgrade: Trench bottom prepared as specified to receive pipe bedding, concrete cradle or concrete encasement of the bottom of excavations prepared to receive pipe line structures.

2. Utility: Any buried pipe, duct, conduit or cable.

3. Final Restoration Elevation: Elevation of bottom of final restoration operation such as bottom of topsoil depth or paving Subgrade.

1.05 REGULATORY REQUIREMENTS

A. Work performed within State Highway rights-of-way shall be completed according to Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities and if applicable, the PennDOT Highway Occupancy Permit secured by DEVELOPER. Work within the State Highway rights-of-ways shall be subject to inspection by representatives of PennDOT.

B. All workmanship, materials and DEVELOPER's responsibility for all Work in and adjacent to PennDOT right-of-way shall be in compliance with PennDOT regulations, specifications and requirements. Where information on the approved DEVELOPER drawings is contradictory to current PennDOT requirements, PennDOT requirements shall govern.

C. Work performed within Township rights-of-way shall be completed according to Warwick Township's requirements.

1.06 PROJECT CONDITIONS

A. Removal of Obstructions:

1. Remove, realign or change the direction of above or below ground utilities and their appurtenant supports, if such is required in the opinion of AUTHORITY. Perform such work unless such work is done by the owner of the obstruction. However, uncover and sustain the obstruction at own expense prior to the final disposition of obstruction. Additional precautions concerning obstructions are as follows:

   a. Do not interfere with persons, firms, corporations or utilities employing protective measures, removing, changing or replacing their property or structures, but allow said persons, firms, corporations or utilities to take such measures as they may consider necessary or advisable under the circumstances.

   b. Break through and reconstruct if necessary, the invert or arch of a sewer, culvert or conduit that may be encountered if the said structure is in such a position, in the judgment of AUTHORITY, as not to require its removal, realignment or complete reconstruction.

B. Environmental Requirements:

1. Do not perform trenching, backfilling or compacting when weather conditions or the condition of materials are such, in the opinion of AUTHORITY, that work cannot be performed satisfactorily.

2. Do not use frozen materials as backfill nor wet materials containing moisture in excess of the amount necessary for satisfactory compaction.

3. Prior to use, moisten dry backfill material not having sufficient moisture to obtain satisfactory placement or compaction.

4. Plan work so as to provide adequate protection during storms with provisions available for preventing flood damage. Protect installed piping and other work against damage from uplift due to high ground water levels.

5. Accommodation of Drainage: Keep gutters, sewers, drains and ditches open for surface drainage. No damming or ponding or water in gutters or other waterways will be permitted, except through approved pipes or properly constructed troughs. When so required, provide pipes or troughs of such sizes and lengths as required, and place the same as required. Perform grading in the vicinity of trenches so that the ground surface is properly pitched to prevent water running into the trenches.

6. Pumping: Keep excavations free from standing water. Build dams and other devices necessary for this purpose, and provide and operate pumps of sufficient capacity for dewatering the excavations. Provide for the disposal of the water removed from excavations in such manner as not to cause injury to the public health, to public or private property, to the work of others, to the portion of the work completed or in progress or produce an impediment to the use of streets, roads and highways.

7. When it is necessary to haul soft or wet soil material over roadways, use suitably tight vehicles to prevent spillage. Clear away spillage of materials caused by hauling on roadways.

8. Provide effective dust control by sprinkling water, use of calcium chloride or other method approved by AUTHORITY. Employ dust control when, where and in a manner required by AUTHORITY.

9. Do not dispose of water in trenches by draining through completed portions of the work.

C. Protection: Assume the risks attending and presence or proximity of overhead or underground public utility and private lines, pipes, conduits and support work for same, existing structures and property of whatever nature. Damages and expenses for direct or indirect injury to such structures or to any person or property by reason of them or by reason of injury to them; whether such structures are or are not shown on the Drawings, rests solely with DEVELOPER.

1. Outside Rights-of-Way: Take necessary precautions to protect trees, shrubs, lawns and such landscaping from damage. Complete restoration work for damaged areas.

2. Pipe Supports: Adequately support underground pipes or conduits exposed as a result of excavations. Provide adequate support along their entire exposed length. Install such supports in such manner that backfilling may be performed without dislodging such pipes or conduits. Place and carefully compact Aggregate Backfill around the supports and leave such supports in place as a guard against breakage due to backfill settlement.

3. Temporary Protective Construction:

   a. Temporary Fence Barricade: Erect and maintain substantial temporary fences surrounding excavation to prevent unauthorized persons from entering such areas.

   b. Barricades: Furnish and erect substantial barricades at crossings of trenches, or along trenches, to protect the traveling public.

   c. Cover open excavation when work therein is suspended or left unattended, including the end of a work day. For such covers, use materials of sufficient strength and weight to prevent their removal by unauthorized persons.

d. Remove temporary protective construction at the completion of work.

D. Structure Supports: Where passing buildings or any structure which by their construction or position might bring a great pressure upon the trenches, the right reserved by AUTHORITY to require that such buildings or structures be underpinned or supported and protected, or special sheeting be driven or that short lengths of trench be opened at one time. Failure of AUTHORITY to recommend said protection shall not relieve DEVELOPER of his responsibility to protect structures near the construction.

E. Accommodation of Traffic: Do not obstruct streets, roads and highways unless Warwick Township authorizes in writing the complete closing of the street, road or highway. Employ such measures as may be necessary, including flagpersons, to keep the street, road or highway open and safe for traffic. Maintain a straight and continuous passageway on sidewalks and over crosswalks, at least three feet wide and free from obstructions. Do not obstruct fire hydrants.

F. Explosives and Blasting:

1. Blasting will be permitted only in areas permitted by Warwick Township and where the proximity of structures, underground facilities or public safety does not preclude the use of explosives. Blasting must comply with Township regulations.

2. The use of explosives shall be governed by the "Regulations for the Storage, Handling and the Use of Explosives" of the Pennsylvania Department of Labor and Industry and any other applicable federal, state or local codes that may have jurisdiction.

3. All blasts shall be properly matted and securely covered. DEVELOPER shall be solely responsible for injury to persons or property located within or beyond the area or scope of the project that may result from use of explosives.

4. Blasting work shall be supervised by personnel licensed and experienced in this type of work.

5. Explosives shall be stored in state-approved magazine off the job site and shall be delivered to the site in vehicles clearly marked to indicate cargo.

6. Blasting within State Highway and railroad rights-of-way is not permitted unless authorized by PennDOT or the railroad. DEVELOPER shall be responsible for securing required permits.

7. DEVELOPER shall post a weekly and daily schedule of the street location of blasting at the Municipal Offices. The schedule shall be updated daily during blasting periods.

8. DEVELOPER shall be responsible for the depths to which all blasting is performed.

9. Notify utilities having structures or other installations above or below ground in proximity to the trenching work prior to use of explosives. Such notice must be given sufficiently in advance to enable the utilities to take such steps as they may deem necessary to protect their property from injury. Such notice shall not relieve DEVELOPER of responsibility of damage resulting from his use of explosives. The right is reserved to direct that rock within five (5) feet of pipe, conduit or other structures encountered in the trench be removed by methods other than blasting.

10. Cease blasting operations when street paving adjacent to trench is damaged. Repair damaged street paving. Submit to AUTHORITY methods to be used in subsequent blasting. Do not proceed with blasting without written approval of AUTHORITY on methods to be used in subsequent blasting.

G. Removal of Rock by Means Other Than Blasting: Where removal of rock by means other than blasting is required, in accordance with the requirements of State and local laws, rules and regulations, and AUTHORITY requirements, remove by the use of mechanical surface impact equipment, or by drilling and hydraulic rock splitting equipment, or by other methods.

H. Responsibility for Condition of Excavation: Condition and results of excavation are solely the responsibility of DEVELOPER. Remove slides and cave-ins at whatever time and under whatever circumstance they occur.

I. Excess Materials: No right of property in materials is granted to DEVELOPER for materials excavated on lands not owned by DEVELOPER. This provision does not relieve DEVELOPER of his responsibility to remove and dispose of surplus excavated materials.

J. Borrow Material: When the required quantity of backfill material exceeds the quantity of suitable on site material, provide borrow material. If borrow material is needed, notify AUTHORITY sufficiently in advance to permit AUTHORITY to verify such need and to view the proposed borrow pit to determine the material suitability. Borrow excavation will be subject to AUTHORITY approval whose written consent shall be obtained prior to its use. DEVELOPER shall be responsible for all sampling and testing required by AUTHORITY to determine suitability.

K. Change of Trench Location or Depth: AUTHORITY reserves the right to change the location of a trench from that indicated on the Drawings due to the presence of an obstruction, or for other causes.

L. Advance Trenching: Where existing utilities or other suspected underground obstructions as indicated on the Drawings are within close proximity of proposed pipelines, uncover and verify the exact location of utilities and other underground obstructions far enough in advance of pipe laying to allow any changes in pipe alignment or grade required to bypass the obstructions to avoid removing sections of pipe already installed. If any sections of installed pipe must be removed and reinstalled as a result of not verifying utilities or other underground obstructions far enough in advance, DEVELOPER shall remove and reinstall the pipe.

1.07 FIELD MEASUREMENTS

A. Verify that survey bench mark, control point, and intended elevations for the Work are shown on the Drawing.

PART 2 - PRODUCTS

2.01 FILL MATERIAL

A. Earth Backfill: On site excavated soil or soil-rock mixed materials free of topsoil, vegetation, lumber, metal and refuse; and free of rock or similar hard objects larger than six inches in greatest dimension. Rock to soil ratio shall not exceed one part rock to three parts soil.

B. Aggregate Backfill: PennDOT 2A Coarse Aggregate or Select Granular Material (2RC) conforming to PennDOT Publication 408, Section 703.

C. Pipe Bedding and Initial Backfill:

1. Pipe Bedding: AASHTO No. 8 Coarse Aggregate conforming to PennDOT Publication 408, Section 703.2.

2. Initial Backfill: AASHTO No. 8 Coarse Aggregate conforming to PennDOT Publication 408, Section 703.2.

D. Concrete Cradle and Encasement: PennDOT Publication 408, Section 704, Type A, a 28-day compressive strength of 3,300 psi.

E Final Backfill:

1. Within PennDOT right-of-way and where shown on Drawings: 2RC Aggregate.

2. Within Township right-of-way or unpaved surfaces: 2RC or Select Backfill when approved by AUTHORITY.

F. Unsuitable Bearing Replacement: AASHTO No. 3 Coarse Aggregate conforming to PennDOT Publication 408, Section 703.2.

G. Underground Warning Tape: Required for all pipe.

1. Printed polyethylene tape, three inches minimum width, color coded, one inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.

2. Magnetic.

3. Provide for:

   a. Sewage force main – green

   b. Gravity sewer/lateral – green

   c. Water line/service - blue

PART 3- EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.

C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Maintain and protect above and below grade utilities which are to remain.

3.02 EXCAVATING

A. The DEVELOPER shall notify PA "One Call System" at (1-800-242-1776) in accordance with the regulations of Act 287, as amended, or latest revision. For those existing utilities on private property, contact the property owner and with their assistance locate the utilities on private property.

B. Perform sheeting and shoring according to OSHA Standards.

C. Perform soil erosion and sedimentation control work according to Erosion and Sedimentation Control Plan approved by Lancaster County Soil Conservation Office.

D. General:

1. Excavation shall be performed to the lines and grades indicated on the Drawings or directed by AUTHORITY.

2. Perform excavation and backfilling using machinery except where hand excavation and backfilling is required or is necessary to protect existing structures, utilities, or other private or public properties.

3. Begin excavation in trenches for sewer lines at the control point having the lower invert and proceed upward.

4. Saw cut existing pavement. Remove pavement according to Warwick Township requirements.

5. Remove rock to Subgrade at least twenty-five (25) feet in advance of pipe laying.

6. Do not interfere with 45 degree bearing splay of foundations.

7. Blasting, if approved, shall be in strict conformance with these specifications.

E. Stripping, Storing and Restoring Surface Items: The DEVELOPER shall remove all topsoil, paving, sub-paving, curbing, gutters, brick, paving block, granite curing, flagging or other similar materials, and grub and clear the surface over the area to be excavated. He shall properly store and preserve such materials that may be required for future use in restoring the surface. The DEVELOPER shall be responsible for any loss or damage to said materials because of careless removal or neglectful or wasteful storage, disposal, or use of the materials. Any excavated materials not required for backfill or restoration shall be disposed of by the DEVELOPER at a suitable disposal location.

F. Subgrade Preparation:

1. Do not excavate below depths indicated or specified except where unsuitable material is encountered at Subgrade.

2. Remove unsuitable material found below Subgrade to a depth determined by AUTHORITY and backfill with suitable material or as directed by AUTHORITY to required Subgrade.

3. Remove rocks or other hard matter protruding through trench bottom at Subgrade which could damage pipe or impede consistent backfilling or compaction. Backfill with AASHTO No. 8 Coarse Aggregate to required Subgrade. Compact in four (4) inch lifts.

4. Remove rock below Subgrade if shattered due to excessive drilling impact or splitting operations and in the opinion of AUTHORITY it is unfit for foundations. Backfill to Subgrade with Concrete or other material acceptable to AUTHORITY.

5. If more materials are removed from any trench than can be backfilled over the completed pipe or stored in the street, leaving space for traffic, the excess materials shall be removed and stored at a suitable site.

6. When directed by the AUTHORITY, the DEVELOPER shall furnish such other suitable materials as may be necessary to properly refill the trench.

7. The DEVELOPER shall restore all shrubbery, fences, poles or other property and surface structures, removed or disturbed as a part of the Work, to a condition equal to that before the Work began.

8. The AUTHORITY may mark certain trees, shrubs, or other items that are not to be disturbed or damaged. In the event such items are disturbed or damaged, they shall be replaced or compensated for at the DEVELOPER expense.

G. Excavated Material Storage:

1. Separate and stockpile in designated area, excavated materials suitable for use as backfill. Remove from the site, excess materials and excavated materials not suitable for backfill.

2. In no case shall excavated materials be stockpiled outside of the construction easements or the permanent right-of-way if construction easements are not in place.

3. In streets, roads and highways or in any other locations where working space is limited, remove the excavated materials from the first 100 feet of any opening, when required by AUTHORITY, as soon as such is excavated; store and return same for backfilling when required. In no case will DEVELOPER be allowed to cast excavated material beyond the curb or right-of-way lines or on sidewalks or lawns.

4. At all times keep excavated materials at least five (5) feet back from edge of trench to facilitate access.

H. Trench Width:

1. From Subgrade elevation to an elevation at least twelve (12) inches above the top of the outside barrel of the pipe, excavate trench banks to vertical lines and not less than the minimum nor more than the maximum widths specified in Table A. If sheeting is required, the Table A dimensions apply to the inside face of sheeting.

Table A	
Minimum Trench Width (Outside Diameter of Pipe at the Barrel Plus)	Maximum Trench Width (Outside Diameter of Pipe at the Barrel Plus)
12 inches	16 inches

2. From a point twelve (12) inches above at the top of the outside barrel of the pipe, maintain trench banks as follows:

   a. Vertical as possible for trenches in paved or unpaved roadways, with a maximum of forty (40) inches.

   b. In open areas, trenches may be sloped at angles required to make trench stand; however, in no case shall angle exceed one-half horizontal to one vertical.

   c. Top of trench shall not exceed limits of right-of-way or construction easement if such is in place.

   d. Maintain trenches such that there is no conflict with State or OSHA regulations.

I. Length of Open Trench:

1. Complete trench excavation at least twenty-five (25) feet but not more than one hundred (100) feet in advance of pipe laying and keep trenches free from obstructions, except that at the end of a work day or at the discontinuance of work, the pipe laying may be completed to within five (5) feet of the end of the open trench.

2. DEVELOPER shall limit all trench openings to a distance commensurate with all rules of safety.

3. If the work is stopped either totally or partially, DEVELOPER shall refill the trench and temporarily repave over the same. The trench shall not be opened until he is ready to proceed with the construction of the pipeline.

4. AUTHORITY reserves the right to request trench refilling over completed pipe if in AUTHORITY judgment such action is necessary.

3.03 PIPE BEDDING

A. Place Pipe Bedding and Initial Backfill as specified herein unless indicated otherwise on the Drawing. Place material in trench for full width. Place on each side of pipe and fittings simultaneously.

B. Pipe Bedding: Carefully place on undisturbed Subgrade or compacted Subgrade as approved by AUTHORITY, Pipe Bedding material from six (6) inches below outside of pipe barrel to pipe springline. Work Pipe Bedding material by hand under pipe haunching to provide adequate side support. Place in three (3) inch layers (uncompacted).

C. Initial Backfill: From pipe springline to twelve (12) inches above outside of pipe barrel carefully place Initial Backfill in four (4) inch layers (uncompacted). Place carefully so as not to disturb pipe.

D. Special Bedding:

1. Concrete Cradle and Concrete Encasement: If concrete cradle and/or encasement is indicated on the Drawings or required by the AUTHORITY, the trench shall be excavated to a depth of six inches below the outside of the barrel of pipes. All of this excavation may be done by machine.

2. Unstable Subgrade: Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type or refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the AUTHORITY, should be removed, the DEVELOPER shall excavate and remove such unsuitable material to the width and depth recommended by the AUTHORITY.

a. Before pipe is laid, the subgrade shall be made by backfilling with aggregate material, as directed by the AUTHORITY, in six inch (compacted thickness) layers thoroughly tamped and the bedding prepared as specified.

3.04 BACKFILL

A. Backfill trenches to contours and elevations indicated on the Drawing.

B. Maintain optimum moisture content of fill materials to attain required compaction density.

C. Do not use frozen backfill materials or place backfill on frozen subgrades or trench subgrades.

D. Perform backfilling by methods which will result in thorough compaction of backfill material.

E. Backfill to Final Restoration Elevation: Backfill from one (1) foot above the top of pipe to Final Restoration Elevation using backfill materials specified below. Consolidate backfill materials evenly from center to side of trench to prevent arching.

1. Within the Right-of-Way Limits of Existing State Highways: Backfill material as specified below unless stated otherwise in the approved PennDOT Highway Occupancy Permit.

   a. Paved Areas: Aggregate Backfill compacted in four inch layers to the bottom of the temporary or permanent paving.

   b. Unpaved Shoulders: Aggregate Backfill compacted in four inch layers to existing grade.

   c. Unpaved Areas: Aggregate Backfill compacted in four inch layers to bottom of topsoil. Replace topsoil to approximate depth of existing as final refill operation and crown to such height as required by AUTHORITY. Maintain crowned surface to the satisfaction of AUTHORITY, during the warranty period.

2. Existing and Proposed Township Roadways and Private Driveways: Aggregate Backfill compacted in four inch layers to bottom of temporary or permanent paving.

3. Unpaved Shoulders of Proposed and Existing Township Streets: Backfill compacted in six inch layers to a point 6 inches below the adjacent existing surface. Refill the remaining 6 inches with compacted Aggregate Backfill.

4. Unimproved Streets: Aggregate Backfill compacted in eight inch layers to within 6 inches of existing grade. Refill the remaining 6 inches with compacted PennDOT 2A Aggregate.

5. Stone Driveways: Backfill compacted in eight inch layers to within 6 inches of existing grade. Refill the remaining 6 inches with compacted PennDOT 2A Aggregate.

F. If there is a deficiency of backfill material, provide borrow material as required.

3.05 COMPACTION

A. Solidly tamp each layer of backfill around the pipeline and above pipeline using proper tamping tools made especially for this purpose. Compact each layer to the densities specified using ASTM D698 Standard Proctor Test Methods determined at maximum density at optimum moisture content as determined by AASHTO T 99.

1. Within the Right-of-Way limits of existing State Highways and Township Roadways.

a. Paved Areas: 100%

b. Unpaved Areas: 92% (Up to bottom elevation of final restoration material)

2. Other Areas

a. Paved Areas: 97%

b. Stone Driveways: 97%

c. Lawns, Fields: 92% (Up to bottom elevation of final restoration material)

B. Do not use rolling equipment or heavy tampers to consolidate backfill until at least two (2) feet of backfill is placed over the top of the pipe.

C. The use of HYDRA-HAMMER for compacting backfill in trenches is prohibited.

D. The use of puddling or jetting for compacting backfill in trenches is prohibited.

E. Compaction Tests: During the course of backfilling and compacting, AUTHORITY may at various locations and depths of trenches request that DEVELOPER make field tests to verify that specified compactions are being achieved. Perform field density tests according to AASHTO T 191.

F. If compaction tests indicate that Work does not meet specified requirements, remove Work, replace, compact and retest.

3.06 STREAM CROSSINGS

A. Excavate trenches in stream crossings to the depth shown on the Drawing or otherwise required by AUTHORITY.

B. Material excavated may be used as backfill unless specifically prohibited by any governing agency having jurisdiction.

C. Make all necessary provisions for cofferdaming, dewatering and removal of excess excavated material.

D. Maintain the flow in the stream at all times.

E. Where rock is encountered in the stream crossings, do not use forms to construct the concrete encasement; place concrete on firm rock below the pipe and against firm rock on both sides of the pipe to provide a firm bond between the encasement and the rock.

F. Install concrete encasement to a minimum of ten (10) feet back from the top edges of the stream banks.

G. Construct stream crossing according to drawings and permit(s) issued.

3.07 CLEAN-UP AND MAINTENANCE

A. General: During construction, the surfaces of all areas including, but not limited to, roads, streets, and driveways shall be maintained on a daily basis to produce a safe, desirable, and convenient condition. Streets shall be swept and flushed after backfilling, and recleaned as dust, mud, stones and debris caused by the Work, or related to the Work again accumulates.

B. Remove surplus excavated materials, rubbish and other construction debris from the site after backfilling is completed.

C. Construction site shall be left clean at end of each working day to satisfaction of AUTHORITY.

END OF SECTION

SECTION 3 - BORING AND JACKING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Construction of bored or jacked crossings.

1.02 RELATED WORK

A. Section 4 - Pipe and Fittings

1.03 REFERENCES

A. American Society for Testing and Materials:

1. ASTM A53, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

2. ASTM A 153; Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. Commonwealth of Pennsylvania Department of Transportation (PennDOT)

1. Publication 408 - Specifications

a. PDT Section 703 Aggregates.

C. State Code: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67. Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities, as supplemented or revised (PennDOT Chapter 459).

D. State Publication: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 212, Official Traffic Control Devices (PennDOT Chapter 213).

1.04 REGULATORY AGENCY REQUIREMENTS

A. DEVELOPER shall be responsible for complying with requirements of owner of crossing or right-of-way or entity having jurisdiction. Work shall not commence until the proper notice to proceed has been issued by said owner or entity.

B. DEVELOPER shall be responsible for making application and obtaining all permits required to complete work from owner of crossing or right-of-way or entity having jurisdiction. DEVELOPER shall contact AUTHORITY for additional requirements if permit is required to be in the AUTHORITY's name.

C. Work performed within PennDOT rights-of-ways shall comply with Pennsylvania Code, Title 67, Chapter 459 - Occupancy of Highways by Utilities and PADOT Publication 408.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Transport, handle and store materials and Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects.

1.06 PROJECT CONDITIONS

A. DEVELOPER shall keep boring pits dewatered at all times. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site. When dewatering, close observation shall be maintained to detect any settlement or displacement of roadway embankment.

PART 2 - PRODUCTS

2.01 STEEL CASING PIPE

A. Unless required otherwise by owner of crossing or right-of-way or by entity having jurisdiction, the following specifications shall be adhered to:

B. Steel Pipe: ASTM A 53, or ASTM A139, Grade B.

1. 35,000 psi minimum yield strength.

2. Full circumference welded joints.

3. Asphalt coated.

4. Minimum Wall Thickness: 0.50 inch

5. Select casing pipe diameter to accommodate casing pipe joints, runners, and allowance for adequate installation space. Casing pipe diameter shall be no less than twice the diameter of the carrier pipe, unless otherwise approved by the AUTHORITY.

6. DEVELOPER's ENGINEER is responsible for proper sizing of the casing pipe to house carrier pipe and to withstand loading demands.

2.02 CARRIER PIPE AND FITTINGS

A. As specified in Section 4 - Pipe and Fittings unless required otherwise by owner of crossing or right-of-way or by entity having jurisdiction.

2.03 MISCELLANEOUS MATERIALS

A. Casing Spacers: Use casing spacers to center and support carrier pipe inside casing pipe. Provide spacers by Cascade Waterworks Mfg. Co. Model CCS.

1. Shell: 2- piece bolt on style, stainless steel, 14 gauge minimum thickness.

2. Liner: Shell shall be lined with a ribbed PVC extrusion with retaining section that overlaps the edge of the shell and prevents slippage.

3. Runners: Ultra high molecular weight (UHMW) polymer and shall be attached to risers. Runners shall have low coefficient of friction, high resistance to abrasion and sliding wear and low deflection under compression.

4. Hardware: 304 stainless steel.

B End Seals: Provide end seals to wrap around casing and carrier pipes following installation to provide barrier to backfill and seepage. Seals shall be fabricated of 1/8" thick minimum synthetic rubber. Secure end seals to casing using 304 stainless steel straps with worm mechanism for tightening. End seals shall be by Cascade Waterworks Mfg. Co. Model CCES.

C. Grout (Sand/Cement):

1. Portland Cement: ASTM C 150 Type II.

2. Sand: ASTM C 33, fine aggregate.

3. Water: Potable.

4. Grout Quality: Mixture of one part Portland Cement, three parts fine aggregate and water.

D. Sand: ASTM C 33, fine aggregate.

PART 3 - EXECUTION

3.01 PREPARATION

A. Trenching: Excavate approach cased crossings, pits and trenches using methods specified in Section 2 – Trenching, Backfilling and Compaction.

B. Brace and shore trenches to comply with OSHA requirements.

3.02 BORING

A. Push the pipe into the fill with a boring auger rotating within the pipe to remove the spoil. When augers, or similar devices are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The auger and cutting head arrangements shall be removable from within the pipe in the event an obstruction is encountered.

B. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one-half inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.

C. The use of water or other liquids to facilitate casing emplacement and soil removal is prohibited.

D. Any method which employs simultaneous boring and jacking or drilling and jacking for pipes over 8 inches in diameter which does not have the above approved arrangement will not be permitted. For pipes 8 inches and less in diameter, augering or boring without this arrangement may be considered for use only as approved by AUTHORITY.

3.03 JACKING

A. Jacking shall be conducted without handmining ahead of the pipe and without the use of any type of boring, augering, or drilling equipment.

B. Bracing and backstops shall be so designed and jacks of sufficient rating used so that the jacking can be progressed without stoppage except for adding lengths of pipe.

C. Accurately place guide timbers on line and grade.

D. The vertical face of the excavation shall be supported as necessary to prevent sloughing.

E. Use poling boards and bulkheads as required if subgrade conditions in the heading are unstable.

F. Jacking and excavation within the pipe shall proceed simultaneously with the ground being cut no more than 2 inch above subgrade at the bottom.

G. The use of water or other liquids to facilitate casing placement and spoil removal is prohibited.

H. If voids develop or if jacked hole diameter is more than 1 inch greater than the outside diameter of the encasing conduit place grout to fill voids in manner approved by the regulatory agencies.

I. Check conduit alignment in a manner and at times required by AUTHORITY. Check alignment and grade at least once per shift as the work progresses.

J. Completely bulkhead heading at interruptions in jacking operation.

K. Completely weld joints around the circumference between sections of steel pipe encasing.

3.04 INSTALLATION AND TESTING OF CARRIER PIPE

A. Install carrier pipe one pipe length at a time. Push carrier pipe through steel casing pipe using casing spacers.

B. Assemble pipe joints with retainer glands or restrained joint before pushing.

C. Test carrier pipe as specified in Section 4 – Pipe and Fittings.

3.05 CLOSING CASING PIPE

A. After the pipe has been installed in the casing and has been tested, close both ends with rubberized end seals.

B. The casing end seals shall be properly installed to form a watertight seal between the casing pipe and carrier pipe.

END OF SECTION

SECTION 4 - PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewer pipe, force mains, fittings and related appurtenances.

B. Water system pipe, fittings and related appurtenances.

1.02 RELATED SECTIONS

A. Section 2 – Trenching, Backfilling and Compaction

B. Section 3 – Boring and Jacking

C. Section 5 – Manholes

D. Section 6 – Disinfection of Water Facilities

E. Section 7 – Cast-In-Place Concrete

1.03 REFERENCES

A. American National Standards Institute:

1. ANSI A 21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.

2. ANSI A 21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.

3. ANSI A 21.50, Thickness Design of Ductile-Iron Pipe.

4. ANSI A 21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.

B. American Society for Testing and Materials:

1. ASTM A 307 Carbon Steel Externally and Internally Threaded Fasteners.

2. ASTM D 1784, Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds.

3. ASTM D 1785, Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80 and 120.

4. ASTM D 2467, Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

5. ASTM D 2564, Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

6. ASTM D 3034, Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

7. ASTM D 3212, Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

8. ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

9. ASTM F 789, Type PS-46 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings.

10. ASTM D 2321, Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

C. American Water Works Association:

1. AWWA C104, Cement-Mortar Lining for Ductile Iron and Gray-Iron Pipe and Fittings for Water.

2. AWWA C110, Gray-Iron and Ductile-Iron Fittings, 3 inch through 48 inch, for Water and Other Liquids.

3. AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

4. AWWA C150, Thickness Design of Ductile-Iron Pipe.

5. AWWA C151, Ductile-Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.

6. AWWA C153, Ductile-Iron Compact Fittings, 3 inch through 24 inch and 54 inch through 64 inch.

7. AWWA C600, Installation of Ductile Iron Water Mains and their Appurtenances.

1.04 SUBMITTALS

A. Make submissions required by Section 1- Construction Submittals.

1.05 QUALITY ASSURANCE

A. Design Criteria:

1. Use only one type and class of pipe in any continuous line of sewer between structures, unless otherwise indicated on the Drawings.

2. Use pipe and fittings designed to withstand imposed trench loadings and conditions at the various locations.

B. Laboratory Tests:

1. The AUTHORITY reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish without compensation, labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Transport, handle and store pipe materials and other Products specified herein in a manner recommended by the respective manufacturers to prevent damage and defects.

1.07 SITE CONDITIONS

A. Environmental Requirements:

1. Keep trenches dewatered until pipe joints have been made and concrete cradle and encasement, if any, have cured.

2. Under no circumstances lay pipe in water or on bedding containing frost.

3. Do not lay pipe when weather conditions are unsuitable, as determined by AUTHORITY, for pipe laying work.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Size:

1. All pipe diameters referenced or noted shall be inside diameters.

2. All water lines shall have a minimum diameter of 8 inches. Size shall be based on hydraulic design requirements.

B. Ductile Iron (DIP): TO BE APPROVED AND INSERTED:

1. Manufacturers:

a. Griffin Pipe Products

b. Clow

c. U.S. Pipe

2. Pipe: ANSI/AWWA C151/A21.51.

3. Wall Thickness Class: AWWA C150, Class 52 for buried pipe and Class 53 for flanged pipe. Class designation shall be stamped on pipe.

4. Fittings: Ductile iron, ANSI/AWWA C153/A21.53 and ANSI/AWWA C110/A21.10. Mechanical joints shall conform to ANSI/AWWA C111/A21.11. Working pressure rated at 350 psi.

5. Joints:

   a. Buried Joints:

      1. Push-on: ANSI/AWWA C111/A21.11.

      2. Restraint push-on gasket AWWA C110 or C153 (depending on pipe size).

      3. Mechanical: ANSI/AWWA C111/A21.11.

   b. Exposed/Interior Joints:

      1. Flanged: ANSI A21.15 with ANSI B16.21 1/16 inch thick cloth insertion rubber face gaskets. ANSI B18.2 nuts and bolts.

6. Pipe Lining: Ductile Iron pipe and fittings shall be coated inside in accordance with the following:

   a. Sanitary Sewage Pipe and Fittings: Lining shall be Sewper Coat as manufactured by Lafarge Calcium Aluminates or equal and shall meet all quality requirements of ANSI C104 and AWWA A21.4. Lining thickness though 12-inch, shall not be less than 0.125 inches and over 12 inches shall not be less than 0.1875 inches and seal coated per ANSI/AWWA C104/A21.4

   b. Water Pipe and Fittings: Lining shall be double coated cement mortar with a minimum thickness of 0.125 inches and seal coated per ANSI/AWWA C104/A21.4

7. Pipe and Fittings Coating: ANSI/AWWA C151/A21.51, factory coated inside and out with bituminous paint, minimum 1 mil dry thickness.

8. Pipe shall be furnished in 18-feet or 20-feet lengths except when smaller lengths are required for the location of valves, fittings and/or specialties.

C. Polyvinyl Chloride Pipe (PVC) - SDR 35:

1. Manufacturers:

   a. J. M. Manufacturing Co.

   b. Extrusion Technologies, Inc.

c. Carlon

2. Pipe: Type PSM SDR-35, ASTM D 3034 (4"-15"), or Type PS-46, ASTM F 789 (4"-18").

3. Fittings: Conforming to same applicable ASTM Specification requirements for pipe.

4. Joints: ASTM D3212 push-on joint with ASTM F477 elastomeric gasket. Gasket shall be locked in groove of bell to prevent displacement when pipes are joined.

D. POLYVINYL CHLORIDE PIPE (PVC) – SDR21 FOR LOW PRESSURE SEWERS

1. Manufacturers:

a. J.M. Manufacturing Co.

b. Extrusion Technologies, Inc.

c. Carlon

d. Or equal

2. Pipe: SDR21 PVC Pipe for 10" or smaller.

3. Thrust blocks and anchors at every direction change, in accordance with manufacturer directions.

2.02 WATER SERVICE LINES AND APPURTENANCES

As of January 1, 2011, all water service lines shall be a minimum of 1 inch in diameter.

A. Polyethylene Pipe (PE):

1. Manufacturer: Polystar

2 AWWA C901, SDR 9, copper tube size made of PE 3408 type resin conforming to ASTM D 2737, NSF certified.

3. Pressure Rating: 200 psi minimum.

4. Fittings: Compression type equivalent to Mueller Insta-tite or 110 Series or Ford Pack-Joint.

B. Copper Pipe:

1. ASTM B88, Type K copper tubing.

2. Fittings: ANSI B16.26 compression type equivalent to Mueller Insta-tite or 110 Series or Ford Pack-Joint

C. Corporation Stops:

1. Manufacturers:

a. Ford Meter Box Co., Model No. F 1000

b. Mueller Company, H15008

2. AWWA C800, 300 psig working pressure, ball valve, bronze body, double-stem o-rings, AWWA threaded inlet connections, compression style or Insta-tite outlet connections suitable for pipe or tubing used.

D. Curb Stops:

1. Manufacturers:

a. Ford Meter Box Co., B44-333

b. Mueller Company, B25209

2. AWWA C800, 300 psig working pressure, ball valve, bronze body and tee head, double-stem o-rings, compression style inlet and outlet connections suitable for pipe or tubing used.

E. Curb Boxes:

1. Manufacturers:

a. Bingham & Taylor Fig. No. 4901

b. Tyler, Series 6500, 93E (24T and 33B)

2. Cast iron construction, adjustable, two (2) piece screw type, 2 1/2 inch shaft with inlaid cover and bolt down lid marked "WATER". Length of box and base shall be as required for the actual field conditions encountered. Interior and exterior of boxes shall be hot bituminous coated.

F. Service Saddles:

1. Manufacturers:

a. Ford Meter Box Company, Style 202B

b. Mueller Company, DR2S

2. Double strap type suitable for use on new or existing water main material, self sealing gaskets rated for minimum 250 psig working pressure, type 304 stainless steel or ASTM A 536 ductile iron saddle with type 304 stainless steel.

G. Stainless steel inserts for SDR9 pipe: To be used in the compression fitting to prevent crimping.

H. Meter Pits:

As of January 1, 2011, all water service lines shall be a minimum of 1 inch in diameter.

1. ¾ inch Service Line:

   a. For ¾ inch service lines, the meter pit shall be a bottomless, single meter thermal-coil meter box as manufactured by Mueller, Ford or approved equal.

   b. The meter box shall be constructed of rigid PVC material and include the following:

      1. Insulation pads
      2. Polybutylene coil tubing
      3. Diameter – 18 inches
      4. Depth – 48 inches
      5. Meter Inlet – lockwing angle meter stop
      6. Meter Outlet – Dual check valve
      7. Lid – Non-locking, lid to accept meter reader

2. 1 inch Service Line:

   a. For 1 inch service lines, the meter pit shall be a bottomless, single meter thermal-coil meter box as manufactured by Mueller, Ford or approved equal.

   b. The meter box shall be constructed of rigid PVC material and include the following:

      1. Insulation pads
      2. Polybutylene coil tubing
      3. Diameter – 20 inches
      4. Depth – 48 inches
      5. Meter Inlet – lockwing angle meter stop
      6. Meter Outlet – Dual check valve
      7. Lid – Non-locking, lid to accept meter reader

3. 1 ½ and 2 inch Service Lines:

   a. For 1 ½ and 2 inch service lines, the meter pit shall be a bottomless, single meter box as manufactured by Mueller, Ford or approved equal.

   b. The meter box shall be constructed of rigid PVC material with appropriate brackets for the meter, valving and service line and include the following:

1. Insulation pads
2. Diameter – 27 inches
3. Depth – 48 inches
4. Meter Inlet – Flanged lockwing angle ball valve (full port)
5. Meter Outlet – Flanged lockwing angle ball valve (full port)
6. Lid Frame
7. Lid – Flat Lid, non-locking, lid to accept meter reader.

2.03 VALVES AND APPURTENANCES

A. Plug Valves (4 inches and larger):

1. Manufacturers:

a. DeZurik, Series 100

b. Clow

2. General: Non lubricated eccentric type valves with resilient faced plugs rated for 175 psi working pressure. End connections shall be ANSI 125/150 lb standard.

3. Valve Body: ASTM A 126 Class B cast iron with 1/8 inch welded overlay seat of not less than 90% nickel. Seat area shall be raised with raised surface completely covered with weld to insure that plug face contacts only nickel.

4. Plug: ASTM A 126 Class B cast iron resilient faced with neoprene or hycar, suitable for use with sewage. The interference between plug face and body seat, with plug in closed position, shall be externally adjustable in the field with the valve in-line under pressure.

5. Valve Shaft Seals: Multiple V-ring type, externally adjustable and repackable without removing bonnet or actuator from valve while under pressure.

6. Furnish buried valves with 2-inch square operating nut and tee handle of sufficient length to properly operate valve.

B. Gate Valves:

1. Manufacturers:

a. American Flow Control, Series 500.

b. Mueller.

c. U. S. Pipe and Foundry Company.

2. General: AWWA C 509 resilient seat wedge type designed for 150 psi operating pressure.

a. Buried: Non-rising stem.

b. Interior: Outside stem and yoke.

3. Valve Body: ASTM A 126, Class B cast iron.

4. Resilient Wedge: ASTM A 536 ductile iron created with nitrite rubber.

5. Stem: ASTM B 763 bronze with two (2) upper and one (1) lower nitrite rubber O-ring seals.

6. End Connections:

a. Buried service: Mechanical joint.

b. Interior: ANSI 125/150 lb. flanged.

7. Provide square operating nut and valve box for buried service.

8. Interior and Exterior Coating: AWWA C 550 fusion bonded epoxy coating, 8 mils minimum.

C. Air Release Valves:

1. Manufacturer: Cla-Val, or otherwise approved by AUTHORITY.

2. Use valves of appropriate size at high points vent air which may accumulate. Valve shall be designed for 150 psig working pressure.

3. Construction: Cast iron body and cover, stainless steel floats and parts.

D. Pressure Reducing Valves:

1. Manufacturer: Golden Anderson, Model 4500

E. Valve Boxes:

1. Manufacturers:

a. Tyler Pipe, 6850 series

b. Bingham & Taylor, Figure No. 4905

2. All valves buried in the ground shall be provided with cast iron valve boxes of the Two Piece or Buffalo Type. The valve boxes shall have an adjustable two section screw-type telescoping column and a separate base. The valve box column shall have an inside diameter of 5.25 inches. Valve boxes shall be furnished with a cover. Mark covers to read "SEWER" or "WATER" as appropriate. The valve boxes shall be hot coated inside and out with a tar or asphalt compound. For deep installations, provide screw-type extensions as

required, designed for use with the valve box furnished. Set top of stem between 1 – 2 feet below grade.

2.04 PIPE COUPLINGS

A. Flexible Pipe Coupling (for gravity sewers only):

1. Manufacturers:

a. Fernco Joint Sealer Company

b. Indiana Seal Company

2. Clamped design with virgin PVC coupling and two (2) type 305 stainless steel bands.

B. Steel Pipe Couplings (for pressure sewers):

1. Manufacturers:

a. Dresser, Style 38

b. Smith-Blair, Style 411

2. Coupling shall consist of a middle ring, two (2) follower rings, two (2) gaskets and a sufficient number of bolts and nuts.

a. Middle Ring: ASTM A513 or ASTM A635 steel.

b. Followers: AISI C1012 or ASME SA 36.

c. Gasket: Resilient wedge-shaped suitable for use with raw sewage and sludge.

d. Bolts: AWWA C111/ANSI A21.11.

2.05 SADDLES

A. Romac Style CB Sewer Saddle.

2.06 THRUST RESTRAINT

A. DEVELOPER has option of either of the means specified below. Length of restraint specified by AUTHORITY.

1. Concrete Thrust Blocks and Tie Rods: Details as shown on drawings. Concrete shall be as specified in Section 8 - Cast-In-Place Concrete, 3,000 psi compressive strength (at 28 days). Tie rods shall be constructed of suitable metal. Metal harness of tie rods shall be galvanized or otherwise rust proofed and shall be painted with bituminous coating after installation.

2. Megalug Retainer Glands: Mechanical joint restraint consisting of follower gland which when actuated imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. ASTM A 536-80 ductile iron follower gland of dimensions such that it can be used with AWWA C153 mechanical joints. Restraining devices shall be of ductile iron, heat treated to a minimum hardness of 370 BHN. Twist-off nuts shall be used to insure proper actuating of the restraint device. Restraint device shall have a 250 psi minimum working pressure with 2:1 minimum safety factor. Megalug retainer gland equivalent to EBAA Iron, Inc.

2.07 FIRE HYDRANTS

A. Manufacturers:

1. American Flow Control, American-Darling Model B-62-B.

B. General: AWWA C502, compression type (opening against the pressure/closing with pressure), traffic type with breakable safety flange and stem couplings.

C. Construction: Cast iron or ductile iron body, cast iron base, bronze operating nut, steel operating rod, bronze hose and steamer nozzles with cast iron caps secured to barrel, and bronze drain system.

D. Rated Working Pressure: 200 psig.

E. Inlet Connection: 6-inch, mechanical joint unless noted otherwise on Drawings.

F. Nozzle Sizes:

1. Hose: Two (2) - 2-1/2 inch.

2. Steamer: One (1) 4-1/2 inch.

G. Color: Red

H. Threads: Threads shall be in accordance with National Standard Threads.

I. Marker: Metal fire hydrant marker with spring at mounting bracket.

2.08 PIPING SPECIALTIES AND APPURTENANCES

A. Tapping Sleeve and Valve Assemblies:

1. Manufacturers:

a. Mueller Company

b. American Flow Control.

c. U. S. Pipe and Foundry Company.

2. Tapping Sleeve:

   a. General: ASTM A 126, Grade B ductile iron (4" - 12") or ASTM A 526 ductile iron (14" and larger), mechanical joint end connection with ANSI/ AWWA C 111/A21.11 nuts and bolts. Outlet end connection shall be ANSI 125/150 lb. flanged for mating to tapping valve.

   b. Exterior Coating: Fed. Spec. TT-V-51 or Military Spec. MIL C-450 asphaltic varnish or equal.

3. Tapping Valves:

   a. General: AWWA C 509 resilient seat wedge type gate valve as specified herein in this Section under Gate Valves except valve shall be modified for passage and clearance of tapping machine cutlers.

   b. Mating Flange: Flange shall have a raised male face to ensure true alignment of valve and tapping machine.

   c. Outlet End Connection: Mechanical joint with ANSI/AWWA C 111/A21.11 nuts and bolts for buried service.

B. Steel Pipe Couplings:

1. Manufacturers:

   a. Smith-Blair, Style 411

   b. Dresser, Style 38

2. Coupling shall consist of a sleeve, two (2) follower rings, two (2) gaskets and a sufficient number of bolts and nuts.

   a. Sleeve: ASTM A53 or ASTM A512 or carbon steel.

   b. Followers: ASTM A47 malleable iron.

   c. Gasket: Grade 30 rubber.

   d. Bolts: AWWA C111/ANSI A21.11.

C. Flanged Adapters:

1. Manufacturers:

   a. Smith-Blair, Style 912

   b. Dresser, Style 127

2. General: Use to connect plain end pipe to flanged equipment. Coupling shall consist of iron body, a follower ring, a gasket and o-ring, and a sufficient number of bolts and nuts.

   a. Body: ASTM A126 Class B gray iron or ASTM A47 malleable iron. ANSI 150 lb. flange drilling bolt circle, bolt size and spacing.

   b. Follower: ASTM A47 malleable iron or ASTM A536 ductile iron.

   c. Bolts: AWWA C111/ANSI A21.11.

   d. Gasket: Grade 30 rubber

   e. O-ring: Grade 60 rubber

D. Repair Sleeve:

   1. Manufacturer: Mueller Company Model H-785

E. Casing Pipe (for bored crossings):

   1. Casing Pipe: ASTM A53 seamless steel, full circumference welded joints and of diameter as shown on Drawings unless required otherwise by governing agency having authoritative jurisdiction.

   2. Casing Spacers: Use casing spacers to center and support carrier pipe inside casing pipe. Provide spacers by Cascade Waterworks Mfg. Co. Model CCS or equal.

      a. Shell: 2- piece bolt on style, stainless steel, 14 gauge minimum thickness.

      b. Liner: Shell shall be lined with a ribbed PVC extrusion with retaining section that overlaps the edge of the shell and prevents slippage.

      c. Runners: Ultra high molecular weight (UHMW) polymer and shall be attached to risers. Runners shall have low coefficient of friction, high resistance to abrasion and sliding wear and low deflection under compression.

      d. Hardware: T 304 stainless steel.

   3. End Seals: Provide end seals to wrap around casing and carrier pipes following installation to provide barrier to backfill and seepage. Seals shall be fabricated of 1/8" thick minimum synthetic rubber. Secure end seals to casing using 304 stainless steel straps with worm mechanism for tightening. End seals shall be by Cascade Waterworks Mfg. Co. Model CCES.

F. Sewer Vent and Cleanout Protection:

1. Unit shall have a cast iron body and Lid suitable for traffic loadings similar to a "Stratton box".

2. Dimensions:

a. Length – 10 ½ inches (minimum)

b. Diameter – 5 ¼ inches (minimum)

3. Shaft shall have continuous extension on the bottom circumference.

4. Lid shall have the word "SEWER" cast on the top.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Carefully examine each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.

B. Remove rejected pipe from the Project.

3.02 PREPARATION

A. Clean piping interior and mating surfaces of bell, spigot and gasket before laying. Maintain clean until completed work is accepted.

B. Touch-up chipped, cracked, or abraded surfaces and finished joints with two coats of the particular coating material.

C. Perform trenching for sewer pipe and place pipe bedding as specified in Section 2 - Trenching, Backfilling and Compacting.

D. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.

E. Excavate trenches in rock at least twenty-five (25) feet in advance of pipe laying. Protect pipe ends if blasting is allowed.

3.03 LAYING PIPE

A. General Requirements:

1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade.

2. Bed pipe using materials specified in Section 2 – Trenching, Backfilling and Compaction. Gravity sewer pipe bedding must conform to AASHO T-99 to a density of 90% proctor.

3. Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipe line.

4. Center spigot end in bell or socket end of previously laid pipe, shove tight and secure.

5. No wedging or blocking permitted in laying pipe unless by written permission of AUTHORITY.

6. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.

7. Walking or working on completed pipe line, except as necessary in tamping and backfilling, not permitted until trench is backfilled one-foot deep over top of pipes.

8. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.

9. Take up and replace with new, such in-place pipe sections found to be defective.

10. Take necessary precautions to prevent newly laid pipe from floating as a result water accumulation in the trench; or the collapse of the pipe line from any cause. Restore or replace pipe as necessary.

11. At the close of each day's work, and at such other times when pipe is not being laid, protect open end of pipe with a tight fitting stopper.

12. Cut pipe using only equipment specifically designed for that purpose such as an abrasive wheel, rotary wheel cutter, a guillotine pipe saw or a milling wheel saw. The use of chisels or hand saws will not be permitted. Grind smooth cut ends and rough edges. Bevel slightly, cut end for push-on connections.

13. Where cutting of pipe is necessary, minimum laying length shall be five (5) feet.

B. Specific Requirements:

1. Install ductile iron pipe, and fittings, and assemble joints according to AWWA C600.

2. Install PVC pipe and fittings, and assemble joints according to ASTM D2855.

C. Meter Pits:

1. All service lines extending 100 feet or more will require the use of a meter pit and continuous piping of the same material as utilized for the service line leading from the main.

D. Joints:

1. Make pipe and fitting joints according to pipe manufacturer's specifications and to specifications previously specified for pipe.

2. Make joints watertight. Immediately repair detected leaks and defects. Methods of repair subject to AUTHORITY approval.

E. Alignment and Grade:

1. Lay and maintain all pipe at the required lines and grades as shown on the Drawings. Place fittings and valves at the required locations with joints centered, spigots forced home, and all valve stems plumb. Do not deviate from the required line and grade, except with the approval of AUTHORITY.

2. Deflect pipe joints where indicated on the drawings. Deflections shall not exceed pipe manufacturer's recommended maximum allowable deflection.

3. Do not change grade or alignment without AUTHORITY approval.

F. Drop Connections: Make drop connections where indicated on the Drawings, where drop in invert is two feet or more or as required by AUTHORITY. Construct drop connection using the same pipe material used to construct the main. Construct drop connection in accordance with design shown on Standards Detail Drawings.

G. Connections to Existing Manholes or Structures: As specified in Section 5 - Manholes.

3.04 THRUST RESTRAINTS

A. General: Provide thrust restraint at all plugs, caps, tees, and bends (both horizontal and vertical) on pipe lines 4 inches and larger.

B. Concrete Reaction Backing: Place concrete reaction backing between undisturbed solid ground and the fitting to be anchored. The backing unless otherwise shown or directed, shall be located as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair.

C. Install megalug retainer gland according to manufacturer's instructions.

D. Temporary Thrust Restraint: Provide temporary thrust restraint at temporary caps or plugs. Submit details of temporary restraint to AUTHORITY for approval.

3.05 EMERGENCY REPAIRS

A. CONTRACTOR shall be responsible for utilizing great care and superior judgment when working on and around AUTHORITY system(s). CONTRACTOR shall provide emergency repair service (at no cost to AUTHORITY) when a main break or leak results from CONTRACTOR's actions. Emergency repair could include isolation of the affected main, excavation, clamping, possible disinfection, site restoration and other actions necessary to restore satisfactory service to the customers. CONTRACTOR shall notify AUTHORITY immediately when incidents and/or accidents occur that adversely affect service to AUTHORITY's customers. AUTHORITY shall provide guidance towards resolving such situations, including approval of the emergency work and approval of any emergency main appurtenances, including but not limited to, repair saddles and clamps.

3.06 FIELD QUALITY CONTROL

A. General Requirements: Conduct tests specified herein so that each pipe line installed in the Project is tested to AUTHORITY satisfaction.

1. Provide tools, materials (including water), apparatus and instruments necessary for pipe line testing. AUTHORITY will require payment for water used. Procedures for water usage must be approved by AUTHORITY in writing.

2. Conduct tests in the presence of and to the satisfaction of AUTHORITY.

3.07 GRAVITY LINE TESTS

A. Alignment: After the sewer mains have been laid and backfilled, a light will be flashed between manholes or manhole locations to determine whether the alignment of the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. This test will again be conducted before final acceptance of the sewer. Each section (manhole to manhole) of sewer shall show a good light circle throughout its length and any and all defects shall be corrected by DEVELOPER, to the satisfaction of AUTHORITY, before the work shall proceed and before acceptance of and/or payment therefore shall be made.

B. Leakage Tests:

1. Air Testing: DEVELOPER shall test each section of sewer between manholes and all laterals to the limit of this contract using low pressure air. Testing shall not be performed, until all backfilling has been completed. DEVELOPER may, at his option, test the section of sewer for his own purposes, prior to completion of backfilling; however, the requirements of this subsection shall not be deemed to be completed until the lines have been tested after the backfilling has been completed and trench settlement has been minimized.

2. A minimum of two minutes shall be provided to allow equilibrium of the air temperature with pipe wall before test readings shall commence. The rate of air loss shall be determined by measuring the time interval required for the average internal pressure to decrease by 1.0 psig.

3. The initial test pressure to be developed in the sewer and laterals shall be determined as follows:

   a. For depths six (6) feet or less, the internal pressure shall not be less than 6.0 psig.

   b. For depths greater than six (6) feet, the internal pressure in psig shall be calculated as the sum of 3.5 plus the maximum height in feet divided by 2.3 between the invert of the sewer and the existing ground surface in the section of sewer to be tested. (For example, if the maximum height is determined to be 9.2 feet, the added pressure would be 4.0 psig. The initial test pressure in the sewer would then be 7.5 psig. The allowable drop would be to 6.5 psig within the time indicated elsewhere in this Section.)

   c. In no case shall the test pressure in the sewers or laterals be greater than the maximum internal differential joint pressure recommended by the manufacturer of the pipe.

4. The pipe shall be considered acceptable if the air loss rate does not exceed 0.0030 cubic feet per minute per square foot of internal pipe surface when tested at the initial pressure previously defined in this subsection. The time for the air pressure to decrease 1.0 psig shall not be less than the time indicated in the following table:

Pipe Diameter	Minutes	Seconds
6"	2	55
8"	3	57
10"	4	43
12"	5	5
15"	7	5

5. If the above rates of leakage are exceeded, DEVELOPER shall determine source of leakage and make all necessary corrections and retest.

6. DEVELOPER shall submit to AUTHORITY for approval the detailed test procedure and list of test equipment he proposes to use prior to testing.

C. Infiltration Test:

1. Use only when gravity pipeline is submerged in groundwater. Obtain prior approval of the AUTHORITY.

2. Maximum Allowable Infiltration: 100 gallons per inch of pipe diameter per mile per day for any one section under test, including the allowances for leakage from manholes.

D. Infiltration:

1. After the air testing has been completed by DEVELOPER, regardless of any indications of the test results made by AUTHORITY, AUTHORITY reserves the right to perform field investigations, prior to final written acceptance of each sewer run by AUTHORITY and/or during the maintenance period required to establish the leakage of groundwater into the sewer and laterals constructed.

2. Should the leakage exceed 100 gallons per day per inch diameter per mile of pipe for any section, DEVELOPER shall, at the direction of AUTHORITY, perform any additional testing or corrective work required to reduce the infiltration in each manhole run from those lines installed by DEVELOPER to less than 100 gallons per day per inch diameter per mile of pipe. This leakage applies to each manhole run separately and should not be construed to mean total leakage in the total system. The scope of this corrective work shall include, but not be limited to, cleaning, televising and testing the sewer and laterals to the limits installed by DEVELOPER, to include testing and grouting of joints, excavation and replacement of faulty or damaged portions of the work, and all final restoration.

3.08 PRESSURE LINE TESTING

A. Alignment Test for Pressure Lines:

1. Prior to backfilling of pressure lines, the joint alignment shall be inspected to assure the maximum deflection present in each joint does not exceed the manufacturer's recommendations.

2. Pressure lines which are a portion of a pump discharge system shall be inspected to assure the line is installed at a constant or increasing grade so as to eliminate the possibility for air accumulation at an intermediate high point.

3. Any and all defects shall be corrected by DEVELOPER to the satisfaction of AUTHORITY prior to backfilling. This shall be completed before the work shall proceed and before acceptance.

B. Leakage Test Requirements:

1. After the pipe has been installed as specified, all newly laid pipe, or any valved section thereof, shall be subjected to a pressure of 150 pounds per square inch, or 50% in excess of the normal working pressure, whichever is greater.

2. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

3. No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula,

$$L = \frac{ND\ (P)\ 1/2}{7400}$$

in which "L" equals the allowable leakage in gallons per hour; "N" is the number of joints in the length of pipelines tested; "D" is the nominal diameter of the pipe, in inches, and "P" is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 11.6 gallons per 24 hours per mile of pipe per inch nominal diameter, for pipe in 18' lengths evaluated on a pressure basis of 150 psi.)

C. Duration of Test: The duration of the test under pressure shall be two hours.

D. Procedure: Each valved section shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to AUTHORITY. The pump, pipe connections, and all necessary apparatus, including gauges, shall be furnished by DEVELOPER. DEVELOPER will make all taps into the pipe, and furnish all necessary assistance for conducting the tests.

E. Expelling Air Before Test: Before applying the specified test pressure, all air shall be expelled from the pipe. If hydrants or blowoffs are not available at high places, DEVELOPER shall make the necessary taps at points of highest elevation before the test is made and insert the plugs after the test has been completed.

F. Variation from Permissible Leakage: Should any test of pipe laid disclose leakage greater than that specified above, DEVELOPER shall, locate, repair and replace the defective joints, pipe or fittings until the leakage is within the specified allowance.

G. Time for Making Test:

1. Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.

2. AUTHORITY shall be present during the operating of valves required to fill mains for pressure and leakage test.

3. DEVELOPER shall advise AUTHORITY of any pressure test and leakage test at least 48 hours in advance. No testing will be authorized unless air temperature is 35°F or higher.

4. The pressure and leakage tests shall be witnessed by AUTHORITY.

5. DEVELOPER shall furnish laboratory calibrated test gauges and measuring devices for the leakage test.

6. The section under test shall be brought back to test pressure at one-half hour intervals during the testing. AUTHORITY will record both the makeup water amount and pressure at each one-half hour repressurization.

H. The waterline section to be pressure tested shall not be more than 1,000 feet in length unless approved by AUTHORITY.

3.09 ACCEPTANCE: Observation of successful testing of manholes, sewers, force mains or water mains by AUTHORITY does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the AUTHORITY, at its sole discretion, may consider acceptance or beneficial use of the facilities.

END OF SECTION

SECTION 5 - MANHOLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewer manholes and related appurtenances.

1.02 RELATED SECTIONS

A. Section 7 – Cast-in-Place Concrete

B. Section 8 – Grout

1.03 REFERENCES

A. American Society for Testing and Materials:

1. ASTM A48, Gray Iron Castings.

2. ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes.

3. ASTM A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

4. ASTM C361, Reinforced Concrete Low-Head Pressure Pipe.

5. ASTM C443, Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

6. ASTM C478, Precast Reinforced Concrete Manhole Sections.

7. ASTM C923, Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

8. ASTM D2146, Propylene Plastic Molding and Extrusion Materials.

9. ASTM D2240, Test Method for Rubber Property-Durometer Hardness.

10. ASTM A307, Carbon steel externally threaded standard.

11. ASTM C270, mortar for unit masonry.

B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Requirements.

C. American Water Works Association:

1. AWWA C 302, AWWA Standard for Reinforced Concrete Water Pipe-Noncylinder Type, Not Prestressed.

D. Federal Specifications:

1. Fed. Spec. SS-S-210A, Sealing Compound, Preformed Plastic, for. Expansion Joints and Pipe Joints (Type 1 Rope Form).

E. Commonwealth of Pennsylvania Department of Transportation (PADOT), Specifications Publication 408.

1.04 QUALITY ASSURANCE

A. Shop Inspection:

1. All materials furnished by the DEVELOPER shall be certified by the supplier for compliance with the pertinent Specifications. Shop inspections and testing may be required.

B. Field Inspection:

1. All materials shall be furnished and installed and tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the AUTHORITY.

C. Source Quality Control:

1. Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast, reinforced concrete manholes.

2. Obtain Certificate of Construction Compliance with ASTM C478 from the precast reinforced concrete manhole manufacturer. Submit same Certificate as part of required submittals.

D. Initial Manholes: Construct first manhole to demonstrate the following, and serve as the minimum acceptable conditions of construction through the project.

1. Demonstrate manhole base construction methods and channel formation.

2. Demonstrate manhole component sealing in the case of precast, reinforced concrete manholes.

3. Demonstrate manhole step alignment.

4. Demonstrate pipe opening sealing.

5. When pavement is installed, demonstrate method of adjustment of manhole frame and cover to grade, and manhole frame and cover attachment.

6. Upon completion, demonstrate successful manhole acceptance test.

1.05 DELIVERY, STORAGE AND HANDLING

A. Transport and handle precast reinforced concrete manhole components and other Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects. Through-wall lifting holes not permitted in manhole component construction.

B. Store precast reinforced concrete manhole components in accordance with manufacturer's recommendations to prevent joint damage and contamination. Exercise such care in storage of other specified Products as recommended by the respective manufacturers.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. In no instance set or construct manhole bases on subgrade containing frost.

2. To improve workability of preformed plastic sealing compound during cold weather, store such at temperature above 70 degrees F or artificially warm compound in a manner satisfactory to AUTHORITY.

PART 2 - PRODUCTS

2.01 BASIC MATERIALS

A. Cast-In-Place Concrete Products: Form work, Reinforcement, and Cast-In-Place Concrete conforming to requirements of Section 7 – Cast-In-Place Concrete.

B. Epoxy Bonding Compound:

1. Manufacturers:

a. A. C. Horn EPOXTITE BINDER

b. Sika Chemical SIKADUR-HI-MOD

2. Multi-purpose, high-modulus, high-strength, 2-component, solvent free, moisture insensitive, epoxy bonding/grouting adhesive.

C. Non-Shrink Non-Metallic Grout:

1. Manufacturers:

a. Master Builders, Inc., Masterflow 928

b. U.S Grout Corporation, Five Star Products

2. Ready mix, ASTM C1107 high precision, natural aggregate grout.

D. Manhole Steps:

1. Aluminum Step: Aluminum Alloy AA Designation 6061-T6, 3/4-inch minimum diameter and 12-inches minimum rung width with drop front to prevent side slipping. Coat that portion of aluminum step being embedded in concrete with heavy-bodied bituminous paint. Aluminum manhole steps No. 12653B by ALCOA.

2. Reinforced Plastic Step: Composed of a 1/2-inch Grade 60, ASTM A615 deformed steel reinforcing bar completely encapsulated in Grade 49108, ASTM D2146 polypropylene copolymer compound, Type II; M. A. Industries, Inc., Type PS2-PF or PS2-PFS.

3. Manhole step dimensions shall meet requirements of OSHA Standard 1910.27 for fixed ladders.

E. Manhole Frame and Cover:

1. Manufacturers:

a. Modena Foundry, Pattern No. 541-S

b. Washington Street Brass and Iron

c. Neenah Foundry Company

2. General: Gray iron castings conforming to ASTM A48, Class No. 30, designed for AASHTO Highway Loading Class HS-20. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects.

a. Finish: Bearing surfaces machined to prevent rocking and rattling under traffic. Casting surfaces shotblast cleaned and coated with asphalt paint, non-tacky drying.

b. Identification: Cast the letters "SEWER" or "WATER", as appropriate, integrally in center of cover in 2-inch raised letters.

c. Frame Hold-down Bolts: Type 316 stainless steel, ASTM A276 bolts and washers.

d. Cover Gasket: One piece O-ring gasket factory installed in a machined rectangular or dovetail groove in the cover bearing surface.

1) Gasket material of neoprene composition having good abrasion resistance, low compression set, Type D 40 durometer hardness determined in accordance with ASTM D 2240 and suited for use in sanitary sewer manholes.

2) Gluing of gasket is not permitted.

e. Tensile Test Bar: Size B, cast separately, but poured from same iron as castings they represent.

F. Watertight Manhole Frame and Cover: Gray iron castings conforming to previously specified requirements for Manhole Frame and Cover except that cover shall contain four (4) hold-down bolts.

1. Manufacturers:

a. Modena Foundry, Pattern No. 541-WT

b. Washington Street Brass and Iron

c. Neenah Foundry Company

2. Cover Hold-down Bolts: 2 inch diameter minimum type 316 stainless steel, ASTM A276 bolts and washers; or manufacturer's standard bronze bolts and washers. Drill and tap frame to accept cover hold down bolts.

3. Threaded Sleeves: Manhole frame factory fitted with stainless steel or bronze threaded sleeve to accept cover bolts.

G. Preformed Plastic Sealing Compound:

1. Manufacturers:

a. K. T. Snyder Company, Inc.; RAM-NEK.

b. K. T. Snyder Company, Inc.; RUB'R-NEK.

c. Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.

2. Fed. Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound, and shipped protected in a removable two-piece wrapper. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.

H. Rubber Compression Gasket: Composition conforming to ASTM C 361 or ASTM C 443.

I. Expandable Sleeve Type Pipe Opening Seal: ASTM C923, consisting of a power sleeve, gasket and two (2) take-up clamps. Sleeve is mechanically expanded to compress gasket against receptacle hole in manhole wall. Provide seal equivalent to Press Seal Gasket Corp. PSX Positive Seal Gasketing System.

1. Power Sleeve: Type 304 stainless steel, 85,000 psi yield strength.

2. Gasket: Compound Polyisoprene suitable for use with raw sewage.

3. Take-Up Clamps: Type 304 stainless steel with stainless steel screw.

J. Modular Mechanical Type Pipe Opening Seal: Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with stainless steel bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and the wall opening. The seal shall be constructed so as to provide electric insulation between the pipe and wall to reduce the occurrence of cathodic reaction between the two members. Wall penetration closures shall be "Link-Seal" as manufactured by Thunderline Corp.

K. Manhole Adapters: Gasket type waterstop composed of elastomeric polyvinyl chloride (PVC) such as manufactured by Fernco Joint Sealer Co.; CMA Concrete Manhole Adapter; CMA Waterstop distributed by The General Engineering Company, Frederick, Maryland.

L. Coatings:

1. Manufacturers:

a. Koppers 300 M Epoxy

b. Pennsbury 32-B-4 Epoxy

2. Apply two (2) coats to outer surface of entire manhole to waterproof manhole.

2.02 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

A. Materials and Construction: Conforming to requirements specified in ASTM C478 except as follows:

1. Concrete: Composition and compressive strength conforming to ASTM C478 except use Type II sulfate resistant Portland cement in manhole components and increase compressive strength to 4500 psi (at 28 days) in precast bases.

2. Casting and Curing: Wet cast and steam curing process in accordance with AWWA C302.

3. Manhole Steps: Factory installed in manhole components, prealigned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Standard Detail drawings.

4. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing either a Rubber Compression Gasket or Preformed Plastic Sealing Compound.

5. Manhole Component Design: Base, tapered and straight riser section, and top section dimensions and diameters, not consistent with ASTM C 478, are as indicated on Standard Detail drawings.

6. Lifting Holes and Lugs: Through-wall holes shall not be permitted in manhole component construction.

7. PennDOT Compliance: In addition to above specifications, manholes for installation within PennDOT rights-of-way shall also conform to PennDOT Publication 408 specifications.

B. Precast Bases and Riser Sections: Design, materials and construction as specified previously.

C. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.

D. Pipe Opening Seals: Option to install one of the following:

1. Resilient Gasket Type Pipe Opening Seal:

a. Manufacturers:

1) A Lok Products Corporation; A LOK Manhole Pipe Seal.

2) Scales Manufacturing Corporation; RES-SEAL.

3) Press Seal Gasket Corporation; PRES-WEDGE II.

4) Thunderline Corporation; LINK-SEAL Modular Wall and Casing Seal.

5) Dual Seal Gaskets Inc.; DUAL SEAL II.

b. Cast integrally with manhole component conforming to requirements specified in ASTM C 923.

2. Expandable Sleeve Type: ASTM C923, consisting of a power sleeve, gasket and two (2) take up clamps. Power sleeve is mechanically expanded to compress gasket against receptacle hole in manhole wall. Install at precast plant. Provide seal equivalent to Press Seal Gasket Corp. PSX Positive Seal Gasketing System.

a. Power Sleeve: Type 304 stainless steel, 85,000 psi yield strength.

b. Gasket: Compound Polyisoprene suitable for use with raw sewage.

c. Take Up Clamps: Type 304 stainless steel with stainless steel screw.

E. Precast Top Sections: Designs as shown on Standard Detail Drawings of materials as specified previously herein this Section except additional and differing requirements as follows:

1. Hold Down Bolt Inserts: Factory cast in top section no less than two 3/4-inch diameter threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Threaded inserts of 3-inches depth. Both insert types designed for an ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert location with manhole component manufacturer to assure proper location in top sections.

2. Flat Slab Tops: Thickness indicated on Drawings. Tops factory formed to properly accept and support required manhole frame and cover and formed to join riser section in a matching joint.

3. Eccentric Cone Tops: Manufactured to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections.

F. Precast Grade Rings: Leveling and adjusting units of 3-inches or 4-inches thickness of materials and constructions as specified previously. Factory cast grade rings with hold down bolt holes matching location of same in manhole frame. Design must provide for full bearing of manhole frame.

G. Manhole Inserts: Manufactured of high density polyeythylene material.

H. PVC Coated Precast Reinforced Concrete Manhole Bases, Risers, Cones or Flat Slab Tops:

1. Air release manholes and manholes to which force mains or low pressure lines discharge to and the next two (2) manholes downstream shall be PVC coated as described below.

2. PVC Liner system:

a. PVC Coated Manholes shall be as manufactured by A-Lok Products, Inc., or pre-approved equal. The interior plastic liner for the precise manholes shall be Dura Plated 100. The Dura Plate 100 liner, when installed, shall provide a continuous, impermeable lining which will shield the precast concrete manhole against deterioration caused by corrosive material. The PVC Coated Manholes shall also meet all of the requirements specified for standard precast concrete manholes.

b. The design of the liner shall insure that it will conform to the contour of the manhole and form a permanent mechanical bond to the concrete through use of preformed horizontal ribs. The liner will be formed in such a manner that the joints between the manhole sections will be afforded protection through the use of a continuous PVC return into the joint for a minimum of ¾ of an inch. Provisions will be made to allow the pipe openings to be sealed.

c. The liner shall be manufacture from Polyvinyl Chloride resin and shall be white in color. The compound will result in a semi-rigid material suitable for thermoforming to the contour of the manhole. The liner may be fabricated in panels with the panels joined together by a slotted strip of EDPM rubber according to the manufacturer's specifications. All plastic liner sections shall be free of cracks, pinholes, or other defects adversely affecting the protective characteristics of the material and shall have a minimum thickness of 65 mils.

d. The Dura Plate 100 liner will be installed during the precasting process in accordance with the specific instructions of the manufacturer.

e. The manhole manufacturer shall provide installation instructions to contractor prior to initial use of the Dura Plate 100 liner. The manhole will be installed using a joint sealing material as later specified.

f. The joint sealing material shall be placed on the joint surfaces as recommended by the manufacturer, to provide a watertight seal by filling the annular cavity, while providing sufficient squeeze-out between the PVC returns to protect against corrosion.

g. Flexible, corrosion-resistant, watertight connections between manhole castings and precise concrete cones or flattops shall be installed for all PVC coated manholes. This connection shall be accomplished by Water-Lok Connectors, as manufactured by A-Lok Products, Inc., or approved equal. The connector shall allow flexibility in reaching finished grade and permit up and down movement to accommodate free/thaw conditions close to the ground surface without compromising watertightness. This shall be accomplished by utilizing two independent sleeves by a system of neoprene o-rings. The top and bottom flanges of the Water-Lok Connector are sealed to their appropriate mating surfaces by a preformed butyl gasket material furnished with the assembly. The Bolt Fastening Assembly shall be an anti-floating assembly.

h. All interior concrete surfaces not covered by the PCV liner, including the flow channel and grade rings, shall be coated with two coats of epoxy-amine. Coating of the base shall overlap the liner by a minimum of 2-inches.

2.03 DEVELOPER OPTIONS IN PRODUCTS

A. Manhole Construction Options: Permitted option to construct one type of manhole in the Project of types listed herein, except where required otherwise on Drawings.

1. All-precast reinforced concrete manhole components.

2. All-precast reinforced concrete manhole components except manhole base. Base of cast-in-place concrete.

3. Precast reinforced concrete grade rings used as frame and cover leveling units in either of above manhole construction.

PART 3 - EXECUTION

3.01 EXAMINATION

A. All manholes will be field located by the Contractor and AUTHORITY. No manholes shall be ordered until the actual location of such is determined in the field.

B. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C 478 regarding repairable defects and defects subject to rejection by AUTHORITY.

C. All material found during the progress of the Work, either before or after installation, to have cracks, flaws or other defects will be rejected by AUTHORITY. All defective materials furnished by DEVELOPER shall be promptly removed from the site.

3.02 PREPARATION

A. Keep pipe and manhole interiors cleared of debris as construction progresses.

B. Earthwork: Perform earthwork as previously specified in Section 2 - Trenching, Backfilling and Compacting.

3.03 MANHOLE INSTALLATION

A. Cast-In-Place Concrete Manhole Base: Construct in accordance with design and dimensions indicated on Drawings. When necessary to construct wider or deeper manhole bases than indicated or specified, build such bases as required by AUTHORITY.

1. Form and pour concrete in accordance with requirements of Section 7 – Cast-In-Place Concrete. Additional requirements as follows:

   a. Vibrate poured concrete using mechanical vibrator of a type and design approved by AUTHORITY. Use vibrators of type capable of transmitting vibration to concrete in frequencies of not less than five thousand impulses per minute.

   b. Form and pour joint monolithically in manhole base top to match joint of adjoining precast riser section. Use template as obtained from precast concrete manhole component manufacturer.

2. Install sewer piping in cast-in-place manhole bases prior to pouring the concrete.

a. Apply Epoxy Bonding Compound in accordance with manufacturer's instructions to pipe at base connection prior to pouring the concrete.

b. Install Manhole Adapter on pipes entering and leaving manhole base prior to pouring concrete. Install Manhole Adapter according to manufacturer's written instructions.

3. Coat bases in accordance with the requirements for precast manhole components.

B. Precast Concrete Bases:

1. Install precast bases on aggregate subbase. Materials and thicknesses as shown on the Standard Detail drawings.

2. When pipe opening seal materials create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with preformed plastic sealing compound.

a. Tightly caulk sealing compound into annular spaces in a manner to completely fill the spaces and render the installation watertight.

b. Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.

C. Length of Pipe Connections into Manholes:

1. Use full pipe section when connecting into manholes through resilient gasket type pipe opening seals.

D. Concrete Channel Fill: Field pour concrete channel fill for each manhole base.

1. Form inverts directly in concrete channel fill.

2. Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.

3. Make changes in size and grade gradually.

4. Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.

5. Make slopes gradual outside the invert channels.

6. Use 3000 psi Type II concrete as specified in Section 7 - Cast-In-Place Concrete, unless indicated otherwise on Drawings.

E. Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps.

1. Install sealing compound in accordance with manufacturer's recommendations, and join sections also in accordance with written instructions of manhole component manufacturer.

a. Prime joint surfaces if required by preformed sealing compound manufacturer.

b. If sealing compound is installed in advance of section joining, leave exposed half of two piece protective wrapper in place until just prior to section joining.

c. Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.

d. To improve workability of Preformed Plastic Sealing Compound during cold weather, store such at temperature above 70°F or artificially warm compound in a manner satisfactory to AUTHORITY.

e. During warm weather stiffen Preformed Plastic Sealing Compound by placing under cold water or by other means as recommended by the compound manufacturer.

f. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.

g. Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.

h. Remove all excessive plastic sealing compound after all manhole sections have been set.

F. Lifting Recess Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into recesses in such manner to render them completely water and air tight. Sealing of lifting recesses with grout not permitted.

G. Frame and Cover Installation: Where required, make final adjustment of frame to elevation using Precast Grade Rings.

1. Set Precast Grade Rings in Non-shrink Non-Metallic Grout. Grout thickness shall not exceed 3/4-inch maximum and 3/8-inch minimum. Wet, but do not saturate Precast Grade Rings immediately before laying.

2. Parge the inside and outside of the grade rings to a minimum thickness of 1/2 inch using Non-shrink Non-Metallic Grout.

3. Bolt manhole frames only following grout curing period. Install manhole frames on 1/2-inch thick Preformed Plastic Sealing Compound on bearing surface of manhole frame. Remove excess sealing compound as it is squeezed out after manhole frame is bolted in place.

4. Use bolts of sufficient length to properly pass through leveling units, if any, engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer. Tighten manhole frame bolts after grout has cured.

H. Waterproofing: Coat entire outer surface of all manhole components including parged grade rings with two (2) coats of a Bitumastic Coating.

I. Drop Manholes: Construct in accordance with Standard Detail Drawing. Use same type pipe and fittings in drop connection as used in sewer line from which drop connection is made.

J. Plugging Pipe Openings: Plug pipe openings in manholes where such openings are required for future pipe connections. Use manufactured units specifically designed for the purpose. Plugs shall be designed to allow for future removal without damage to manhole.

3.04 PIPE CONNECTIONS TO EXISTING MANHOLES

A. Make connection to existing manhole by core drilling pipe opening in wall at invert elevation to match existing unless directed otherwise by AUTHORITY.

B. Remove existing bench as needed to make new connection. Reconstruct bench and form new flow channel after new pipe has been inserted.

C. Seal pipe to wall opening using either the Expandable Sleeve Type or Modular Mechanical Type Pipe Opening Seal.

3.05 CONSTRUCTION OF NEW MANHOLES OVER EXISTING SEWER MAINS

A. Where new manholes are constructed on top of existing sewer mains, DEVELOPER shall have the option to use cast-in-place concrete manhole bases or precast concrete bases. Construct according to Standard Detail drawing and as follows:

1. Replace broken or damaged pipe resulting from Work with new pipe. New pipe shall be of materials as previously specified. Use couplings compatible with new and existing pipe for making final connections.

2. Connect new pipe to new manhole bases using materials and methods previously specified. Form smooth channel to conduct flow into main channel.

3. Maintain flow of existing sewer during construction and until concrete is properly cured in the case of cast-in-place work and formed inverts.

4. Saw cut existing pipe to be removed. Chipping or breaking pipe with a hammer shall not be permitted.

3.06 FIELD QUALITY CONTROL

A. General: Test each manhole constructed by one of the methods specified herein. If the manhole is constructed on an existing sewer where flow must be maintained, the test may be waived, at the sole discretion of AUTHORITY.

1. Conduct tests in presence of and to complete satisfaction of AUTHORITY.

2. Should a manhole not satisfactorily pass testing, AUTHORITY may direct DEVELOPER to discontinue manhole construction in the Project until such manhole does test satisfactorily.

3. Provide tools, materials (including water), equipment and instruments necessary to conduct manhole testing specified herein.

4. Prior to testing manholes, thoroughly clean such and seal openings, both to complete satisfaction of AUTHORITY. Seal openings using properly sized plugs.

5. Perform testing with frames installed. The joint between the manhole and the manhole frame shall be included in the test.

6. DEVELOPER may elect to make a test prior to backfilling for his own purposes; however, the tests of the manholes for acceptance, shall be conducted after the backfilling has been completed.

B. Vacuum Testing:

1. Vacuum Testing Equipment:

a. Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from manhole and to monitor vacuum.

b. Provide an extra vacuum gauge of known accuracy to frequently check test equipment and apparatus.

c. Vacuum testing equipment and associated testing apparatus subject to AUTHORITY approval.

d. Provide seal plate with vacuum piping connections for inserting in manhole frame.

2. Vacuum Test Procedure:

   a. Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions.

   b. Draw a vacuum of (-) ten-inches of mercury and close the valves.

   c. Consider manhole acceptable when vacuum does not drop below (-) nine-inches of mercury for the following manhole sizes and times.

      1) Four foot diameter - 60 seconds

      2) Five foot diameter - 75 seconds

      3) Six foot diameter - 90 seconds

C. Exfiltration Test Procedure:

1. Water Test Procedure will not be permitted when the air temperature is expected to fall below 35° F, or as directed by AUTHORITY.

2. Completely fill manhole with water. The AUTHORITY will charge for water used for testing based either on a minimum amount or an actual meter reading.

3. Allow water filled manhole to stand twelve hours prior to testing to allow absorbing in materials.

4. At commencement of test, fill manhole to top of manhole frame.

5. During a consecutive four hour period keep an accurate record of the amount of water to be added because of exfiltration.

6. Consider manhole acceptable when exfiltration rate does not exceed a rate of 0.0189 gallons a day per inch of manhole diameter per vertical foot of manhole.

D. Repair and Retest:

1. Determine source or sources of leaks in manholes failing acceptable limits.

2. Repair or replace defective materials and workmanship, as is the case, and conduct such additional Manhole Acceptance Tests and such subsequent repairs and retesting as required until manholes meet test requirements.

3. Materials and methods used to make manhole repairs must meet with AUTHORITY approval prior to use.

END OF SECTION

SECTION 6 – DISINFECTION OF WATER FACILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Disinfection procedures of water mains and related facilities.

1.02 QUALITY ASSURANCE

A. Bacteriological Tests:

1. AWWA Standard C651, Sections 7 and 8.

a. Number of Samples Required: One sample or as directed otherwise by AUTHORITY.

B. Reference Standards:

1. American Water Works Association:

a. AWWA B300, Standard for Hypochlorite's.

b. AWWA B301, Standard for Liquid Chlorine.

c. AWWA C600, Installation of Gray and Ductile Cast Iron Water Mains and Appurtenances.

d. AWWA C651, Disinfecting Water Mains.

e. AWWA Manual M12, Simplified Procedure for Water Examination.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Transport, handle and store disinfection products specified herein in the manner recommended by the respective manufacturers to prevent contamination and deterioration of products.

B. When handling disinfection products, due caution is advised. Utilize procedures in the manner recommended by the manufacturer.

1.04 JOB CONDITIONS

A. Environmental Requirements:

1. Testing and disinfection of water mains will not be performed if the air temperature is expected to fall below 35°F or as directed by AUTHORITY.

2. Keep interior of pipe clean. Close open end of pipe with a watertight plug anytime pipelaying is not in progress.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hypochlorites: AWWA Standard B300.

B. Liquid Chlorine: AWWA Standard B301.

PART 3 - EXECUTION

3.01 DISINFECTION

A. General: Before being placed in service, all water pipe (including water service connections) and other water facilities installed shall be disinfected by chlorination.

B. Form of Chlorine for Disinfection: Either of the following methods of procedure may be followed upon approval of AUTHORITY.

1. Liquid chlorine: Apply a chlorine gas-water mixture by means of a solution feed chlorinating device in combination with a booster pump for injecting the chlorine gas-water mixture into the main to be disinfected. Use only if DEVELOPER can demonstrate to AUTHORITY that the person supervising the operation is thoroughly familiar with and experienced in the handling of chlorine gas, and that the equipment to be used in suitable and that proper safety equipment is available.

2. Calcium Hypochlorite Solution: Prepare a chlorine-water solution of 1 percent (1%) available chlorine using granular calcium hypochlorite, and this solution shall be injected or pumped into the pipeline. A chlorine-water solution of 1 percent available chlorine may be prepared by mixing approximately one (1) pound of calcium hypochlorite with eight (8) gallons of water.

3. Chlorine Tablets or granules: Install chlorine tablets or granules in mains at the recommended dosages and intervals. Fill main at the recommended rate to prevent the tablets or granules from flushing to the end of the main. Only tablets suitable for pipeline disinfection and in accordance with AWWA standards shall be used.

C. Preparation:

1. Preliminary Flushing: Prior to disinfection, flush the section of pipeline being disinfected as thoroughly as possible with the water pressure and outlets available.

2. Flush after the pressure and leakage tests have been completed.

D. Chlorination:

1. Apply the hypochlorite solution to the water main with a gasoline or electrically-powered chemical feed pump. For small applications, the solution may be prepared in a barrel, and then pumped into the main with a hand pump, such as a hydraulic test pump. Apply at a dosage rate such that the chlorine concentration in the water in the pipe is a minimum of 25 mg/l free chlorine.

2. Apply the chlorinating agent at the high end of the pipeline section being chlorinated through a corporation stop inserted in the top of the new pipe. If the water for the preparation of the chlorine solution is supplied from a tap on the existing pipeline, a physical break between the injector supply and the injector or pump must exist.

3. Pump the chlorine solution slowly into the new pipeline. Chlorine application shall not cease until the entire main is filled with chlorine solution. If required by AUTHORITY, measure the chlorine residual at several points along the section of main being disinfected to insure that the proper dosage and distribution of the chlorine solution is obtained.

E. Alternate Chlorination Method:

1. Place calcium hypochlorite granules at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-foot intervals. The quantity of granules shall be as shown in the table below.

WARNING: This procedure must not be used on solvent-welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

Pipe Diameter (Inches)	**Calcium Hypochlorite Granules (Ounces)**
4	0.5
6	1.0
8	2.0
12	4.0
16 and larger	8.0

2. Place 5g calcium hypochlorite tablets in each section of pipe and also place one such tablet in each hydrant, hydrant branch, and other appurtenance. The number of 5g tablets required for each pipe section shall be $0.0012d^2L$ rounded to the next higher integer, where d is the inside pipe diameter, in inches, and L is the length of the pipe section, in feet. The table below shows the number of tablets required for commonly used sizes of pipe.

Number of 5g Calcium Hypochlorite Tablets Required for Dose of 25 mg/L*.

	Length of Pipe Section				
Pipe Diameter Inches	**13 feet or less**	**18 feet**	**20 feet**	**30 feet**	**40 feet**
	Number of 5g Calcium Hypochlorite Tables				
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13
***Based on 3.25g available chlorine per tablet; any portion of tablet rounded to next higher number.**					

The tablets shall be attached by a food-grade adhesive. Examples of a food-grade adhesives are Permatex Form-A-Gasket No. 2 and Permatex Clear RTV Silicone Adhesive Sealant, which are manufactured by Loctite Corporation, Kansas City, KS 66115. These products have both been approved by USDA for uses that may contact edible products. Neither product has been approved in accordance with NSF Standard 61. Other company products, such as Permatex Form-A-Gasket No. 1, have not received FDA approval.

There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

3. When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 ft/s. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 41 degrees F (5 degrees C), the water shall remain in the pipe for at least 48 hours. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service.

F. Disinfection:

1. Exercise care in manipulating valves so that the strong chlorine solution in the line being treated will not flow back into the adjoining water distribution system.

2. Retain the chlorinated water in the main for at least 24 hours. All valves and hydrants in the section shall be operated in order to disinfect those appurtenances. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 20 mg/l free chlorine.

3. Following chlorination, thoroughly flush the heavily chlorinated water from the main at its extremities until the replacement water throughout its length, upon test, shall be proven comparable to the quality of water in the existing distribution system.

4. At no time will valves on the water distribution system be operated without the presence of a representative of AUTHORITY.

5. Discharge the chlorine solution from the water main through available outlets or through taps in the main. Inspect the area of the discharge point thoroughly before discharging the chlorine bearing water, since it is extremely toxic and, if allowed to flow into streams, can readily destroy aquatic life. Disposal of the chlorinated water shall conform to all state and local codes and regulations.

6. If the possibility of damage of aquatic life is such that special precautions are required, dechlorinate the disinfecting solution before it goes to waste. The chlorine solution may be neutralized by applying sodium thiosulfate. The procedure shall be approved by AUTHORITY prior to installation.

G. After final flushing and before each treated water main is placed in service, collect a sample or samples from the end of the line and every 1000 feet of water main. Test the sample or samples for bacteriological quality in accordance with Standard Methods to show the absence of coliform organisms. Take samples of water that has stood in the main for at least 24 hours after final flushing has been completed. Coordinate with AUTHORITY on testing for the bacteria quality. The DEVELOPER is responsible for coordinating submission of test results from the testing agency to the AUTHORITY. Testing shall be preformed by a laboratory certified by the Pennsylvania Department of Environmental Protection.

H. If the initial disinfection fails to produce satisfactory bacteriological samples, the main shall be reflushed and shall be resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated as specified hereinbefore.

I. All samples shall be taken with AUTHORITY personnel present. Coordinate this activity with them.

J. The AUTHORITY will charge for water used for testing based on either a minimum amount or an actual meter reading.

3.02 DISINFECTION OF WATER MAIN CONNECTIONS

A. Since it may not be possible to disinfect the pipe, valves, and fittings installed at certain connections in the manner specified in Paragraph 3.01, DEVELOPER shall proceed with the following procedure.

1. The interior of all pipe, fittings, and valves shall be swabbed with a five percent (5%) hypochlorite solution.

2. After the pipe, fittings, and valves have been swabbed, they shall be thoroughly flushed with water. Extreme care shall be used during installation to keep foreign material out of the pipe and to the proper disposal of flushing water.

END OF SECTION

SECTION 7 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete work for:

1. Pipe thrust restraint
2. Restoration of disturbed/damaged concrete curbs and sidewalks
3. Miscellaneous concrete specified in other Sections.

1.02 REFERENCES

A. American Concrete Institute (ACI)

1. 301 - Specifications for Structural Concrete for Buildings
2. 305 - Hot Weather Concreting
3. 306 - Cold Weather Concreting
4. 318 - Building Code Requirements for reinforced concrete
5. 347 - Recommended practice for concrete formwork

B. American Society for Testing and Materials (ASTM)

1. A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
2. C31 - Making and Curing Concrete Test Specimens in the Field
3. C39 - Compressive Strength of Cylindrical Concrete Specimens
4. C94 - Ready-Mixed Concrete
5. C143 - Slump of Portland Cement Concrete
6. C173 - Air Content of Freshly Mixed Concrete by the Volume Method

C. Pennsylvania Department of Transportation (PennDOT) Publication 408, latest edition

1. Section 704 - Cement Concrete
2. Section 711 - Concrete Curing Material and Admixtures
3. Section 1001 - Cement Concrete Structures

1.03 SUBMITTALS

A. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, and others if requested by AUTHORITY.

B. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

C. Laboratory test reports for concrete materials and mix design test.

D. Material certificates in lieu of material laboratory test reports when permitted by AUTHORITY. Material certificates shall be signed by manufacturer, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.04 PROJECT REQUIREMENTS

A. DEVELOPER shall be responsible for replacing or restoring all concrete damaged or disturbed in performing work of the Project to match original conditions in addition to those requirements specified herein this Section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete: Class A cement concrete as specified in PennDOT Publication 408, Section 704.1(b), 3300 psi minimum compressive strength at 28 days.

B. Concrete Admixtures: Curing Materials and Admixtures: As specified in PennDOT Publication 408, Section 711.

C. Liquid Membrane-Forming Curing Compound: As specified in PennDOT Publication 408, Section 711.

D. Reinforcing Bars: 60 ksi yield grade, ASTM A615, deformed billet steel bars.

E. Curb and Sidewalk Restoration Materials: Materials shall comply with Warwick Township Specifications.

F. Epoxy Bonding Compound: Use product equivalent to A.C. Horn AEpoxite Binder or Sika Chemical Sikadur 32 Hi-Mod.

G. Form coatings: Provide commercial formulation form-coating compounds that will not bond with, nor affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that excavation is completed to required depth, and that subgrade has been properly compacted.

3.02 PREPARATION

A. Accurately place and adequately support embedded items and joint materials in pour.

B. Prepare existing hardened concrete to bond to new concrete.

1. Roughen and clean existing concrete surface of foreign matter.

2. Apply Epoxy Bonding Compound over existing prepared concrete according to manufacturer's instructions.

C. Sprinkle sufficient water over subgrade to prevent water loss from concrete.

3.03 FORMING

A. Construct forms according to ACI 347 to required dimensions, plumb and straight.

1. Securely brace and shore forms to prevent displacement, bowing and pillowing, and to safely support imposed concrete load.

2. Fabricate forms for easy removal without harming or prying against concrete surfaces.

B. Provide openings in concrete formwork of the correct size and in the proper location to accommodate piping and other construction work items. Accurately place and securely support items to be built into forms.

C. Where soil conditions will permit excavation to accurate sizes without bracing, and where cave-ins can be prevented during the concrete pour, earth forms may be used. Earth forms shall be wetted, but not muddy before concrete is placed.

3.04 REINFORCING

A. Place reinforcing steel accurately and securely brace against displacement using reinforcing accessories according to ACI 318.

B. Splice bars according to ACI 318.

3.05 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Notify AUTHORITY minimum 24 hours prior to commencing concrete pour.

C. Ensure that reinforcement, formed expansion and construction joints and embedded items are not disturbed during concrete placement.

D. Place concrete continuously between predetermined expansion, control, and construction joints.

E. Do not interrupt successive placement; do not permit cold joints to occur.

F. Consolidate concrete by vibration, spading, rodding or other manual methods.

G. Perform concrete work in cold and hot weather according to ACI 306 and ACI 305, respectively.

3.06 FINISHING

A. Finish concrete to match original conditions or as directed by AUTHORITY.

3.07 CURING

A. Cure concrete with Liquid Membrane-Forming Curing Compound. Apply curing compound in according to PennDOT Publication 408, Section 1001.3.

3.08 CURB AND SIDEWALK RESTORATION

A. Restore curbs and sidewalks damaged by construction to conform to Warwick Township Specifications.

B. Saw cut and reconstruct sidewalks to the first expansion joint on either side of the damaged section.

C. Saw cut and reconstruct curbs to a minimum of one (1) foot beyond each side of damaged section. Match original lines and grades.

3.09 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The DEVELOPER shall employ an independent testing agency to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement shall include the following, as directed by AUTHORITY.

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

a. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

b. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

d. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. (4 cu. m) plus additional sets for each 50 cu. yd. (38 cu. m) more than the first 25 cu. yd. (19 cu. m) of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

4. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).

C. Test results will be reported in writing to AUTHORITY, ready-mix producer, and DEVELOPER within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by AUTHORITY. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

END OF SECTION

SECTION 8 - GROUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cement grout for:

1. Manholes

2. Miscellaneous grout requirements

1.02 RELATED WORK

A. Section 5 - Manholes

B. Section 7 - Cast-In-Place Concrete

C. Individual grouting requirements as specified in various other Sections of these Specifications.

1.03 REFERENCES

A. American Society for Testing and Materials:

1. ASTM C 191, Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.

2. ASTM C 596, Test Method for Drying Shrinkage of Mortar Containing Portland Cement.

3. ASTM C 827, Test Method for Early Volume Change of Cementitious Mixtures.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Prevent moisture damage and contamination of materials.

B. Store materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.05 SITE CONDITIONS

A. Protect against high and low temperatures and bad weather in accordance with American Concrete Institute standards for placement of concrete.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Non-Shrink Non-Metallic Grout: Factory Premixed material containing no corrosive irons, aluminums, chemicals or gypsums.

1. Grouts containing water reducers, accelerators, or fluidifiers shall have no drying shrinkage greater than the equivalent cement and water mix as tested per ASTM C 596.

2. Grout shall be nonshrink before initial set and show no expansion after set as tested per ASTM C 827.

3. Initial set of grout not less than 60 minutes per ASTM C 191 Test.

4. Use Type I (Normal) cement for grout applications not in contact with sewage.

5. Use Type II (Sulfate Resistant) cement for grout applications in contact with sewage.

6. Acceptable Manufacturer: U.S. Grout Corporation; FIVE STAR.

2.02 CHEMICAL GROUP

A. General: An intimate mixture of dry acrylamide and dry, N, N-methylenebisacrylamide, in such proportions that dilute aqueous solutions, when properly catalyzed, will form stiff gels.

1. The grout must make a true solution at concentrations as high as three pounds per gallon of water.

2. The viscosity of the chemical solution shall have a viscosity of less than 2 cps, which remains constant until gelation occurs.

3. The reaction time shall be controllable from 10 seconds to 1 hour.

4. The reaction shall produce a continuous and irreversible gel at chemical concentrations as low as 0.4 pounds per gallon of water.

B. Catalyst: The catalyst for the chemical grout shall be ammonium persulfate. This material shall normally be used in combination with an activator, but it may be used in combination with a buffer for high-temperature work. Use of a catalyst containing Dimethyl Amino Propionitrile (DMAPN) is prohibited.

C. Activator: Triethanolamine or other compounds of equivalent properties.

D. Inhibitor: Under some conditions, it may be necessary or desirable to control the chemical reaction by inhibition. The inhibitor used shall be Potassium Ferricyanide.

E. Portland Cement: ASTM C 150, Type II

F. Fine Aggregate: ASTM C 33 gradation.

G. Waterproof Cement Grout: A mixture of portland cement, finely graded mineral fillers, and a chemical additive equal to Drycon, a product of IPA Systems, Inc., or Thoroseal by Standard Dry Wall Products Inc.

H. Joint Sealant Compound: Federal Specification SS-S-00210, preformed, flexible, self-adhering, cold applied.

2.03 GROUT QUALITY

A. Non-Shrink Grout: Use ready-mix type requiring only the addition of water. Do not add other materials. Water requirement proportions shall conform to manufacturer's specifications for the desired mix consistence.

PART 3 - EXECUTION

3.01 PREPARATION

A. Forming:

1. Use forming procedures that allow proper and complete placement of grout.

2. Anchor support elements so no movement is possible.

3. Remove supports only after grout has hardened.

4. Pre-treat with forming oils wood forms that may absorb moisture.

B. Preparation of Surface:

1. Non-Shrink Grout: Prepare in accordance with manufacturer's printed instructions.

3.02 MIXING

A. Time:

1. Non-Shrink Grout: In accordance with manufacturer's printed instructions.

3.03 PLACING

A. Non-shrink Non-Metallic Grout: Perform grout placement in accordance with the recommendations of ACI and the manufacturer's published specifications for mixing and placing. Place Non-Shrink Non-Metallic grout only where indicated on Drawings.

3.04 MANHOLE SEALING

A. Manhole Grouting Repair:

1. Drill a hole at each identifiable leakage point from the inside of the manhole, extending through the side wall of the manhole. Insert a metal rod through the hole to determine if there is an exterior void space.

2. Fill any void space found with a hydraulic grout mix consisting of one part portland cement, maximum of three parts sand, and water just sufficient to allow the mix to be pumped into void space until refusal is recorded by a rise in pressure on a pump pressure gauge. Ensure the hole through the manhole wall is kept open and free of hydraulic grout. Plug hole and allow one hour for the hydraulic grout to set.

3. Upon completion of hydraulic void grouting, pump chemical grout until refusal at a minimum pressure of 3.0 psig through probe type injection equipment. Deposit sealant from the interior surface of the set hydraulic grout through the drilled hole to the inside periphery of the manhole. Mix, apply, and cure chemical grout according to manufacturer's instructions.

4. Upon setting of the chemical grout, remove excess material protruding into the inside of the manhole.

5. When authorized by AUTHORITY in writing, parging the interior of manholes with two coats of waterproof cement grout can be done in lieu of hole drilling and hydraulic grouting specified. Prior to parging manhole, surfaces shall be cleaned by high velocity water jet or other means to remove all grease, sludge, sewage and dirt.

B. Sealing Manhole Cover Frames:

1. On manholes being grouted and sealed, remove the frame and cover and clean the bottom of the frame of any mortar or other materials stuck to the casting. Remove any loose materials from the manhole structure.

2. Apply joint sealant compound to the top of the manhole and replace the frame and covers squeezing the compound into crevices. Trowel any compound that squeezes into the manhole flush with the interior surface.

END OF SECTION

SECTION 9 – GREASE TRAPS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Grease Traps

1.02 RELATED SECTIONS

A. Section 2 – Trenching, Backfilling and Compaction

B. Section 5 – Manholes

1.03 REFERENCES

A. ASTM A48, Gray Iron Castings

B. ASTM A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

C. ASTM C478, Precast Reinforced Concrete Manhole Sections

1.04 SUBMITTALS

A. Make submissions required by Section 1 Construction Submittals.

PART 2 – PRODUCTS

2.01 REQUIREMENTS

A. All connections to the sewer system which discharge wastewater containing oils and/or greases shall be provided with a grease trap. Requirement shall include food processing and/or production establishments serving food, as well as those involving equipment or materials from which oils or greases could enter the wastewater generated from the property.

B. Volume of grease trap shall be determined by DEVELOPER with minimum volume being 500 gallons. A 20-minute retention time is required within the vessel. AUTHORITY reserves right to require a greater volume or multiple units.

C. Grease trap shall be baffled and provided with direct access for cleanout of each compartment. Grease traps larger than 500 gallons will require a middle baffle. Unit shall be installed outside in an area with easy and continuous access for a tanker unit to remove waste from the unit.

D. Cleaning/hauling frequency of vessel will depend on quantity and content of sewage flows generated. AUTHORITY will request greater frequency if grease is found to be entering the sewer collection system.

E. Property owner is required to submit cleaning/hauling reports to AUTHORITY concerning cleaning/hauling on a regular basis.

F. Internal grease traps are prohibited by the AUTHORITY.

2.02 GREASE TRAP

A. Unit shall be precast concrete meeting all requirements of Section 5. - Manholes and the Standard Detail Drawing and shall be suitable to withstand traffic loads.

B. Access covers shall be located at the center of the vessel for ease of cleaning and shall be gasketed to prevent the inflow of groundwater, surface water or rain from entering the unit. Where required, covers shall be suitable to withstand traffic loads. Should usage in the area of installation be modified to a traffic area from a non-traffic area, the covers shall be changed to withstand traffic loads.

2.03 PIPE MATERIALS

A. Connection of the grease trap to the AUTHORITY's system shall comply with Section 4 Piping and Appurtenances.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Grease trap and all connecting piping and appurtenances shall conform to the requirements of Section 2 – Excavating, Backfilling and Compaction and Section 4 – Pipe and Fittings.

B. Installation shall be in accordance with Standard Detail Drawing.

END OF SECTION

PART V

FORMS

APP-1	Application for Consideration of A Request to Extend and/or Connect with the Water System and/or Sewer System and Request for Allocation and Reservation of Capacity.
ROC-1S	Assignment, Acceptance & Acknowledgment - Sewer Capacity
ROC-1W	Assignment, Acceptance & Acknowledgment - Water Capacity
EXT-APP	Application to Extend Water and/or Sewer Lines
EXT-LW	Lititz Water Extension Agreement
EXT-RW	Rothsville Water Extension Agreement
EXT-S	Sewer Extension Agreement
LOC-W	Letter of Credit Form - Water System Only
LOC-S	Letter of Credit Form - Sewer System Only
LOC-COM	Letter of Credit Form - Water and Sewer
LOC-MG	Maintenance Guarantee Letter of Credit Form
GP-1	Developer Grinder Pump Agreement
GP-2	Grinder Pump Buyer Acknowledgment Form
GP-3	Grinder Pump Checkout Form
GP-4	Grinder Pump Loan Agreement
GP-	info Grinder Pump Packet
DE1	Agreement Providing for Grant of Easements Water, Sewer, Stormwater (Permanent to Authority)
DE2	Agreement Providing for Grant of Water and/or Sewer Easement (Permanent to Authority) DE3S Declaration of Easement - By Developer. Lot __ in favor of___ (Permanent Private) Sewer
DE3W	Declaration of Easement - By Developer. Lot __ in favor of___ (Permanent Private) Water
DE3C	Declaration of Easement - By Developer. Lot __ in favor of___ (Permanent Private)Water & Sewer
ROE	Right of Entry Agreement - For Construction.

Section 1. Application for Consideration of a Request to Extend and/or Connect with the Water System and/or Sewer System of Warwick Township Municipal Authority Relative to a Proposed Subdivision and/or Land Development and Request for Allocation and Reservation of Capacity

Section 2. List of Standard Authority Forms.