STANDARD SPECIFICATIONS
FOR DEVELOPERS

SANITARY SEWERAGE SYSTEM ADDITIONS
AND IMPROVEMENTS

LIMERICK TOWNSHIP MUNICIPAL AUTHORITY
Limerick Township, Montgomery County
Pennsylvania

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Table of Contents

		Page
I.	CONDITIONS	
	A. Introduction	1
	B. Definitions	1
	C. Insurance	3
	D. Conduct of Work and Safety	4
	E. Equipment and Materials	5
	F. Delivery, Storage and Handling of Equipment and Materials	6
	G. Location and Protection of Existing Utilities	6
	H. Emergency Maintenance During Construction	8
	I. Observation	8
	J. Use After Testing	8
	K. Maintenance and Completion	9
	L. Final Acceptance of Work	9
II.	PRODUCTS AND MATERIALS	
	A. General	9
	B. Concrete	10
	1. General	10
	2. Cement	11
	3. Concrete Aggregates	12
	4. Water	12
	5. Ready-Mixed Concrete	12
	6. Reinforcement	13
	7. Mortar	13
	8. Non-Shrink Grout	13
	C. Landscaping	13
	1. Topsoil	13
	2. Lime and Fertilizer	13
	3. Seed Mixtures	14
	4. Sod	15
	D. Sanitary Sewer Pipe	15
	1. Polyvinyl Chloride	15
	a. Pipe and Fittings	15
	b. Miscellaneous	16

Page

2. Ductile Iron Pipe 16
a. Pipe and Fittings 16
b. Miscellaneous 17
E. Manholes 17
1. Coarse Aggregate 17
2. Steps 18
3. Frames and Covers 18
a. General 18
b. Standard Manhole Frame and Cover 19
c. Watertight Manhole Frame and Cover 19
d. Inserts 20
e. Anchor Bolts 20
f. Joint Material 21
4. Precast Concrete Manholes and Components 21
a. General 21
b. Risers and Top Sections 21
c. Bases 22
d. Joint Sealant Compound 22
e. Pipe Connections 23
f. Coatings 23
g. Grade Ring Assembly Encapsulation Sleeve 24
F. Pavements 24
1. Aggregate 24
2. Bituminous Materials 24
G. Pipe Bedding and Trench Backfill 24
1. Coarse Aggregate 24
2. Select Granular Material 24
3. Suitable Backfill Material 25
4. Pipe Bedding 25
5. Trench Backfill 25

III. CONSTRUCTION

A. Trench Excavation and Backfill 25
1. General 25
2. Removal of Existing Pavement and Storage of Materials 27
3. Excavation 28
4. Accommodation of Traffic 30
5. Accommodation of Drainage 31
6. Pumping 32

Page

7. Explosives and Blasting 32
8. Tunneling 33
9. Embankment 33
10. Pipe Bedding 34
a. General 34
b. Coarse Aggregate Cradle 34
c. Coarse Aggregate Encasement 35
d. Concrete Encasement 36
e. Concrete Cradle 36
11. Backfilling 37
a. General 37
b. Non-Traffic Areas 37
(1) Initial Backfilling of PVC Pipe 37
(2) Initial Backfilling of Ductile Iron Pipe 37
(3) Backfilling Trench to Finished Grade 38
(4) Settlement 38
c. Traffic Areas Other than State Highways 38
d. State Highways 39
(1) PennDOT Requirements 39
(2) Initial Backfilling of PVC Pipe 39
(3) Initial Backfilling of Ductile Iron Pipe 39
(4) Backfilling Trench to Underside of Paving After Initial Backfilling 40
e. Areas with Unsuitable Supporting Soil 40
12. Responsibility for Condition of Excavation 40
13. Protection of Property and Structures 41
14. Removal of Obstructions 42
15. Clearing Street, Cleaning Up and Repairs 42
16. Sheeting, Bracing and Shoring 43

B. Concrete Installation 43
1. Delivery 43
2. Placing 44
3. Temperature of Concrete 45
4. Protection of New Work 45
5. Curing 45
6. Defective Concrete 46

Page

C. Sanitary Sewer Installation 46
1. General 46
2. Materials 46
3. Construction Methods 47
a. Lines and Grades 47
b. Laying Pipe 47
c. Handling of Ductile Iron Pipe 48
d. Handling of PVC Pipe 48
e. Specials (Wye and Tee-Wye Branches) 49
f. Sewer Laterals 49
g. Deep Cut Laterals 50
h. Stoppers 50
i. Protecting and Keeping Pipe Clean 50
j. Installing Ductile Iron Pipe 50
k. Installing PVC Pipe 52
(1) Joints 52
(2) Pipe Installation 52
l. Force Main Construction 52
D. Manhole Installation 53
1. General 53
a. Schedule 53
b. Ground Water 53
c. Drop Connections 53
d. Line and Grade 54
e. Doghouse Manholes 54
2. Precast Manholes 55
a. Handling 55
b. Site Inspection of Precast Sections 55
c. Coatings 56
d. Placement of Cast-in-Place Manhole Bases 56
e. Placement of Precast Manhole Bases 56
f. Placement of Sections 57
g. Masonry Work 57
h. Grade Ring Assembly Encapsulation Sleeve 58
3. Flow Channels and Bench Walls 58
4. Manhole Frames and Covers 59
E. Restoration of Roads, Landscaping and Miscellaneous Items 59
1. Roads 59
a. General 59

Page

b. Raising Manhole Frames and Valve Boxes 59
c. Temporary Repaving 60
(1) General 60
(2) Between March 1 and October 31 60
(3) Between November 1 and the End of February 60
d. Surface Preparation 60
e. Township Road Permanent Repaving 61
(1) Base Course 61
(2) Surface Course 61
f. Overlay 61
g. Driveways 62
h. State Highway Permanent Repaving 62
i. Sealing 62
j. Thicknesses 62
k. Traffic Lane Paint Striping 63
2. Landscaping 63
a. Landscaping 63
(1) General 63
(2) Topsoil 63
(3) Fertilizing and Rolling 64
(4) Seeding 64
(5) Sodding 65
b Inspection and Acceptance of Landscaping 65
3. Miscellaneous Items 66

IV. TESTS

A. Laboratory Tests 66
B. Shop Tests 67
C. Field Tests 67
1. Compaction Test for Soils 67
2. Leakage Tests 68
a. Gravity Sewers 68
(1) General 68
(2) Low Pressure Air Method 69
b. Force Main 72
c. Manholes 72
(1) Vacuum Method 72

Page

3. Deflection Test for Gravity Sewer 74
   a. General 74
   b. Maximum Deflection 74
   c. Testing Apparatus 74
   d. Deflection Testing Procedure 74
4. Television Inspection 75

V. STANDARD CONSTRUCTION DETAIL DRAWINGS 76

#1 Sanitary Sewer Pipe Embedment Details
#2 Concrete Encasement Detail
#3 Temporary Pavement and Trench Restoration for Existing Township Roads and State Highways
#4 Permanent Pavement and Trench Restoration for Existing Township Roads
#5 Trench Restoration for New Township Roads
#6 Trench Restoration for Unimproved Shoulder of Existing Township Roads or Easements
#7 Permanent Pavement and Trench Restoration for State Highways
#8 Trench Restoration for Unimproved Shoulder of State Highways (≤ 3' from Edge of Pavement)
#9 Trench Restoration for Unimproved Shoulder of State Highways (≥ 3' from Edge of Pavement)
#10 Type "A" Standard Manhole
#11 Type "A" Drop Manhole
#12 Type "B" Standard Manhole
#13 Standard Manhole Frame and Cover
#14 Watertight Manhole Frame and Cover
#15 Grade Ring Detail
#16 Manhole Wall Penetration Details
#17 Manhole Step Detail
#18 Shallow Sewer Lateral Detail
#19 Deep Sewer Lateral Detail
#20 Building Sewer Detail
#21 Building Sewer Embedment

I. CONDITIONS

A. Introduction

All work shall be done in accordance with the requirements and regulations of the Limerick Township Municipal Authority and these Specifications.

The Developer is the party who is ultimately accountable to the Authority for all Work and responsible for all Work, regardless if the Work is performed by the Developer, Developer's consultant or Contractor. If the Developer will directly perform the Work, any responsibilities or obligations required of the Contractor shall be assumed by the Developer. These condition are implied throughout these Specifications.

The Developer shall obtain a copy of the "Standard Specifications for Developers" and the "Sewerage System Extension Policy" from the Authority and comply with these documents. If any conflict appears between the preceding documents, the "Sewerage System Extension Policy" shall control.

B. Definitions

The following definitions shall be applicable in these Specifications:

1. Authority shall mean the Limerick Township Municipal Authority, a municipal authority in the Commonwealth.

2. Building Sewer shall mean the sewer from any structure to the public sewer lateral.

3. Construction Details shall mean those drawings which are prepared by the Engineer, approved by the Authority as the Authority's "Standard Details", and included in the Specifications to show general and typical construction details.

4. Contractor shall mean any individual, partnership, or corporation performing sewer construction work for the Developer.

5. Developer shall mean any landowner, agent of such landowner, or tenant with the permission of such landowner, who makes or causes to make a subdivision of land or a land development, or who constructs, or causes to be constructed a sanitary sewer extension.

6. Developer's Construction Drawings shall mean those drawings prepared by the Developer or his engineer and approved by the Authority to show the detailed design of the specific project including plan layout and design details.

7. Engineer shall mean the Consulting Engineer that represents the Authority. The term may also include a construction observer employed by the Authority or Engineer.

8. Equal shall mean equal as approved by the Engineer.

9. Lateral shall mean that part of the sewer system extending from a sewer located in the street or easement, to the right-of-way or easement boundary at which point the building sewer serving an improved property is connected. If there shall be no improvement on the property, the lateral shall be that part of the sewer system extending from said sewer to the right-of-way or easement boundary to a point of future connection to the building sewer, if and when said property is improved.

10. Specifications shall mean the "Standard Specifications for Developers" as adopted by the Authority.

11. Subdivision shall mean the division or redivision of a lot, tract, or parcel of land by any means into two or more lots, tracts, parcels, or other divisions of land.

12. Township shall mean Township of Limerick, Montgomery County, Pennsylvania.

13. Work shall mean labor, services, materials, and equipment as required for the successful completion of the project for the extension of sanitary sewer lines pursuant to the Authority.

C. Insurance

The Developer shall provide adequate protection against injury or loss arising from or in connection with the Work to be performed under this Agreement and any property affected. Developer shall make good such damage, injury or loss, whether incurred by an individual, personal property, or real property.

The Contractor shall purchase and maintain such insurance as will protect the Contractor from claims which may arise out of or result from the Contractor's operation, whether such operations be by the Contractor or any subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for those actions any of them may be liable. A Certificate of Insurance, or copies of the policies, shall be produced by Contractor upon request of the Authority or its Engineer which: (i) is written by an insurer qualified for business in Pennsylvania and satisfactory to the Authority; (ii) shall be for such amounts, not less than Five Hundred Thousand Dollars ($500,000) per person and One Million Dollars ($1,000,000) per occurrence, and providing no less than Five Hundred Thousand Dollars ($500,000) for property damage, as are satisfactory to the Authority; and (iii) names the Authority, the Engineer and the construction observer as additional insureds.

The Developer shall indemnify and hold harmless the Authority and its Engineer and their agents and employees from and against all claims, damages, losses and expenses, including attorneys' fees arising out of or resulting from the performance of the Work, provided that any such claims, damage, loss or expense (a) is attributable to bodily injury, sickness, disease, death, or to injury or destruction of

tangible property (other than the Work itself) including the loss of use resulting therefrom; (b) is caused in whole or in part by any negligent act or omission of the Developer, any Contractor or subcontractor, anyone directly or indirectly employed by them or anyone for whose actions any of them may be liable regardless of whether or not it is caused in part by the party indemnified hereunder. Developer shall save harmless the Authority and its Engineer from any and all claims against the Authority and its Engineer or any of their agents or employees by any employee of the Developer, any Contractor or subcontractor or anyone directly or indirectly employed by any of them or anyone for whose actions any of them may be liable, the indemnification obligation under this paragraph shall not be limited in any way by any limitation on any Contractor or subcontractor under workmens' compensation acts, disability benefits acts, and other employee benefit acts.

Additionally, the Developer shall save harmless the Authority and its Engineer from any and all claims against the Authority and its Engineer by any property owner adjacent to the sewer line installation or Limerick Township or the Commonwealth of Pennsylvania Department of Transportation, relative to the digging, cutting, patching, tunneling, and laying of asphalt and cement and resurfacing the area which have been dedicated to Limerick Township or the Commonwealth of Pennsylvania.

D. Conduct of Work and Safety

The Contractor shall make use of all reasonable means to maintain the normal flow of traffic on Township and State Highways during all phases of construction. Should it become necessary to close any street or highway, the Developer shall obtain permission to do so from the applicable governing agency including obtaining the PennDOT Highway Occupancy Permit and/or the Township's Road Opening Permit.

Caution shall be exercised at all times for the protection of persons and property in accordance with applicable laws and codes. Compliance with the safety

provisions of applicable laws and building and construction codes are completely the Developer's responsibility.

The Contractor shall take all precautions and furnish and maintain all guards, barricades, handrails, lights, and other appurtenances, etc., for the protection of the traveling public and property at or near the project site.

The Contractor shall be responsible for and shall see that all equipment, tools, and supplies are operated or handled in such a manner that at no time will they be permitted to contact electric, communication or other utility lines.

The Contractor shall be responsible for the safety, efficiency, and adequacy of his equipment, tools, supplies, materials, and methods and for any damage which may result from their failure or their improper construction, maintenance, or operation.

The Engineer will not be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, and Engineer will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Developer's Construction Drawings.

The Contractor shall take care to repair all facilities in the Township affected by construction. These works shall have an appearance or condition equivalent to or better than that condition which existed prior to construction.

E. Equipment and Materials

Whenever an item of equipment or material is designated by reference to a particular brand, manufacturer, or trade name in these Specifications, it is understood that an approved equal product may be substituted, if acceptable to the Engineer, unless substitutions are not allowed because of product standardization.

Each major item of equipment shall be inspected by a manufacturer's representative during installation and upon completion of the Work. The Developer shall supply the Authority with a certificate of such inspection.

F. Delivery, Storage, and Handling of Equipment and Materials

The Contractor shall:

1. Transport and handle products in accordance with manufacturer's instructions.

2. Promptly inspect shipments to assure that products comply with requirements and products are undamaged.

3. Provide equipment and personnel to handle and store products by methods to prevent soiling, disfigurement, or damage.

4. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weathertight, climate-controlled enclosures.

5. Protect products from vandalism by man or animal, contamination by dirt, dust or water, damage from heat or cold, and damage from direct sunlight.

G. Location and Protection of Existing Utilities

The streets and easements in which the sewer extension and appurtenances are to be constructed may contain existing underground utilities and structures. The data pertaining to size, location, and depth of the existing underground utilities and structures shall be shown on the Developer's Construction Drawings.

The Contractor shall make reasonable inspection to determine the existence of utilities and structures before commencing work. Developer shall be responsible and hold harmless the Authority for any damage to existing utilities or structures.

The Contractor will be responsible for locating all existing utilities including, but not limited to, water, steam, oil and gas mains, sanitary and storm sewers, communications and electric conduits which may be encountered during the construction operation. He shall also be responsible for locating all underground structures. He shall, at his own expense, arrange with the owners of such utilities relative to locating them. The Contractor shall be held responsible for providing adequate protection against damage to utilities encountered during the course of construction and shall be responsible for repair of any utilities damaged during the course of his construction. The Developer, his engineer, and Contractor are referred to and cautioned to comply with the requirements of PA Act 287, December 10, 1974 as amended.

All recorded or unrecorded lines shall be located on the ground with pipe locating equipment well ahead of the work at all times. All such locations shall be plainly marked by coded paint symbols on pavement or by marked stakes in the ground. Such locations shall be established at least 50 feet in advance of all trench excavation.

The Contractor shall conduct operations and take all special precautions necessary to protect equipment, utility lines, roadways and subsurface, submerged and overhead facilities which are to remain in place and undisturbed by the Work. The Developer and/or Contractor shall immediately notify the owner of the facilities or areas which are disturbed, damaged, or injured as a result of the Work, and determine the proper method of replacing or repairing the affected facilities at least to an equivalent condition which existed prior to the Work. The Contractor shall replace, repair, or restore the affected facilities or areas to at least an equivalent condition which existed prior to the Work or shall reimburse the owner of said facilities or areas for such expenses as the said owner may accrue to replace, repair or restore the affected facilities or areas.

H. Emergency Maintenance During Construction

The Contractor shall have available at all times, including nights and holidays, an emergency maintenance crew and a person of authority and responsibility to act in cases of emergency such as flooding, cave-ins, or other disorders, resulting from the construction of the Work. Such person(s) shall be made known to the Authority. The Developer will be responsible for the cost of any such emergency Work.

The Developer is responsible for all costs incurred for any emergency Work performed by the Authority or others on the Developer's behalf.

I. Observation

The Contractor shall allow for and assist as required in the observation of materials and workmanship and shall execute the Work in a systematic manner. The absence of the Engineer or a construction observer will not in any way lessen the obligation of the Contractor for construction in accordance with the Specifications.

Defective Work or Work not conforming to these Specifications is to be repaired or replaced to the satisfaction of the Engineer.

The cost of any observations performed by the Engineer, including the final inspection, shall be borne by the Developer.

J. Use After Testing

After the new sewer system has been tested and approved, the Authority may permit use of the completed facilities. Use prior to completion, however, will not imply final acceptance. The Developer shall be responsible for the maintenance of all completed facilities, whether used by the Authority or not, until the final inspection is made and for a period of eighteen months following acceptance of the facilities in dedication by the Authority.

K. Maintenance and Completion

Final inspection of the sewer extension shall not take place until final road construction is completed. The Developer may be requested to enter into a Maintenance Bond Agreement prior to the final inspection. Under such circumstances, the Developer shall escrow sufficient funds, in cash, as determined by the Engineer to repair, replace or reset manhole frames and covers that may be damaged prior to or during final paving operations. Developer shall be obligated to maintain and repair the line and trench, including paving for a period of eighteen (18) months and rebuild or replace the same in whole or in part if defective. Upon written notice from the Engineer or Authority, the Developer shall immediately authorize the Contractor to make any repairs that may be necessary. Depending on the urgency of the repairs, the Authority may allow a maximum of 72 hours to make these repairs. However, some repairs may require immediate attention and less than 72 hours will be required to make the repairs. If less than 72 hours will be required, then the maximum time for repairs will be given by the Engineer or Authority in written notice. If the Developer exceeds the maximum time to make the repairs, then the repairs will be made by the Authority at the expense of the Developer.

L. Final Acceptance of Work

Following acceptance of dedication by Authority, the Authority shall then become the owner of the facilities, subject to the duty of Developer to maintain, repair, rebuild, or replace the facilities (refer to Section I.K above) and the requirements set forth in the "Sewerage System Extension Policy".

II. PRODUCTS AND MATERIALS

A. General

All materials used in the Work shall be approved in advance by the Authority in accordance with requirements and procedures of Section VI entitled "Shop Drawings" as set forth in the Authority's Sewerage System Extension Policy.

Unless otherwise specified, all materials used in the Work shall conform to the requirements of the current specifications of the American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) and/or other specifications as noted in these Specifications. All materials shall be tested in accordance with the requirements of the specifications. It is understood and agreed that wherever the word "current" is used relative to the specifications and methods of testing, it refers to the standard or tentative standard in effect at the time when construction of the Work was initiated.

No material shall be used until it has been inspected and approved on the site of the Work. When required by the Engineer, any or all materials entering into the construction of any Work shall be tested by a reputable testing laboratory. Such inspection shall not relieve the Developer and/or Contractor of any of his obligations in this respect, and any defective material or workmanship shall be at all times liable to rejection when discovered, until the final completion of the Work.

B. Concrete

1. General

Base slabs, manhole bases, endwalls, curbs, sidewalks, miscellaneous reinforced structures and miscellaneous exposed mass concrete shall be Class A. Reaction and support blocking, cradles, encasements and miscellaneous buried mass concrete shall be Class C or better.

All concrete Work located within a State Highway Right-of-Way shall conform to the applicable provisions of Section 704 in PennDOT Publication 408.

Concrete mix shall have a consistency enabling it to be readily worked into all corners of the form and around all reinforcing by usual methods of

placing and consolidating without permitting segregation or excessive free water.

All concrete exposed to a wet, freezing atmosphere shall be air-entrained, and the air content shall comply with the requirements set forth in ACI-318 for air-entrained concrete.

Concrete mix shall be proportioned by an acceptable independent testing and/or inspection laboratory at the Contractor's expense. The design shall provide the following minimum 28-day compressive strengths:

a. Class A Concrete - 3000 psi @ 28 days.
b. Class C Concrete - 2000 psi @ 28 days.
c. PennDOT Concrete - in accordance with Section 704 in Publication 408.

Regardless of the strengths shown by testing, all Class A concrete shall be designed with a minimum cement content of six (6) sacks per cubic yard and all Class C concrete shall be designed with a minimum cement content of 4.2 sacks per cubic yard.

The slump of the concrete mix shall be one (1) to three (3) inches for Class A and two (2) to six (6)inches for Class C.

Concrete design mix shall be submitted to the Engineer for review before work commences. No concrete shall be placed until the Engineer has reviewed and accepted the design mix.

2. Cement

Cement shall be an acceptable brand of Portland Cement, ASTM C150, Type I. In the event field conditions require, and the Engineer finds it acceptable, a high-early strength Portland Cement, Type III may be used.

3. Concrete Aggregates

Fine aggregate shall be clean, hard, natural sand or manufactured sand, or a combination of both and shall conform to ASTM C33.

Coarse aggregate shall be hard, durable, uncoated crushed stone, gravel, or air-cooled blast-furnace slag conforming to ASTM C33. Maximum size of coarse aggregate shall not be larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear distance between reinforcing bars, whichever is least. In no case shall the maximum size exceed 1 1/2 inches.

4. Water

Water shall be clean, free from organic or vegetable matter, acid, alkali, or other injurious elements.

5. Ready-Mixed Concrete

Ready-mixed concrete may be used for all Work involving concrete providing it conforms to the requirements of ASTM C94, with the following conditions specified:

a.	Basis of Purchase	Net weight of the concrete in the batch as delivered.
b.	Materials	As listed in Sections B.2 and B.3.
c.	Quality	Developer responsible for concrete meeting requirement for compressive strength as listed in these Specifications.
d.	Mixing	Central, or transit-mixed.

6. Reinforcement

All reinforcing bars shall conform to ASTM A615, Grade 60.

7. Mortar

Composition of mortar shall conform to ASTM C270, Type S, using a portland cement cementitious material.

8. Non-Shrink Grout

Non-shrink grout shall be "Masterflow 713 Grout" manufactured by Master Builders, "Non-Shrink Five Star Grout" manufactured by U. S. Grout Corporation, or equal. Non-shrink grout shall be capable of meeting test requirements of ASTM C827. Non-shrink grout shall use Type II (sulfate resistant) cement for applications in contact with sewage. Liquid used in the preparation of the grout may consist of 50% water and 50% "antihydro" compound in order to achieve a suitable consistency for use.

C. Landscaping

1. Topsoil

Topsoil shall be a natural, fertile, friable soil, typical of productive soils in the vicinity, obtained from naturally well-drained areas, neither excessively acid nor alkaline, and containing no substances harmful to grass growth.

Topsoil shall not be delivered to the site in frozen or muddy condition.

Topsoil stockpiled during sewer trenching may be used if it meets the above requirements.

2. Lime and Fertilizer

Lime and fertilizer shall be of the composition and applied at the rate as recommended by the

Agricultural Agent of the Penn State Cooperative Extension in Montgomery County.

3. Seed Mixtures

Seed composition shall be in accordance with the following table:

a. Wetland Areas: Seed mixture applied at a rate of 30 lbs. per 1000 square yards:

Species	% of Weight
Tall Fescue	55
Kentucky Bluegrass	20
Perennial Ryegrass	15
White Clover	5
Switch Grass	5

b. Pasture/Meadow Areas: Seed mixture applied at a rate of 20 lbs. per 1000 square yards:

Species	% of Weight
Kentucky Bluegrass	50
Smooth Bromegrass	20
Timothy	20
Ladino Clover	10

c. Other Areas - Sunny: Seed mixture applied at a rate of 20 lbs. per 1000 square yards:

Species	% of Weight
Creeping Red Fescue or Chewings Fescue	30
Kentucky Bluegrass Mixture	50
Perennial Ryegrass Mixture	20

d. Other Areas - Shady: Seed mixture applied at a rate of 20 lbs. per 1000 square yards:

Species	% of Weight
Tall Fescue	70
Creeping Red Fescue or Chewings Fescue	30

e. Temporary Stabilization: Seed mixture applied at a rate of 10 lbs. per 1000 square yards:

Species	% of Weight
Annual Ryegrass	100

Seed shall be of an approved mixture, new crop, clean, high in germinating value and low in weed seed. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates relative to mixture purity and germinating value.

4. Sod

Sod shall be live, fresh, and of similar mix as used in seeding lawns. It shall be of suitable character for the purpose intended and for the soil in which it is to be planted.

D. Sanitary Sewer Pipe

1. Polyvinyl Chloride

a. Pipe and Fittings

The polyvinyl chloride (PVC) pipe for gravity sewers, 15-inch and smaller, shall be manufactured in accordance with ASTM D3034 having a minimum wall thickness in accordance with the following Standard Dimension Ratio (SDR):

Depth <15 feet: SDR 35
Depth 15 to 20 feet: SDR 26
Depth >20 feet: Use Ductile Iron Pipe

The PVC pipe for gravity sewers, 18-inch through 27-inch, shall be manufactured in accordance with ASTM F679.

The PVC pipe for force mains, subject to approval by the Engineer for small and/or temporary pumping stations shall be manufactured in accordance with ASTM D2241

with a minimum rating of SDR 26 (160 psi) unless a higher rating (i.e., lower SDR) is required because of the anticipated pressure and design life.

The pipe shall be "bell and spigot" type wherein the bell is integral to the pipe. For pipe with belled ends, the thickness of the wall in the bell may be considered satisfactory if the bell was formed on pipe meeting the requirements of the applicable standards.

Sanitary sewer laterals shall be SDR 35 PVC pipe and a minimum of six inches in diameter.

b. Miscellaneous

The pipe and fittings shall be joined by an elastomeric gasket system conforming to ASTM D3212 for gravity sewers and to ASTM D3139 for force mains.

The critical sealing dimensions of the bell, spigot and gasket shall be in accordance with the manufacturer's standard dimensions and tolerances.

The elastomeric gasket shall be rubber and shall comply with the physical requirements of ASTM F477.

Stoppers shall be provided for the open end of each wye fitting, lateral and manhole. This stopper shall be compatible to type of joint material being used.

2. Ductile Iron Pipe

a. Pipe and Fittings

Ductile-iron pipe shall be bell and spigot type, centrifugally cast and conforming to standard specifications of ANSI A21.51, with slip-on joint of type that employs a single

modified bulb-shape grooved rubber gasket to effect the joint seal. Inside contour of bell shall provide a seat for the gasket, and an internal bead in the socket shall fit into the groove in the gasket. Plain end of the pipe shall be slightly tapered to ease its sliding fit with the gasket when joint is being made. Standard bituminous coating shall be provided on the exterior of all pipe and fittings.

Pressure class 350 pipe is required for all ductile iron pipe gravity sewers and for all ductile iron force mains unless a higher rated class is required due to the expected external loading or internal pressure.

Fittings for ductile iron pipe may be either gray or ductile iron conforming to ANSI A21.10 for standard body and ANSI A21.53 for compact body gray and ductile iron fittings, with a 350 psi water pressure rating and shall be made with mechanical joint ends conforming to ANSI A21.11.

b. Miscellaneous

(1) Cement Lining

All pipe and fittings shall have a double cement mortar lining in accordance with ANSI A21.4.

(2) Internal Coatings

Interior surfaces of pipe and fittings shall be coated with a seal coat in accordance with ANSI A21.4.

E. Manholes

1. Coarse Aggregate

Coarse Aggregate shall be in accordance with the coarse aggregate specified in the section for Backfill and Pipe Bedding.

2. Steps

Manhole steps shall be extruded 6061-T6 aluminum as shown on the Construction Details or steel reinforced polypropylene steps as manufactured by M. A. Industries, Inc. (Model PS2-PF) or approved equal.

Portions of aluminum manhole steps which are to be embedded in concrete shall be protected by coating those portions with a mastic or other suitable protective coating, which will prevent corrosion due to galvanic action. Direct contact between the aluminum alloy step and any steel reinforcing bars or other dissimilar metal will not be permitted.

Manhole steps shall be cast into the walls of risers and conical top sections at the factory, and shall be aligned vertically and spaced so as to be on equal centers in the assembled manhole at a maximum distance apart of twelve (12) inches and extend out of the wall a minimum of seven (7)inches for cast-in-place walls and a minimum of six (6) inches for precast manholes. Steps shall be located a minimum of six (6) inches from the ends of riser and top sections, and shall be securely embedded in manhole risers and tops.

3. Frames and Covers

a. General

Castings shall be heavy duty gray cast iron, meeting ASTM A48 specifications, designed for H-20 loading as designated by AASHTO.

Castings shall be free from cracks, holes, swells, and other imperfections. All manhole castings shall be made accurately to the pattern and to the dimensions shown on the Construction Details, and shall be machined where necessary to secure perfectly flat and true surfaces. All lids which "rock" and do not lie solid after

construction is finished will be rejected and must be replaced.

No plugging, burning in, or filling will be allowed. Covers must fit the frames in any position.

b. Standard Manhole Frame and Cover

Standard manhole frames and covers shall conform to the dimensions and details on the Construction Details and be a standard casting. The cover shall be self-sealing utilizing a continuous O-ring rubber gasket within a dovetail groove. All manhole covers shall be inscripted with the phrase "DANGER SEWER -- DO NOT REMOVE COVER" consisting of cast-in raised letters which are a minimum of one (1) inch in height and width. Two (2) pick holes shall be located diametrically opposite and two (2) fixed lifting rings shall also be located diametrically opposite. Frame base shall have four (4) one-inch diameter holes at 90 degrees on the bolt circle to receive the anchor bolts.

The frame and cover shall be as manufactured by one of the following companies or approved equal:

(1) Syracuse Castings Sales Corporation (Model 1255/1039).
(2) Neenah Foundry Company (Model R-1788-A).

c. Watertight Manhole Frame and Cover

Watertight manhole frames and covers may be required at manholes which are located in areas prone to flooding, including manholes which are located in low-lying, flood-prone areas as well as manholes which are located along curbed roadways. The Authority may require the Developer to install watertight manhole frames and covers wherever the

Authority deems such installations to be required.

Watertight manhole frames and covers shall conform to the dimensions and details on the Construction Details and be a standard casting.

In addition to the features noted for the standard manhole frame and cover, the watertight manhole frame and cover shall include four (4) bolt holes in the frame and cover with 1/2 inch diameter bronze or stainless steel bolts.

The frame and cover shall be as manufactured by one of the following companies or approved equal:

(1) Syracuse Castings Sales Corporation (Model 1030/1204)
(2) Neenah Foundry Company (Model R-1916-F)

d. Insert

Inserts for surface water inflow prevention shall be the Parson Manhole Insert by Parson Environmental Products, Inc.. The type of insert shall be the deep bowl style with ventilation holes only (i.e., no pressure or vacuum relief valves). Material of insert shall meet the requirements of ASTM D1248, Class A, Category 5, Type III, with a finish thickness of 1/8" for High Density Polyethylene and shall have a corrosion-resistant nylon strap for easy removal. There shall be no gasket provided on the lip of the insert.

e. Anchor Bolts

Anchor bolts for bolting manhole frame to the precast manholes shall be made of 3/4-inch diameter galvanized steel.

f. Joint Material

Joint material for use between the manhole frame and manhole top shall be equal to that as specified for "Joint Material" in Paragraph 6.d of this section of the Specifications.

4. Precast Concrete Manholes and Components

a. General

A manhole shall be a minimum of four (4) feet in diameter for sewers up to and including 15-inch diameter. Larger diameter manholes will be required for sewers greater than 15-inch diameter in accordance with the Construction Details or for special circumstances.

The manhole structure shall conform to the requirements of ASTM C478 except that the joints shall be sealed with a preformed flexible joint sealant compound.

b. Risers and Top Sections

The top of base walls, the ends of reinforced concrete risers and the bottom ends of precast tops shall be so formed that when risers and tops are assembled with the base, they will make a continuous manhole. Joints shall be of such design as will permit effective joining and placement without irregularities in the interior wall surface of the manhole.

Manhole barrels shall consist of riser and top sections. The top section for a Type A manhole shall be an eccentric conical section with thickened upper walls with the smallest inside diameter equal to 24 inches to receive the manhole frame and cover. The top section for a Type B manhole shall be a

flat slab with an opening of 24 inches to receive the manhole frame and cover. No more than two (2) lift holes shall be cast in each barrel or top section.

Manholes shall be constructed by the wet process method and shall have a slump of 3 1/2 inches to 4 1/2 inches.

c. Bases

The bases shall be integrally cast and shall consist of a manhole bottom and a wall which shall extend a minimum of six (6) inches above the top of the highest inflowing sewer. The top of the base section shall be carefully formed to receive the tongue of the barrel section. There shall be a minimum distance of four (4) inches between the invert of the lowest outflowing sewer and floor of the precast base to provide for the construction of a formed invert and bench wall within the manhole. No more than two (2) lift holes shall be cast in the base.

d. Joint Sealant Compound

The joint sealant compound shall be a preformed flexible plastic compound conforming to FS SS-S-00210. The joint sealant compound shall be self adhering and cold applied and manufactured by A-Lok Products, Inc. ("Butyl-Lok"), K. T. Snyder Company, Inc. ("Ram-Nek") or approved equal.

Joint sealant compound shall be supplied in extruded rope form of suitable cross-section and of such sizes as to seal the joint space when the sections are set in- place. The sealing compound shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half to

facilitate application of the sealing compound.

e. Pipe Connections

The type and method of the pipe connection to the manhole base or section shall be in accordance with the following requirements and the Construction Details.

For a new manhole, an integral resilient pipe to manhole connection device shall be used conforming to ASTM C923.

For connection to an existing manhole, a removable flexible pipe to manhole connection assembly shall be used as manufactured by Press-Seal Gasket Corporation (Model PSX) or approved equal.

f. Coatings

Manhole sections shall be inspected and any minor imperfections patched before application of surface coatings.

Exterior precast manhole surfaces shall be coated with coal tar epoxy. Lift holes shall be filled first to prevent entry of the exterior coating. The coal tar epoxy coating shall be Bitumastic 300M by Kop-Coat Carboline Company or approved equal. At least two (2) coats shall be applied giving a total dry film thickness of a minimum of 16 mils.

Interior manhole surfaces shall be coated with two (2) coats of a white epoxy. The white epoxy coating shall be Hi-Gard Epoxy by Kop-Coat Carboline Company or approved equal. At least two (2) coats shall be applied giving a total dry film thickness of a minimum of 12 mils.

g. Grade Ring Assembly by Encapsulation Sleeve

A heat activated, high shrink membrane shall be applied to a manhole which has grade ring(s) to be buried to minimize infiltration while accommodating movement. The membrane shall consist of a crosslinked polyolefin backing coated with a protective heat activated butyl adhesive and include a separate closure strip for the overlap joint. The membrane shall be Wrapid Seal® as manufactured by Canusa or approved equal.

F. Pavements

1. Coarse Aggregate

Coarse aggregate shall conform to the applicable provisions of Section 703 of Publication 408 of the Commonwealth of Pennsylvania, Department of Transportation.

2. Bituminous Materials

Bituminous materials shall conform to the applicable provisions of Sections 305, 420, 421 and 702 of Publication 408 of the Commonwealth of Pennsylvania, Department of Transportation.

G. Pipe Bedding and Trench Backfill

1. Coarse Aggregate

Coarse aggregate shall conform to the applicable provisions of Section 703 of Publication 408 of the Commonwealth of Pennsylvania, Department of Transportation.

2. Select Granular Material

Select granular material (2RC) shall conform to the applicable provisions of Publication 408 of the Commonwealth of Pennsylvania, Department of Transportation.

3. Suitable Backfill Material

Suitable backfill material may consist of excavated material if free of stone larger than 8" in size (2" in size to a point 12" over top of pipe) and free of wet, frozen or organic materials. Suitable backfill material shall be capable of being compacted as specified in Section IV.C.1 "Compaction Tests for Soils".

4. Pipe Bedding

Pipe bedding will involve one or more of the following coarse aggregates as shown on the Construction Details:

a. AASHTO #8 (PennDOT 1B)
b. AASHTO #57 (PennDOT 2B)
c. PennDOT 2A

5. Trench Backfill

Trench backfill will involve the following aggregate or materials as shown on the Construction Details:

a. PennDOT 2A
b. Select Granular Material (2RC)
c. Suitable Backfill Material

III. CONSTRUCTION

A. Trench Excavation and Backfill

1. General

In open trenching on highways, the Contractor shall be governed by the conditions, restrictions, and regulations made by the appropriate agency having jurisdiction. All such regulations shall be in addition to the ones set down in these Specifications.

The Contractor shall excavate, protect, and backfill all trenches that may be necessary for

completing the Work. All excavation shall be in open trenches, unless the Engineer authorizes and directs otherwise. The use of excavation machinery will be permitted except in places where operation of same will cause damage to trees, buildings, or existing structures above or below ground; in which case, hand methods shall be employed. No tunneling, boring, or forcing will be allowed without permission from the Engineer. All existing pipes, poles, wires, fences, curbing, property line markers, and other structures which must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the Contractor. Trenches may be, in general, excavated and backfilled either by machinery, or by hand as the Contractor may elect, provided however, that the Engineer shall be empowered, wherever he shall decide that such necessity exists, to direct that hand excavation shall be done to the extent hereinafter specified.

Until final acceptance of the Work, the Contractor shall continuously maintain adequate protection of the Work and Work in progress from damage, and shall protect from loss or damage machinery, equipment, materials and supplies being handled from loss or damage arising out of or in connection with the prosecution of the Work. He shall make good any such loss or damage. He shall adequately protect adjacent private and public property as provided by law.

The Contractor shall assume all risks of loss or damage of any kind to any vehicles, machinery, equipment, materials or supplies which he shall provide in doing the Work.

The Contractor shall conduct the Work in such a manner as to adequately protect property owned by others on or about the Owner's premises from damage by the construction operations.

The Contractor shall implement and maintain an erosion and sedimentation control plan for the

areas affected by earthmoving activities as approved by the Montgomery County Conservation District.

During the progress of the Work, the Contractor shall conduct the operations and maintain the area of the activities so as to minimize the creation and dispersion of dust.

Wetland soils upon excavation shall be segregated for eventual use in backfilling the wetlands area.

2. Removal of Existing Pavement and Storage of Materials

The Contractor shall remove all pavements, road surfaces, curbing, driveways, and sidewalks within the lines of excavation. Portland cement concrete pavements shall be opened by sawing and asphalt pavements by cutting to neat, straight lines with channeling machine, hand-operated pneumatic tools, or by such other methods as will furnish a clean cut in the pavement and base without undue shattering. All such Work as above designed shall be done at the Developer's expense and in accordance with the rules and regulations of the Township. The use of a weight dropped on pavement for breaking will not be allowed except by written permission of the Engineer.

The Contractor shall grub and clear the surface and remove all surface materials, of whatever nature, over the line of the trench; and he shall properly separate and classify the materials removed, store, guard, and preserve such of said materials as may be required for use in backfilling, resurfacing, repaving, or for other purposes. All the rock, earth, sand, curbing, gutter, and flagstones, and all sectional paving units which may be removed, together with all materials taken from the trenches, shall be stored, in such parts of the street or roadway, or such suitable place, and in such manner, as shall be approved. The Contractor shall be responsible for any loss of,

or any damage to paving materials through careless removal or neglectful or wasteful storage, disposal, or use of same.

In the business districts or in streets that are important thoroughfares, or in narrow streets or other places so designated by the Engineer, the material excavated shall, upon order of the Engineer, be removed from the street as soon as excavated. For grass areas, the material subsequently excavated shall be used to backfill the trench previously excavated.

In case more material is excavated from any trench than can be backfilled over the completed pipelines or can be stored on the street or within the limits of the right-of-way, while leaving space for the traffic and drainage as herein provided, the excess material shall be removed to some convenient place, provided by the Developer. The Contractor shall bring back so much of the material so removed, as may be required to properly backfill the trench, if of the proper kind; or, if so directed by the Engineer, the Contractor shall furnish such other material as may be necessary.

All surplus excavated material shall be removed by the Contractor who shall dispose of such surplus wherever he can arrange for rights to fill.

When it is necessary to haul soft or wet material over the streets, the Contractor shall provide suitable tight vehicles.

3. Excavation

Perform all excavation of every description and of whatever substances encountered to the depth shown on the Developer's Construction Drawings.

All excavation, unless otherwise authorized by the Engineer, shall be made by open cut.

Where damage is liable to result from withdrawing sheathing, the sheathing shall be left in place.

Care shall be taken not to excavate below the depth specified.

Where the bottom of the trench, by mistake of the Contractor, is taken out to a greater depth than specified for a given pipe bedding, the trench shall be brought back to grade by filling with coarse aggregate as to comply with the bedding requirements.

Refilling with earth to bring the bottom of the trench to the proper grade will not be permitted.

During installation, upon encountering quicksand or a wet spongy material, the Contractor shall determine the actual depth of the soft material. Once the depth of the soft material has been determined, one of the following methods of construction work shall be used as approved by the Engineer:

a. Excavation of the soft material and replacement with a coarse aggregate foundation.

b. Concrete cradle or encasement.

c. Other method proposed by the Contractor and approved by the Engineer.

The trench for the pipe line installation shall not be opened for a distance of more than 200 feet at any one time. At no time will the Contractor be permitted to leave the trench open at the end of a working day.

If concrete is to be installed for a pipe cradle or encasement, the required length of trench may be left open with the Engineer's approval, provided that all trenches are properly secured and protected.

4. Accommodation of Traffic

The Contractor is advised that strict adherence to PennDOT Publication 408 and Chapter 459, "Occupancy of Highways by Utilities" of the Pennsylvania Code, Title 67 is mandatory on all Work being done in the State Highways.

The Contractor shall comply with all State, Township, or local regulations concerning opening of trenches in streets and highways.

Unless otherwise directed by the PennDOT inspector, one traffic lane must be maintained on all State Highways, in order to permit one-way traffic.

Absolutely no equipment or material may be left within State Highways at the end of the working day.

Trenches in State Highways will be completely closed at the end of the working day.

The Contractor shall not close or obstruct any portion of a street, road, or private way without obtaining permits therefore from the proper authorities. If any street or private way shall be rendered unsafe by the operations, the Contractor shall make such repairs or provide such temporary ways or guards as shall be acceptable to the appropriate authority.

The Developer and/or Contractor shall assume full responsibility for the maintenance and restoration of those roadways within the construction area and also those roadways on which equipment must operate to reach the construction area.

Street, roads, private ways, and walks not closed and where trenches/construction activity takes place shall be maintained passable. The Developer and/or Contractor shall assume full responsibility for the adequacy and safety of provisions made.

The Developer and/or Contractor shall, 48 hours in advance of closing any street, notify the Township Police Department, local Fire Company, local School District, local Ambulance Service and affected property owners, in writing, with a copy to the Authority and Engineer. He shall cooperate with the Township in the establishment of alternate routes and, at his own expense, shall provide adequate, plainly marked detour signs. The signs shall be as required by the agency that has jurisdiction over the roadway.

For the proper control of traffic, the Contractor shall provide an adequate number of persons.

5. Accommodation of Drainage

The pipe trench must in all cases be kept substantially free from storm, surface and subsoil water or sewage, so that all concrete, masonry and joint materials may have ample time to set and harden. No joints shall be made under water.

The Contractor shall provide and place all necessary pipes, flumes or other channels of adequate size to carry temporarily all streams, brooks, stormwater, or other water which may flow along or across the pipe line excavation. All pipes, flumes or channels thus utilized shall be tight so as to prevent leakage into the trenches.

Gutters, sewers, drains, and ditches shall be kept open at all times for surface drainage. No damming or ponding of water in gutters or other waterways will be permitted, except where stream crossings are necessary and then only to an extent which the Engineer shall consider necessary. The Contractor shall not direct any flow of water across or over pavements except through approved pipes or properly constructed troughs, and he shall, when so required, provide pipes or troughs, of such sizes and lengths as may be required, and place the same as directed. The grading in the vicinity of trenches shall be

controlled so that the ground surface is properly pitched to prevent water running into the trenches.

In open water courses, ditches, or pipes, encountered during the progress of the Work, the Contractor shall provide for the protection and securing of a continuous flow in such courses or pipes and shall repair any damage that may be done by reason of them.

6. Pumping

The Contractor shall keep all excavation free from water while pipe installation is in progress, and to such extent as may be necessary while excavation alone is being carried on. The Contractor shall build all dams and other devices necessary for this purpose, including lowering the water table below trench bottom by well points and pumping, and provide and operate pumps of sufficient capacity for dewatering the excavations. The Contractor shall provide for the disposal of the water removed from excavations in such manner as shall not cause injury to the public health, to public or private property, to the work of other contractors, to any portion of the Work completed or in progress, or produce any impediment to the use of highways, roads, lanes, and streets by the public. Silt laden water shall be passed through sediment traps, filters or other methods acceptable to the Engineer.

7. Explosives and Blasting

Blasting, when needed for rock excavation, shall be done in accordance with all Township ordinances, State and Federal laws and regulations relating to the transportation, storage, handling and use of explosives.

The Contractor shall provide any required blasting bond to PennDOT prior to blasting in State Highways in accordance with PennDOT Regulations. Blasting within a water course or

body of water will require approval by the PA Fish Commission.

The Contractor shall be responsible for injury to persons or property damage that may result from his use of explosives, and the exercise of, or failure to exercise control on the part of the Engineer shall in no way relieve him of responsibility for injury or damage resulting from its use. A pre-blast survey of structures and wells within 500 feet is required.

All blasting shall be done under the supervision of a competent blasting expert, and subject to the State, County, or Township regulations for blasting. Whenever any pipe main or conduit is encountered in the trench, the right is reserved to direct that all rock within a designated distance as established by the utility owner of the same be removed by some method other than blasting.

8. Tunneling

Prior to undertaking any tunneling, the Contractor shall have a professional engineer, licensed to practice in Pennsylvania, prepare a design and outline the proposed tunneling methods, procedures, and shoring requirements to be followed. An informational copy of these data shall be furnished to the Engineer for review before beginning the tunneling operation. Approvals from all appropriate agencies must be obtained before beginning tunneling.

Tunneling shall be limited to approved locations shown on the Developer's Construction Drawings.

9. Embankment

Where embankment is necessary to support the foundations of pipelines, it shall be made to the height, width, and slopes shown on the Developer's Construction Drawings or as directed. The entire embankment shall be made prior to the

construction of the pipeline or the foundation thereof.

After carefully grubbing and clearing the ground, removing all loose rock and stone, and all muck and improper material, the embankment shall be built up of material conforming to the requirements for backfill as set forth in the materials section of these Specifications.

In case material which is unsatisfactory for the foundation of an embankment is encountered, said material shall be removed to such depth, and for such length and width, as may be required to achieve an adequate bearing capacity of the subsoils as determined by the Engineer.

10. Pipe Bedding

a. General

Take care to avoid contact between the pipe and compaction equipment. All tamping and vibration shall be done by hand between the trench wall and pipe in order to consolidate the coarse aggregate particularly the haunch material below the springline of the pipe.

Do not use compaction equipment directly over the pipe while placing the pipe bedding to insure that such equipment will not damage or disturb the pipe.

Pipe bedding shall, in all cases, extend up until one (1) foot of cover has been built up over the pipe.

b. Coarse Aggregate Cradle

Ductile iron pipe shall be supported on a coarse aggregate cradle. This cradle shall be constructed in accordance with the Construction Details. The coarse aggregate shall be placed in the trench for its full width to uniformly support the pipe at the required line and grade. Suitable recesses

shall be provided in the coarse aggregate to permit adequate clearance for bells, couplings, or similar projections.

Cradle material shall be spread and compacted with tampers until the bedding has reached the spring line of the pipe.

The balance of the bedding to one (1) foot above the pipe shall be PennDOT 2A for Township roads, Select Granular Material (2RC) for State highways and suitable backfill material for easements or grass areas.

c. Coarse Aggregate Encasement

All PVC pipe shall be encased in coarse aggregate. This encasement shall be constructed in accordance with the Construction Details. The coarse aggregate shall be placed in the trench for its full width to uniformly support the pipe at the required line and grade. Suitable recesses shall be provided in the coarse aggregate to permit adequate clearance for bells, couplings, or similar projections.

Encasement material shall be leveled over the width of the trench prior to backfilling.

Coarse aggregate below the springline of the pipe shall be AASHTO #8 (PennDOT 1B) in roads and AASHTO #8 (PennDOT 1B) or AASHTO #57 (PennDOT 2B) if trench water within easements. The balance of the encasement to one (1) foot above the pipe shall be PennDOT 2A in Township roads, Select Granular Material (2RC) in State highways and AASHTO #8 (PennDOT 1B) or AASHTO #57 (PennDOT 2B) if trench water within easements.

d. Concrete Encasement

Where specified or required in the field, the pipe shall be supported by a concrete encasement.

The trench shall be excavated to a minimum depth of six (6) inches below the bottom of the pipe or as shown on the Construction Details. The excavated space shall then be completely filled with, and the entire pipe encased in, concrete such that the concrete encasement measures a minimum six (6) inches on all sides of the pipe. The total minimum width of the concrete encasement shall equal the width of trench excavation. Concrete shall be in accordance with the requirements in these Specifications. No backfilling of the trench shall begin until a minimum time period of 24 hours has elapsed after the encasement has been poured unless high early strength concrete has been used. Steel reinforcing, if required, shall be as shown on the Developer's Construction Drawings.

e. Concrete Cradle

Where unstable conditions are encountered, the pipe shall be supported by a concrete cradle. Concrete cradles shall be installed where no suitable supporting solid or rock stratum exists within two (2) feet of the bottom of the pipe.

The concrete cradle shall be furnished and installed equal to the "Concrete Encasement", except that only that portion of the encasement at and below the springline of the pipe shall be poured, forming a true cradle under the bottom half of the pipe.

The balance of the bedding to one (1) foot above the pipe shall be as specified elsewhere.

11. Backfilling

a. General

No backfilling shall be done before the Engineer gives permission. After pipes have been checked for alignment and bedding, the backfilling may be started. Backfill material may be deposited in trench either by hand or machine. Sufficient number of men shall be available to spread the backfill in uniform layers.

At least 36 inches of cover over the pipe shall be provided before using a trench roller or hydraulic plate tamper (i.e., hoe-pak).

Wetlands areas shall be backfilled in the same order as excavated from the segregated stockpile. The wetlands topsoil containing the root materials shall be returned to the wetlands area.

b. Non-Traffic Areas

(1) Initial Backfilling of PVC Pipe

This portion of the pipe trench shall be backfilled with coarse aggregate to provide a coarse aggregate encasement, installed as described under Section III A.10.c.

When concrete cradle is used, the initial backfill will start at the top of the concrete and then continue as specified above.

When concrete encasement is used, the initial backfill of coarse aggregate will not be required.

(2) Initial Backfilling of Ductile Iron Pipe

This portion of the pipe trench shall be backfilled to provide a coarse aggregate cradle as specified in Section III A.10.b.

When either coarse aggregate or concrete cradle is used, the initial backfill will start at the top of the coarse aggregate or concrete and then continue as specified previously.

When a concrete encasement is sued, the initial backfill of suitable backfill material will not be required.

(3) Backfilling Trench to Finished Grade

After initial backfilling has been compacted as specified above, the remainder of the trench shall be backfilled with suitable material. When the material excavated from the trench is deemed unsuitable for backfilling, the Contractor shall supply and install either suitable material from outside sources or, at his option, Select Granular Material.

(4) Settlement

If settlement occurs, additional backfill shall be deposited and mechanically compacted to the required elevation.

c. Traffic Areas Other than State Highways

Backfill shall consist of PennDOT 2A coarse aggregate for existing paved areas and consist of suitable backfill -material for new paved areas as shown on the Construction Details.

d. State Highways

(1) PennDOT Requirements

Backfilling in State Highways shall be in accordance with Pennsylvania Department of Transportation Regulations, 67 PA Code, Chapter 459, governing "Occupancy of Highways by Utilities".

(2) Initial Backfilling of PVC Pipe

This portion of the trench shall be backfilled with coarse aggregate to provide a coarse aggregate encasement, installed as specified previously.

When a concrete cradle is used, the initial backfill will start at the top of the concrete and then continue as specified previously.

When a concrete encasement is used, the initial backfill of crushed stone will not be required.

(3) Initial Backfilling of Ductile Iron Pipe

This portion of the pipe trench shall be backfilled to provide a coarse aggregate stone cradle as previously specified.

When either coarse aggregate or a concrete cradle is used, the initial backfill will start at the top of the coarse aggregate or concrete and then continue as specified previously.

When coarse aggregate or concrete encasement is used, the initial backfill of select backfill material will not be required.

(4) Backfilling Trench to Underside of Paving After Initial Backfilling

The trench must then be backfilled with Select Backfill Material (2RC) compacted in layers not to exceed eight inches up to the bottom elevation of the pavement structure.

e. Areas With Unsuitable Supporting Soil

In all bedding conditions where a suitable supporting soil or rock stratum occurs at a depth greater than required on the Developer's Construction Drawings but less than two (2) feet below the pipe or where moderately unstable soil conditions are encountered or where the trench is excavated below the specified depth or where required by the Engineer, the foundation shall be modified as follows:

(1) Except in the case of over-excavation where no extra excavation will be required, the trench shall be excavated to the depth necessary to reach the suitable supporting stratum. Coarse aggregate shall be spread in four-inch layers, and each layer shall be compacted with 20-pound hand or pneumatic tampers.

(2) The foundation shall carry vertically from the supporting stratum up to the required level depending on the pipe diameter and the type of bedding specified.

12. Responsibility for Condition of Excavation

The Contractor shall be responsible for the condition of all excavations made by him, at whatever time and under whatever circumstances that may occur.

The neglect, failure, or refusal to order the use of bracing or sheeting, or a better quality, grade, or

section, or larger sizes of steel or timber, or to order sheeting, bracing, struts, or shoring to be left in place, or the giving or failure to give orders or directions as to the manner or methods of placing or driving sheeting, bracing, jacks, wales, rangers, etc., shall not in any way or to any extent relieve the Developer of any responsibility concerning the condition of excavation or of any of his obligations, nor shall any delay, whether caused by any action of the Authority, or his agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve the Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of his obligations relating to injury of persons or property.

13. Protection of Property and Structures

The Contractor shall, at his own expense, sustain in their places, and protect from direct or indirect injury, all trees, shrubs, lawns, landscaping, pipes, tracks, walls, buildings, and other structures or property in the vicinity of his Work, whether above or below the ground, or that may appear in the trench. The Contractor shall at all times have a sufficient quantity of timber and plank, chains, ropes, etc., on the ground and shall use them as necessary for sheeting his excavation and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened.

The Contractor shall take all risks attending the presence or proximity of pipes, poles, tracks, walls, buildings, and other structures and property, of every kind and description, in or over his trenches, or in the vicinity of his Work, whether above or below the surface of the ground; and he shall be responsible for all damages by his Work, to any of them, or to any person or property by reason of injury to them, whether such structures are or are not shown on the Developer's Construction Drawings.

Where necessary, in order to keep one side of the street or roadway free from any obstruction or to keep the material piles alongside of the trench from

falling on private property outside the right of way, a safe and suitable fence shall be placed along the trench.

The Authority reserves the right to stop the excavation or any other part of the Work, and to require the Developer to complete the Work and the backfilling up to such a point as the Engineer may direct before proceeding further with the excavation.

14. Removal of Obstructions

The Contractor shall not interfere with any persons, firms, or corporations, or with the Authority in protecting, removing, changing, or replacing their pipes, conduits, poles, or other structures; but he shall allow said persons, firms or corporations, or the Authority, to take all such measures as they may deem necessary or advisable for the purpose aforesaid, and the Contractor shall thereby be in no way relieved of any of his responsibilities.

15. Clearing Street, Cleaning Up, and Repairs

When backfilling in paved areas, the backfill material shall be placed or stored on the side of the trench which is farthest from the portion of road which will remain open to traffic during construction unless otherwise authorized by the Township or PennDOT and in such a manner that there will be no interference with the flow of water in any gutter, drain, pipe, culvert, ditch, or waterway. The remaining excavated material must be removed from the site.

The Contractor shall be responsible for maintaining roads and highways in a clean and dust-free condition insofar as the dust and dirt related to his Work. Periodic and final sweeping of roads shall be required.

Before final acceptance of the Work, the Contractor shall, by means of a drag or by flushing, clear the sewers of any mortar, bituminous compound, dirt, or other refuse that may have been left or accumulated in the sewers. All manholes, inlets, and other structures shall be cleared of all forms, scaffolding,

centering, surplus, mortar, rubbish, or dirt and left in a clean and proper condition.

All surplus material, tools, equipment, and temporary buildings shall be removed from the site of the Work, and all street surfaces, gutters, walls, lawns, right of way, or other property shall be restored to at least an equivalent condition as originally found.

The Contractor shall repair any and all damage he caused to the street, sidewalk, or adjoining property.

16. Sheeting, Bracing, and Shoring

All timber plank used for sheeting and sheet piling and all timber used for braces, shores, and stringers or waling-strips shall be sound, straight, free from cracks, shakes, and large or loose knots, and of the required dimensions throughout. Plank shall be tongued and grooved or grooved and splined, if so required.

B. Concrete Installation

1. Delivery

A delivery ticket shall be submitted with each batch at the time of delivery. Failure to render such ticket to the Contractor's job superintendent shall automatically be cause for rejection of the concrete. The delivery ticket shall show the following:

a. Name and location of concrete batch plant.

b. Quantity of concrete.

c. Design strength.

d. Slump.

e. Time that truck left batch plant.

f. Time that truck arrived at site.

The Contractor's job superintendent shall write on the back of the delivery ticker:

a. The time of deposit of the concrete from the truck.

b. The place of deposit of the concrete.

The completed delivery ticket shall be delivered to the Engineer.

No concrete shall be deposited on the job when it has contained its mix water longer than 60 minutes.

No mixed or agitated concrete shall be used which has remained in the drum, truck agitator, or truck mixer more than ten minutes without mechanical agitation.

The interval between loads shall be controlled in order that concrete in place shall not become partially hardened prior to placing succeeding batches and in no case shall exceed 20 minutes.

2. Placing

Before placing concrete, all construction debris, water, and ice shall be removed from the places to be occupied by the concrete.

Rock surfaces upon which concrete is to be placed shall be level, free from oil, water, mud, loose semi-detached or unsound rock fragments, and rough enough to assure bond with concrete.

When reinforcing bars are required, said bars shall be securely tied to prevent displacement during the pouring operation.

Concrete shall be deposited in approximately horizontal layers not to exceed 18 inches in thickness to avoid flowing.

Falling concrete shall be closely confined in a drop chute of the proper size to within two or three feet of the place of deposit in the forms and the final drop must be vertical to avoid segregation of aggregates. In no case shall concrete be deposited

from a height that will cause separation of the aggregates.

Concrete shall be mixed in such quantities as required for immediate use and shall be placed while fresh before loss of slump occurs. Retempering by adding water to restore slump lost during excessive mixing or due to too long a lapse of time since initial mixing will not be permitted.

All slabs shall be placed for full thickness in one operation without any change in proportions.

3. Temperature of Concrete

Concrete, when deposited shall have a temperature ranging between a minimum of 50 degree F and a maximum of 90 degree F.

When the temperature of the surrounding air is below 40 degree F or above 90 degree F, concreting shall be done in accordance with the recommendations noted in ACI-306 and ACI-305, respectively.

4. Protection of New Work

All freshly placed concrete shall be adequately protected from mechanical injury or by action of the elements until such time as the concrete is thoroughly set.

All groundwater shall be kept away from newly poured concrete until the concrete has properly set.

5. Curing

Curing shall be started immediately upon completion of the finishing operation. Curing shall continue uninterrupted for a minimum period of 14 days unless a longer period is hereinafter specified. - Rapid drying upon completion of the curing period shall be prevented. At no time during the curing period shall the temperature of the concrete be permitted to drop below 40 degree F.

6. Defective Concrete

Defective concrete is defined as concrete in place which does not conform to strength, shapes, alignments, and/or elevations as shown on the Developer's Construction Drawings.

All defective concrete shall be removed and replaced in a manner meeting with the Engineer's satisfaction.

C. Sanitary Sewer Installation

1. General

The requirements apply to the installation of all sanitary sewers to be constructed, including interceptor sewers, collection sewers, force mains, and service connections of whatever size, material, or type required as designated on the Developer's Construction Drawings. PVC pipe shall not be permitted for a force main (ductile iron pipe only) except for small or temporary pumping stations subject to approval by the Engineer.

2. Materials

Gravity sanitary sewers and force mains shall conform to the requirements of the Materials Section of these Specifications. Gravity sanitary sewers shall meet or exceed the following requirements based on depth from finished grade to pipe invert.

Depth	Material	Class
<15 feet	PVC	SDR35
15-20 feet	PVC	SDR26
>20 feet	Ductile Iron	P.C.350

The same material type and class shall be utilized for the entire sewer segment between manholes.

3. Construction Methods

a. Lines and Grades

Pipes shall be laid true to the lines and grades shown on the Developer's Construction Drawings. The grade shown on the profile is the invert to which the Work must conform. Work not conforming to the grade shall be corrected.

The grade and alignment of the pipe shall be done by laser method or another method acceptable to the Engineer.

The Contractor is responsible for maintaining the line and grade. The pipe shall be checked at each manhole to assure that it is on the correct line and grade.

The locations of the proposed lines must be shown on the Developer's Construction Drawings.

Approximate depths must be shown on the Developer's Construction Drawings.

The Engineer reserves the right to make changes in lines and grades of pipe lines and in locations of pipes and manholes when such changes may be necessary or advantageous.

b. Laying Pipe

After the trench has been brought to the proper grade as heretofore specified, the pipe and specials shall be laid.

Each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses excavated to accommodate bells and-joints. The interior of all pipe shall be thoroughly cleaned of all foreign matter, before being lowered in the trench, and shall be kept clean during laying operations by means of plugs or other approved methods. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when

trench conditions, or the weather, is unsuitable for such work. In all cases, water shall be kept out of the trench until the concrete cradle or encasement, where used, has properly set. The spigot shall be centered in the bell and the pipe pushed into position and brought into true and specified alignment. Except where necessary in making connections with other lines, pipe shall be laid with the bells facing in the direction of laying and for lines on an appreciable slope, bells shall face upgrade.

Care must be taken to fit the joints together properly so that the centers of the pipes shall be in one and the same straight line, and so as to give an annular opening of even thickness, all around between spigot end of pipe and the socket end of specials and fittings. Every precaution necessary to obtain watertight construction for all joints must be taken. This same precaution must be taken for all connections with manholes.

c. Handling of Ductile Iron Pipe

Pipe and accessories shall be handled in such a matter as to insure delivery on the work site in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. No other pipe or material of any kind shall be placed inside of any pipe or fitting at any time after the coating has been applied.

d. Handling of PVC Pipe

PVC sewer pipe and fittings may be stored either inside or outside. If it is stored outdoors for long periods, it shall be protected from direct exposure to sunlight.

PVC sewer pipe and fittings shall be stored in such a way so that the surfaces to be mated are protected from physical damage and are kept as clean as possible.

The pipe shall be stored by providing support at each end and intermediate support at five-foot

intervals along the length of the pipe. The pipe shall be stored in such in such a way as to prevent sagging or bending.

e. Specials (Wye & Tee-Wye Branches)

Wherever necessary, the Contractor shall lay wye or tee-wye branches of the same material and strength as the sewer main for the purpose of making lateral connections. The wye or the tee-wye branches shall be laid at an angle as shown on the Construction Details so as to insure that the invert of the lateral at the point of connection to the bend preceding the wye or tee-wye branch is at or above the crown of the sewer main.

The spur of the wye or tee-wye branch shall be supported by coarse aggregate for the type of pipe used in accordance with the Construction Details. Wye or tee-wye branches shall not be backfilled until the horizontal location from the downstream manhole has been recorded for eventual submission on the record drawings.

f. Sewer Laterals

The Contractor shall be responsible for installing sewer laterals from the sewer main to the road right-of-way line or easement line. The building sewer shall be installed from the right-of-way line or easement line to the building in the presence of the Township inspector. The sewer lateral shall not be backfilled until the distance from the downstream manhole, length and depth at the end and any other pertinent horizontal directional information have been recorded for eventual submission on the record drawings.

Sewer laterals under concrete roads of a State Highway shall be made in tunnel when required. Backfill in tunnel shall be made with concrete to meet the requirements of PennDOT.

g. Deep Cut Laterals

Where required, deep cut laterals shall be constructed as per the Construction Details. All pipe shall conform to the Specifications. Care shall be taken to have all the joints perfectly made and the alignment correct.

h. Stoppers

Factory stoppers shall be securely installed in the open end of each wye or tee-wye fitting, lateral and manhole stub. The stopper shall make a watertight closure.

i. Protection and Keeping Pipe Clean

The Contractor shall also take any and all measures to keep the interior of the pipe clean and free from deposits and protect the pipe from damage.

If the pipe is damaged from any cause or becomes either partly or completely filled with dirt, stones, sand, or other debris, the Contractor shall make all necessary repairs and remove at his own expense all such material.

j. Installing Ductile Iron Pipe

Cutting of pipe for closure pieces or for other reasons shall be done in neat and workmanlike manner by a method which will not damage the pipe. All cutting of pipe shall be done by means of mechanical cutters of an approved type or types. Wheel cutters shall be used wherever practicable.

Before lowering and while suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective, damaged or unsound pipe will be rejected.
The gasket seat in the socket and the gasket should be wiped with a cloth. The gasket should be placed in the socket with the large round end entering first. It can then be sprung into the

gasket seat so that the groove fits over the bead in the seat. A thin film of lubricant should then be applied to the inside surface of the gasket that will come in contact with the entering pipe. Only nontoxic vegetable soap lubricant as recommended by pipe manufacturer shall be used. Mineral oil or petroleum base lubricant shall never be used.

The plain end of the pipe to be entered should be wiped clean and placed in approximate alignment with the bell of the pipe to which it is to be joined. In some cases it might be desirable to apply a thin film of lubricant to the outside of the plain end for about one inch back from the end. When sub-freezing temperatures prevail, the joint should assemble easier if lubricant is applied only to the gasket. After lubrication, the plain end of the pipe should then be lifted and started into the socket so that it is in contact with the gasket. The joint should be made up with entering pipe deflected at an angle.

The joint should be made by exerting sufficient force on the entering pipe so that its plain end is moved past the gasket (which is thereby compressed) until it makes contact with the base of the socket. This can be accomplished by one of the methods recommended by the pipe manufacturer, by crowbar, fork tool, or jack-type tool.

When pipe is cut in the field, the cut end shall be conditioned so that it may be used to make up the next joint. The outside of the cut end should be tapered back about 1/8-inch at an angle of about 30 degrees with the center line of the pipe by using a coarse file or a portable grinder. The operation removes any sharp, rough edges which otherwise might injure the gasket.

When installing rubber gasket joint pipe in below freezing temperatures, keep lubricant and gaskets workable by leaving them in a hot water bath when not actually in use, or in a heated storeroom.

Before placement in the field, all areas abraded in transit will be touched up with two (2) coats of coal tar epoxy using any additional bonding agent to obtain a proper bond as required by the coating manufacturer.

k. Installing PVC Pipe

(1) Joints

The joints shall be assembled in accordance with the manufacturer's recommended procedure.

Lubricants, if necessary for the assembly of the elastomeric gasket joint, shall not support bacterial growth nor have any deteriorating effect on pipe, fitting, or gasket materials and shall be the type recommended by the pipe manufacturer.

(2) Pipe Installation

Installation shall be made in accordance with ASTM D2321.

Any field cutting and fitting of the PVC plastic sewer main shall be done in accordance with procedures and techniques specified by the pipe manufacturer.

The pipe and fittings shall be installed in a coarse aggregate bedding all as specified in the section for earthwork.

During the installation and backfill of the pipe, care must be taken to prevent movement of the pipe.

l. Force Main Construction

Bends and fittings should be shown in sufficient detail to indicate approximately what is required to install the force main to the horizontal and vertical alignments shown on the Developer's Construction Drawings.

Deflections from a straight line or grade, made necessary by vertical curves or horizontal curves or offsets, may be made with the pipe except that the deflection shall not exceed five degrees for sizes through twelve inches. If the required alignment requires deflections in excess of those specified above, the Contractor shall either provide special bends or a sufficient number of shorter lengths of pipe to provide angular deflections within the limit set forth above.

For PVC pipe the joint deflection shall not exceed the recommendation of the pipe manufacturer.

All horizontal and vertical changes of alignment and grade associated with fittings shall be suitable anchored with thrust blocks and/or restrained joints. Details of these items should be shown on the Developer's Construction Drawings.

D. Manhole Installation

1. General

a. Schedule

Manholes shall be constructed promptly as the sanitary sewer construction work progresses to and proceeds from each manhole location. As soon as the manhole is completed, the Contractor shall remove all loose mortar and debris.

b. Ground Water

Manholes which admit ground water after completion must be repaired to the satisfaction of the Engineer. The Contractor shall use extra care in installing/inserting pipes in the concrete base to obtain watertight joints.

c. Drop Connections

In all manholes where the grade line of one sewer is two (2) feet or more higher than that of the other or where specifically noted on the

Developer's Construction Drawings, the connection shall be made by means of a drop connection. Pipe and specials used shall conform to the piping specifications and/or as shown on the Construction Details. Concrete for encasing the drop pipe shall be Class "C" poured against undisturbed earth or erected forms. For drop connections where the grade line of one sewer is five (5) feet or more higher than that of the other, the concrete encasement shall be limited to the lower five (5) feet and the remainder of the drop pipe shall be surrounded with coarse aggregate.

An alternate arrangement involves use of a precast base which includes the 90 degree bend along with precast concrete collars up to the invert of the upper pipe. The annular space between the drop pipe and the collar must be filled with AASHTO #8 (PennDOT 1B) coarse aggregate.

An inside drop connection may be used for special circumstances as approved by the Engineer.

d. Line and Grade

Care shall be taken to have all manholes set to correct line and grade as shown on the Developer's Construction Drawings.

e. Doghouse Manholes

Doghouse manholes are <u>not</u> permitted by the Authority. Where a manhole must be constructed over an existing sanitary sewer, the sewer main shall be cut to allow placement of the manhole base after which the sewers shall be connected to the gasketed manhole openings with short lengths which are provided with a bell end for connection to the existing sewer. Bypass pumping will normally be required during the construction procedure.

2. Precast Manholes

a. Handling

All precast manhole components shall be lifted and moved by use of suitable lifting slings and plugs that will not damage the precast manhole lip.

All damage to precast sections shall be thoroughly repaired in the presence of the Engineer. Repair and patching of minor breaks shall be done by chipping and scarifying the defective area before application of non-shrink grout. Sufficient time shall be allowed for curing before the precast sections are put together. Concrete cast-in-place bases shall be specially formed and keyed to accommodate the bottom precast section.

b. Site Inspection of Precast Sections

Precast sections shall be subject to rejection on account of failure to conform to any of the specification requirements. In addition, individual sections of manholes may be rejected because of any of the following:

(1) Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of a joint.

(2) Defects that indicate imperfect proportioning, mixing, and molding.

(3) Surface defects indicating honey-combed or open texture.

(4) Damaged or cracked end, where such damage would prevent making a satisfactory joint.

(5) Any continuous crack having a surface width of 0.01 inch or more and extending for a length of twelve inches or more, regardless of position in the section wall.

c. Coatings

After installation, damaged surfaces shall be recoated in accordance with the coating manufacturer's recommendation to give the required mils dry film thickness.

d. Placement of Cast-in-Place Manhole Bases

The bases shall be constructed of cast-in-place, reinforced concrete, and shall consist of the manhole bottom including the shaped invert and a wall which shall extend a minimum of six (6) inches above the top of the highest inflowing sewer.

The manhole base, including bottoms, inverts and walls shall be formed using a standard metal form designed specifically for this use. The form shall include a ring at the top to form a groove to receive the first precast riser section. Flow channels shall be formed as the base is cast so as to conform to the inside diameter of the pipes.

The base shall rest upon sound, level, undisturbed earth. If required to reach a sound foundation, Contractor shall furnish and install coarse aggregate to provide a stable base.

Before pouring a cast-in-place base, the downstream and upstream pipes shall be set to proper grade so the pipe ends will be flush with the inside of the manhole. Place the integral gasket around the pipe before pouring the base.

The interior and exterior surfaces shall be coated in accordance with the requirements of Section II E4f.

e. Placement of Precast Manhole Bases

The subbase shall be leveled, then compacted coarse aggregate to a depth as indicated on the Construction Details shall be installed before the base is set. The coarse aggregate shall

extend up around the pipes to at least the spring line of the pipe. The maximum extent of the coarse aggregate shall be in accordance with the Construction Details and these Specifications.

Pipes entering precast sections of manholes shall be installed in accordance with the type of pipe connection set forth in Section IIE4e.

f. Placement of Sections

Manhole sections shall not be set by wedging or placing shims to secure proper level, and manholes shall not be backfilled without the authorization of the Engineer.

A double ring of plastic preformed joint sealant shall be installed between all precast sections.

g. Masonry Work

The top of all precast manholes may be brought to proper grade for receiving manhole frames by using concrete leveling rings that shall not exceed a total maximum height of twelve (12) inches. Masonry construction shall be performed by experienced and qualified workmen only. All work shall be laid plumb, straight, level, square, and true. All joints shall be full and not more than 1/2-inch in thickness using non-shrink grout. The Contractor shall set in place and bond in the masonry all necessary steps and miscellaneous items specified elsewhere. The top step shall be a maximum of 24 inches from the lip of the manhole frame upon which the cover rests. The masonry grade rings shall be parged on the inside and on the outside with a one-half inch coat of mortar. The mortar on the inside shall not cover the joint between the top grade ring and the manhole frame casting.

All material to be used in joining manhole sections, filling lift holes in risers, filling the space between the ends of the pipe and the channel, and in sealing pipe joints of manholes shall be an approved mixture of non-shrink grout.

Masonry shall not be constructed during cold weather (air temperature below 40 degree F) unless necessary precautions are observed as permitted by the Engineer.

h. Grade Ring Assembly Encapsulation Sleeve

A grade ring assembly encapsulation sleeve shall be applied to a manhole which has a grade ring(s) which will be buried. The exterior area of the manhole shall be clean and dry prior to application of a lacquer based primer to seal the porosity of the concrete. The grade ring assembly encapsulation sleeve shall extend from the top of the manhole frame to a point about 12 inches below the top of the manhole frame. A closure strip shall be heated and applied t the overlap joint. The entire sleeve shall be heated with a torch to result in shrinkage while using a roller to smooth wrinkles and eliminate trapped air. The sleeve shall be cut around any manhole frame gussets and pressed against the frame. The sleeve shall be allowed to cool for two (2) hours prior to backfilling.

3. Flow Channel and Bench Walls

The method of constructing flow channels and bench walls is dependent on which type of manhole base has been installed.

For a precast base, the flow channel and bench walls in each manhole shall be carefully formed of concrete.

For a cast-in-place base, the flow channel and bench walls are monolithically constructed with the base.

The minimum depth of flow channel shall be equal to 3/4 the diameter of the largest sewer in the manhole to which it connects. The channel shall be sloped to give a smooth, uninterrupted flow through the manhole.

The space between the ends of the sewer pipes and the channel shall be filled with non-shrink grout and

coated with two (2) coats of a white epoxy coating as used for interior manhole surfaces.

Bench walls shall be sloped a minimum of one inch per foot from the inside periphery of the manhole to the edge of the flow channel.

4. Manhole Frames and Covers

Manhole frames and covers shall be brought to proper grade as previously noted, set on a double ring preformed flexible joint sealant that shall completely fill the space between the manhole frame and top of manhole. Manhole inserts are required for all manholes which are not equipped with watertight covers.

E. Restoration of Roads, Landscaping and Miscellaneous Items

1. Roads

a. General

The Contractor shall notify all companies and authorities that have existing utilities in the streets that are to be overlaid to raise their valve boxes, manhole frames, etc.

Permanent paving restoration can only be done between March 1 and October 31, unless approval obtained from the appropriate governing agency.

Permanent paving restoration shall be performed only after, in the construction observer's opinion, sufficient time for trench settlement has occurred.

b. Raising Manhole Frames and Valve Boxes

Install grade rings on all sanitary sewer and storm sewer manholes and inlet boxes that require adjusting to meet the elevation of the repaving in accordance with the owner's requirements. Metal adjusting rings added to the cast iron frame of sanitary manholes are not permitted.

Coordinate the raising of all valve boxes and/or manhole frames belonging to other utilities in accordance with the respective requirements of those utilities.

Contractor shall be responsible to see that all such items as mentioned above are adjusted to the new paving elevation.

c. Temporary Repaving

(1) General

Temporary paving shall be installed immediately after pipe and backfill have been installed in paved areas.

(2) Between March 1 and October 31

The temporary paving shall consist of two-inch compacted depth of hot-mixed, hot-laid bituminous concrete, conforming to requirements of Section 305 of PennDOT Publication 408 placed on top of the compacted backfill, and maintained for the period until final restoration.

(3) Between November 1 and the End of February

The temporary paving shall consist of two-inch compacted depth of hot-mixed, hot-laid bituminous concrete [see E1c(2)above] if available. Otherwise, the temporary paving shall consist of two-inch compacted depth of bituminous stockpile patching material (cold patch), in accordance with PennDOT Bulletin 27 and Publication 408, placed on top of the compacted backfill, and maintained for the period until final restoration.

d. Surface Preparation

In preparation for permanent repaving the temporary repaving shall be removed to permit permanent repaving.

Prior to the replacement of the base course, the edges of the existing base and surface must be saw-cut, one (1) foot on each side of the trench.

Remove all material within the trench and "cut back" area to subgrade ready for the base course.

The subgrade for all repaved areas shall be thoroughly compacted to the proper distance below and parallel with the prescribed level of the base course. The subgrade shall be completely tamped in an approved manner prior to placing the base course. Compaction shall conform to the Density Requirements in Section 210 of PennDOT Publication 408.

e. Township Road Permanent Repaving

(1) Base Course

Base courses of bituminous concrete shall be prepared and installed in accordance with Section 305 of PennDOT Publication 408.

(2) Surface Course

After thoroughly compacting the base course, it shall be cleaned of all foreign substances, after which the surface course shall be constructed. Where the surface course meets existing paving, such as a side road, a "V" cut shall be made in the existing surface to receive the new paving.

The bituminous surface course shall be constructed of ID-2 in accordance with Section 420 of PennDOT Publication 408.

f. Overlay

Where a surface course is required over existing roads, the surfaces to be covered shall be cleaned of all foreign substances and any irregularities removed or filled in. A tack coat shall be applied in accordance with Section 460 of PennDOT Publication 408, after which the

surface course will be applied in accordance with Section 420 of PennDOT Publication 408.

Where the overlay meets existing paving, a neat cut shall be made in the existing surface.

Overlays may be required on PennDOT highways.

g. Driveways

Stone and gravel driveways shall be covered to their existing surface depth with PennDOT 2A coarse aggregate.

Paved driveways shall be repaved with five inches BCBC and 1 1/2 inches ID-2 surface course and shall be feathered in.

Concrete driveways shall be replaced in kind.

h. State Highway Permanent Repaving

Repaving in State Highways shall be in accordance with "Occupancy of Highways by Utilities" 67 PA Code Chapter 459 and in accordance with the Developer's Construction Drawings as approved by the PennDOT permit.

Prior to placement of permanent restoration, PennDOT will inspect the condition of the State Highway and verify the limits of paving, overlays, etc. for work performed in the PennDOT right-of-way.

i. Sealing

All joints between the new paving and the existing paving and where the new paving abuts other materials such as curbs and manhole frames shall be sealed with PennDOT asphalt cement AC-20.

j. Thicknesses

Thicknesses of all base courses and surface courses shall be as specified elsewhere in these

Specifications and/or shown on the Construction Details.

k. Traffic Lane Paint Striping

All traffic lane paint striping overlayed, removed or otherwise damaged shall be restored in accordance with PennDOT specifications.

2. Landscaping

a. Landscaping

(1) General

Existing seeded and/or planted areas disturbed by construction and all areas indicated on the Developer's Construction Drawings shall be top-soiled, fertilized and seeded or sodded.

Furnish and apply soil conditioners, fertilizers and seed for various areas as noted in Seeding Mixtures as adjusted by the recommendations of the Farm Agent of the Penn State Cooperative Extension in Montgomery County and reviewed by the Engineer.

(2) Topsoil

After approval of rough grading, the Contractor shall place the topsoil on all areas indicated on the Drawings and on other grassed areas damaged by his operations. Topsoil shall be at least four (4) inches deep.

All topsoil from stripping which is not used at the job site shall be removed from the site for proper disposal unless the property owner wishes to retain the excess.

(3) Fertilizing and Rolling

Soil conditioners and fertilizers shall be spread and thoroughly worked into the topsoil. Then the topsoil shall be raked until the surface is finely pulverized and smooth and shall be compacted with rollers, weighing not over 100 pounds per linear foot of tread, to an even surface conforming to the prescribed lines and grades. Minimum depth shall be four (4) inches after compaction.

(4) Seeding

Seeding shall be done when weather conditions are approved as suitable, in the periods between March 15 and May 30, or August 1 to October 15, unless otherwise permitted by the Engineer. Seeding of wetlands areas shall be done in the periods April 1 and June 15 or August 16 and September 15. Annual rye grass for temporary cover on disturbed areas may be applied anytime.

If there is a delay in seeding, during which weeds grow or soil is washed out, the Contractor shall remove the weeds or replace the soil before sowing the seed. Immediately before seeding is begun, the soil shall be lightly raked.

Seed shall be sown at the approved rate, on a calm day and preferably by machine, but if by hand, only by experienced workmen.

One half the seed shall be sown in one direction and the other half at right angles. Seed shall be raked lightly into the soil to a depth of 1/4 inch and rolled with a roller weighing not more than 100 pounds per linear foot of tread and shall be covered with straw or mulch at a minimum rate of 135 lbs. per 1000 sq. ft.

The surface shall be kept moist by a fine spray until the grass shows uniform germination over the entire area. Wherever poor germination occurs in areas larger than three (3) square feet, the Contractor shall reseed, roll, and water as necessary to obtain proper germination.

The Contractor shall maintain and protect seeded areas as necessary to produce a dense, healthy growth of perennial vegetation.

(5) Sodding

Sodding shall be required if the grade exceeds 2 to 1 slope, when the seeding fails to take root or in designated areas shown on the Developer's Construction Drawings.

Sod shall be planted only when the soil is moist and favorable to growth. The area to be sodded shall be shaped and finished to the lines and grades indicated on the Developer's Construction Drawings and the surface loosened prior to placing the sod. The grade shall be kept moist by sprinkling, if necessary, until the sod is placed. The sod shall be placed on the prepared surface with the edges in close contact and, as far as possible, in a position to break joints. Each piece of sod laid shall be fitted and tamped into place with hand tampers not less than one hundred (100) square inches in area.

A sufficient quantity of water shall be applied to all sod after laying to insure immediate growth.

b. Inspection and Acceptance of Landscaping

At the beginning of the next planting season after that in which the permanent grass crop is sown, the seeded areas will be inspected by an Authority representative. Any section not

showing dense, vigorous growth at that time shall be promptly reseeded by the Contractor.

3. Miscellaneous Items

Sidewalks, curbs, driveways, and other special surfaces shall be replaced in accordance to the Township requirements. In lieu thereof, the design engineer shall detail special items on the Developer's Construction Drawings prior to the start of Work, and in the absence thereof, the surfaces destroyed shall be replaced by the Developer to a condition at least equivalent to that which existed prior to the start of the Work.

Mailboxes, street lighting poles and fixtures, ornamental works, guard rails, fencing, culverts, drains (both natural and man-made), catchbasins, manholes and walls shall also be restored when disturbed.

IV. TESTS

A. Laboratory Tests

Where otherwise required by these Specifications or as directed by the Engineer, all materials specified may require advance and periodic laboratory tests. Materials shall be sampled and tested in accordance with the methods of the ASTM, AWWA, ANSI or other Standard, designated or as directed by the Engineer. When required by the Authority, laboratory test results shall be submitted at least two (2) weeks prior to starting delivery of such materials to the site of the project. The testing laboratory shall furnish both the Engineer and the Developer with two (2) copies of the reports showing the results of such tests, and the reports shall be considered as sufficient evidence of the acceptance or rejection of the quality of the materials tested. The specifications for and the method of testing will be found under the detailed Specifications for the particular material involved.

B. Shop Tests

The materials listed below shall be tested at the shop or plant of, and by, the producer. Each manufacturer of such materials shall be fully equipped to carry out the test herein designated. Upon demand of the Engineer, the manufacturer shall perform such additional number of tests as the Engineer may deem necessary to establish the quality of the material offered for use. The Engineer shall be furnished with certified records or reports to contain a sworn statement that the tests have been made as specified. The Engineer may require additional tests by an independent testing laboratory.

Material	Test Method
Polyvinyl Chloride Pipe	ASTM D3034
Ductile Iron Pipe	ANSI 21.51

C. Field Tests

The installation of all sewers shall be tested in the field, in the presence of the Engineer together with a representative of the Contractor in the manner prescribed herein.

1. Compaction Tests for Soils

In all paved areas, the backfill shall be thoroughly compacted over and around the pipe by use of vibratory tamping pads or where these cannot be used, by mechanical or hand tamping. Backfilling in roads shall be compacted to at least ninety-five (95) percent of maximum density at optimum moisture content. For unimproved shoulder areas of Township roads or easements, backfilling shall be compacted to at least eighty-five (85) percent of maximum density at optimum moisture content. For State highways, PennDOT requirements will control.

The optimum moisture content and the maximum density of each type of material used for trench backfill shall be determined by ASTM D1557 or ASSHO T-180.

The field moisture content of materials being compacted shall be determined by ASTM D2216. The field density of compacted material shall be determined by ASTM D1556.

A soils engineering and testing laboratory shall perform sufficient tests and inspection procedures both in the field and lab to insure that the provisions of these Specifications are met. The testing and control firm shall be acceptable to the Authority.

After testing is completed and reports are provided, all subgrades below the paving will be examined by the Engineer before any paving is authorized.

The responsibility of the soils engineering and testing laboratory is to the Authority and the Engineer, to whom that firm must promptly, faithfully and accurately report the results of its tests and inspections. The firm must, in addition, work in coordination with the Contractor making all tests required by the Work. The reports must state whether or not the reported results comply with the requirements. The testing and control firm shall promptly type and deliver all its reports to the Authority and the Engineer with a copy to the Contractor.

2. Leakage Tests

a. Gravity Sewers

(1) General

After backfilling has been completed, the pipes cleaned and before permanent paving has been installed, the Contractor shall provide all apparatus and material required to perform a leakage test to ascertain that there are no broken pipes, leaking joints, or deflected pipe sections. Pipes failing these test shall be repaired, or

replaced at once by the Contractor to the satisfaction of the Engineer.

(2) Low Pressure Air Method

Low pressure air test of sewers and laterals shall conform to ASTM F1417 as specified hereinafter. Each manhole run will be tested separately.

Equipment shall be as manufactured by Cherne Industrial, Inc., Edina, Minnesota; N.B. Products, Horsham, Pennsylvania, or equal. Equipment used shall meet the following minimum requirements:

(a) Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested.

(b) Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used. Air shall be introduced into the plugs to 25 psig. The sealed pipe shall be pressurized to a minimum of 4 psig and a maximum of 9 psig. The plugs must hold against this pressure without having to be braced. -

(c) All air used shall pass through a single control panel.

(d) Three (3) individual hoses shall be used for the following connections:

(i) One (1) hose from control panel to pneumatic plugs for inflation.

(ii) One (1) hose from control panel to sealed line for introducing the low pressure air.

(iii) One (1) hose from sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

After a manhole reach of pipe including laterals has been backfilled in accordance with the specifications, the pipe cleaned, and the pneumatic plugs have been checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average groundwater back pressure but shall not exceed 9 psig. If the air pressure required for the test is greater than 9 psig, the air test method should not be used. At least two (2) minutes shall be allowed for the air pressure to stabilize.

After the stabilization period with 3.5 psig minimum pressure or the increased test pressure as adjusted for groundwater level minimum pressure remaining in the pipe, the air hose from the

control panel to the air supply shall be disconnected. The portion of the sanitary sewer being tested shall be deemed "Acceptable" if the time for the pressure to decrease from 3.5 to 2.5 psig exceeds the following minimum requirements:

Minimum Time for Length Shown (min:sec)

Pipe Dia. (in.)	100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
6"	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8"	7:34	7:34	7:34	7:34	7:36	8:52	10.08	11:24
10"	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12"	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15"	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18"	17:00	19:13	25:38	32:03	38:27	44:52	51:16	52:41

In areas where a high ground water table (ground water back pressure) is known to exist, the Contractor shall determine the height of the water table over the pipe invert at the downstream manhole. The height of water in feet shall be divided by 2.3 to establish the pounds of groundwater back pressure that will be added to all readings. (For example, if the height of water is 11 1/2 feet, then the added groundwater back pressure shall be 5 psig. This increases the 3.5 psig initial test pressure to 8.5 psig, and the 2.5 psig final test pressure to 7.5 psig. The minimum allowable drop of one (1) pound required time for a one (1) psi pressure drop remains the same.

b. Force Main

Sewage force mains shall be tested in accordance with ANSI/AWWA C600 Section 4 - Hydrostatic Testing with the exception that test pressure shall be at least 1.5 times the working pressure at the lowest point in the system.

c. Manholes

After the gravity sewers and manholes have been installed and backfilled, the manholes shall be tested for leakage.

(1) Vacuum Method

(a) Provide tools, equipment and instruments necessary to conduct vacuum testing specified herein.

(i) Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from manhole and to monitor vacuum.

(ii) Provide an extra vacuum gauge of known accuracy to frequently check equipment and apparatus.

(iii) Vacuum testing equipment and associated testing apparatus subject to Engineer's approval.

(iv) Provide seal - plate with vacuum piping connections for inserting in manhole frame.

(b) Prior to testing, clean manholes thoroughly and seal openings, both to the complete satisfaction of

the Engineer. Seal openings using properly sized plugs.

(c) Perform testing with frames installed. Include the joint between the manhole and manhole frame in the test.

(d) The Contractor may elect to make a test for his own purposes prior to backfilling. However, conduct tests of the manholes for acceptance, only after the backfilling has been completed.

(e) Vacuum Test Procedure

(i) Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions.

(ii) Draw a vacuum of ten (10) inches of mercury and close the valves.

(iii) Consider manhole acceptable when vacuum does not drop below nine (9) inches of mercury for the following manhole sizes and times:

* Four foot dia. - 60 seconds
* Five foot dia. - 75 seconds
* Six foot dia. - 90 seconds

(f) Should a manhole not satisfactorily pass testing, repairs and retesting is required.

(g) Repair and retest: Determine source or sources of leaks in manholes failing acceptable limits.

(i) Repair or replace defective materials and retest.

(ii) Materials and methods used to make manhole repairs must meet with Engineer's approval prior to use.

3. Deflection Test for PVC Gravity Sewer

a. General

Deflection testing shall be performed on all portions (except laterals) of the PVC sewer system. This test shall be performed in sections between manholes at least 30 days but not more than 12 months after final backfilling has been completed and the pipe successfully tested for leakage.

Deflection testing shall be performed in accordance with the procedure outlined below.

b. Maximum Deflection

The maximum allowable deflection for all installed PVC sewer pipe shall not exceed 5% of the pipe's original internal diameter in accordance with ASTM D2122.

c. Testing Apparatus

Deflection testing shall be performed with a "go, no-go" mandrel which is sized to such dimensions that it will not "go" when encountering deflection greater than permissible.

d. Deflection Testing Procedure -

Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.

During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line. (A nylon ski rope is recommended.)

After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.

Connect a retrieval rope to the back of the mandrel to pull it back if necessary.

Remove all the slack in the pull rope and place a tape marker on the rope at the ends of the pipe.

Draw mandrel through the sewer line. If any irregularities or obstructions are encountered n the line, corrective action shall be taken as required.

If a section with excessive deflection is found, it shall be located and excavated. The pipe shall be inspected for damage; if any damaged pipe is found, it shall be replaced; if pipe is not damaged, replace and thoroughly tamp the haunching and initial backfill; replace remainder of backfill.

Retest this section for deflection and leakage.

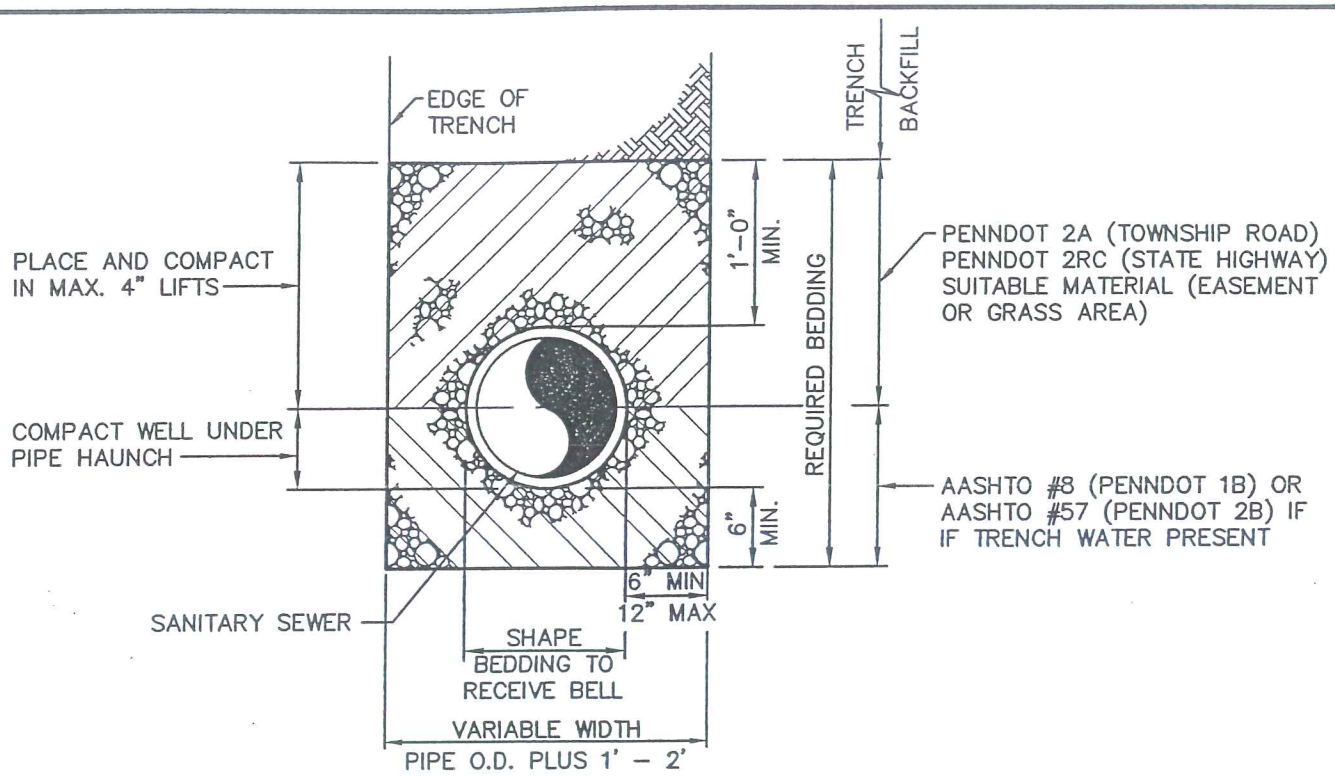
4. Television Inspection

Internal inspection in the presence of the Engineer must be performed of all gravity sewer mains installed by the Developer using television inspection prior to the Authority's acceptance of sewer dedication and the start of the 18 month Maintenance Bond period. The Developer shall bear the entire cost of television inspection. The Engineer shall be notified 72 hours prior to any television inspection.

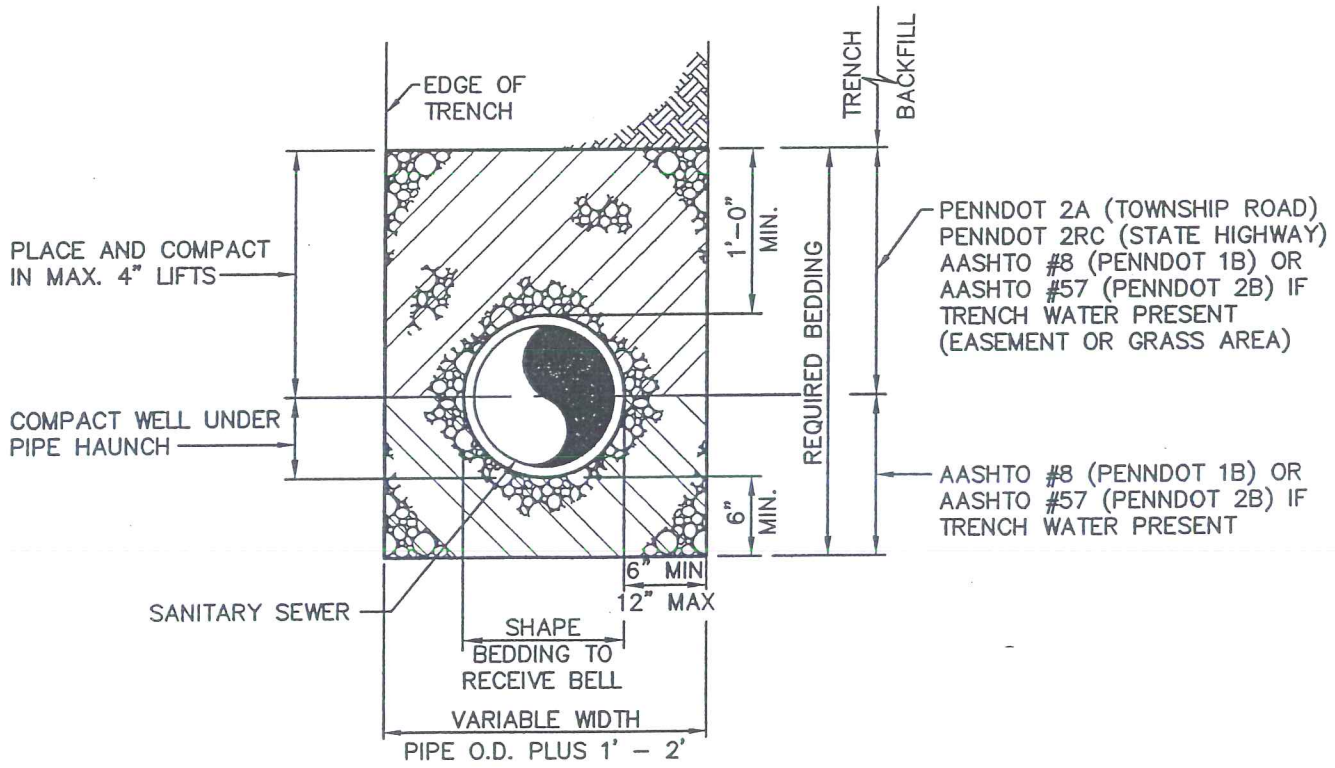
The video tape shall become the property of the Authority prior to acceptance of the sewer extension and the start of the Maintenance Bond period.

V. STANDARD CONSTRUCTION DETAIL DRAWINGS

See Attached Drawings

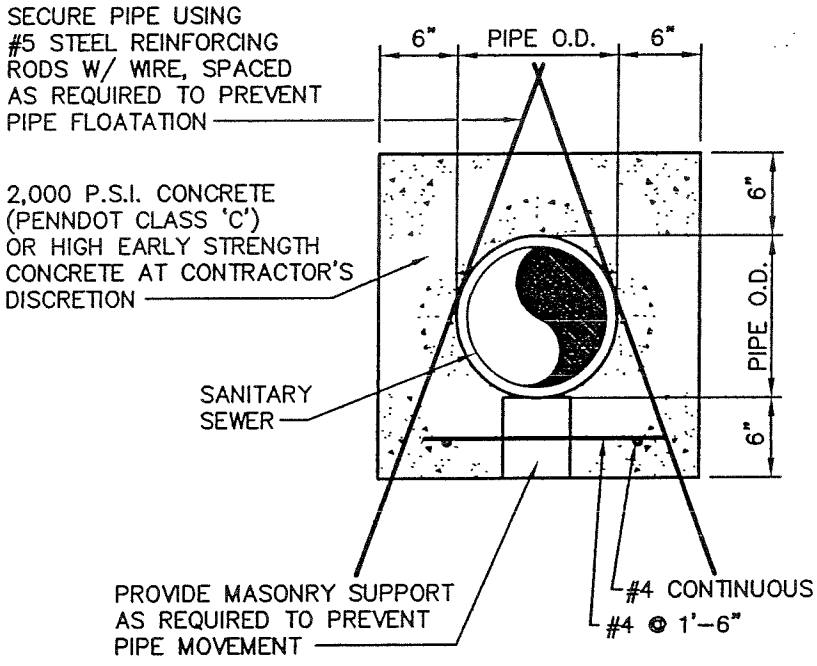


D.I. PIPE EMBEDMENT



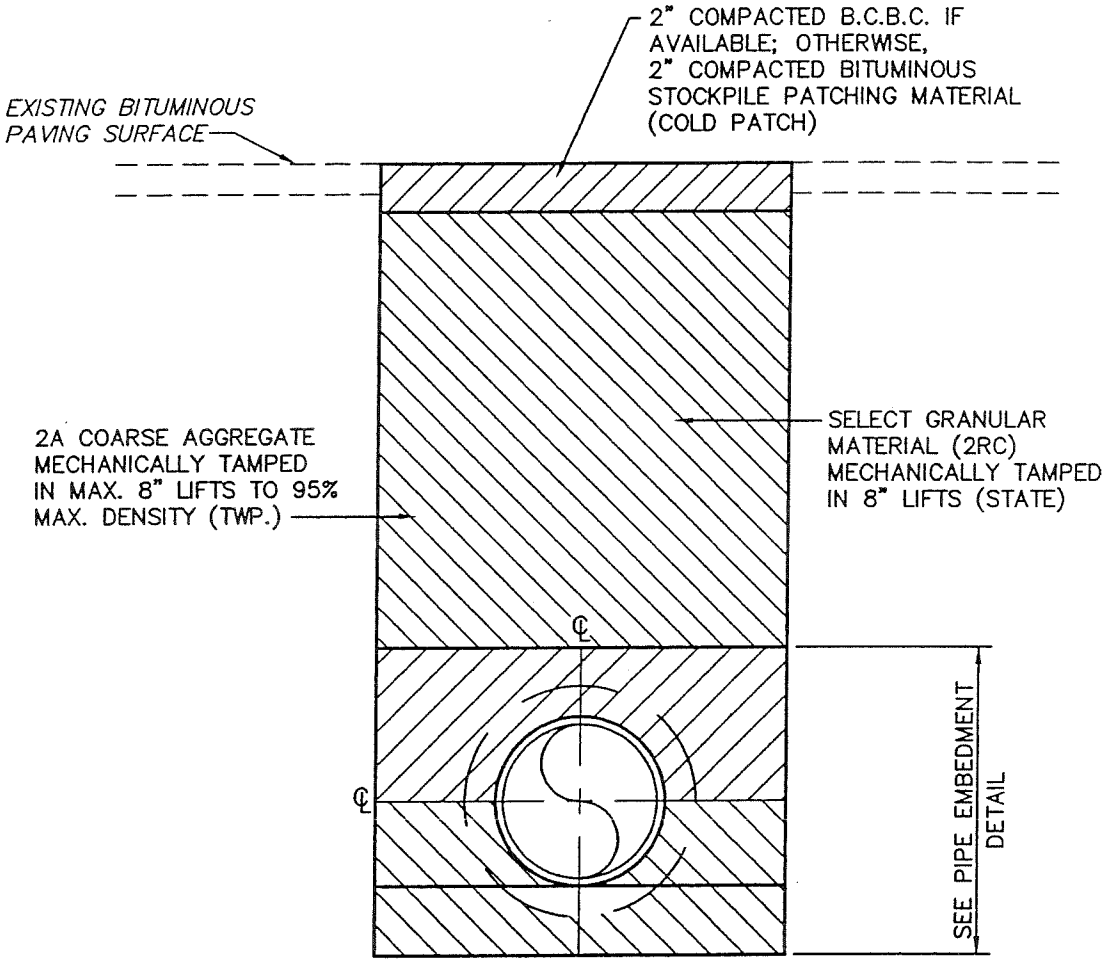
P.V.C. PIPE EMBEDMENT

LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #1	SANITARY SEWER PIPE EMBEDMENT DETAILS
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE

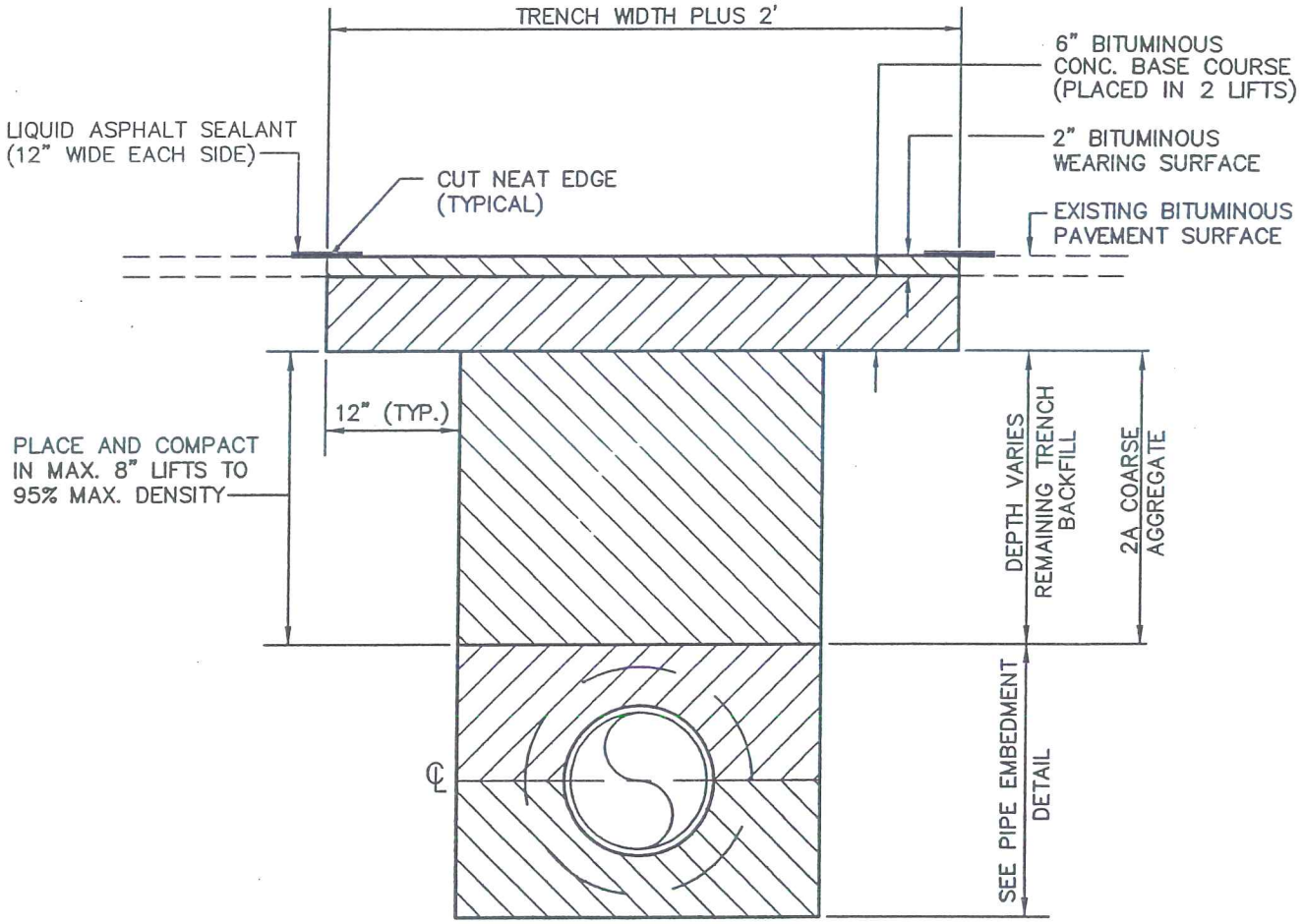


NOTES:
PROVIDE REINFORCEMENT AT UTILITY CROSSINGS ONLY.

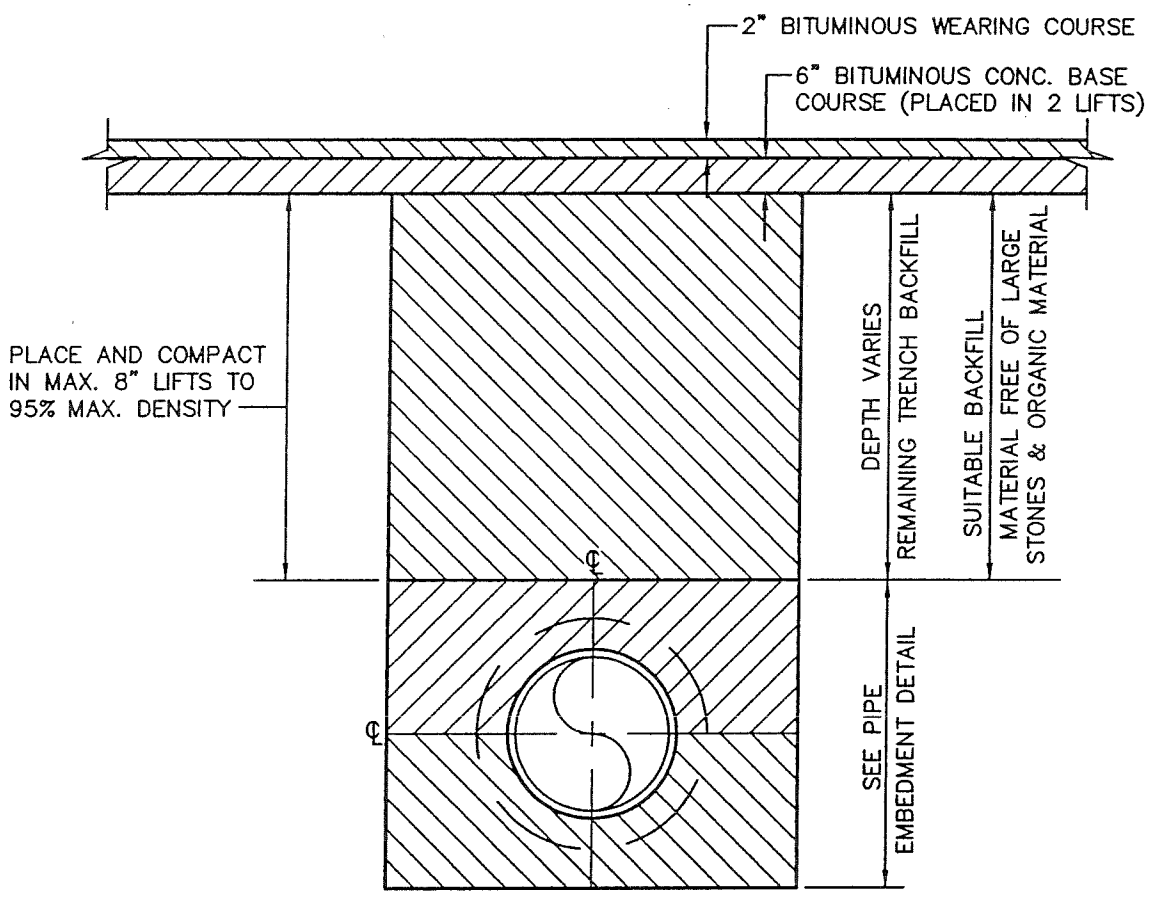
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #2	CONCRETE ENCASEMENT DETAIL
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



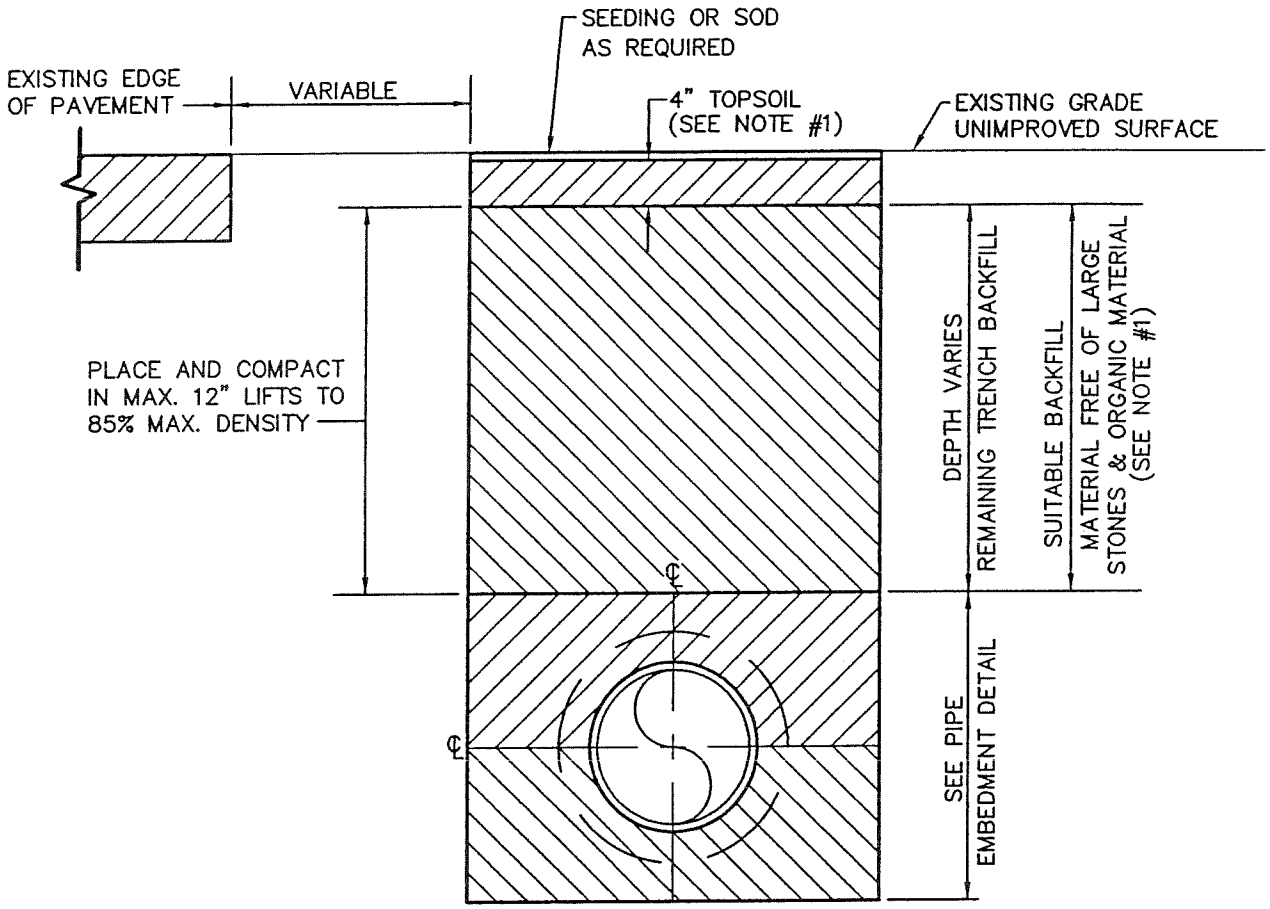
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #3	TEMPORARY PAVEMENT AND TRENCH RESTORATION FOR EXISTING TOWNSHIP ROADS AND STATE HIGHWAYS
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #4	PERMANENT PAVEMENT AND TRENCH RESTORATION FOR EXISTING TOWNSHIP ROADS
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



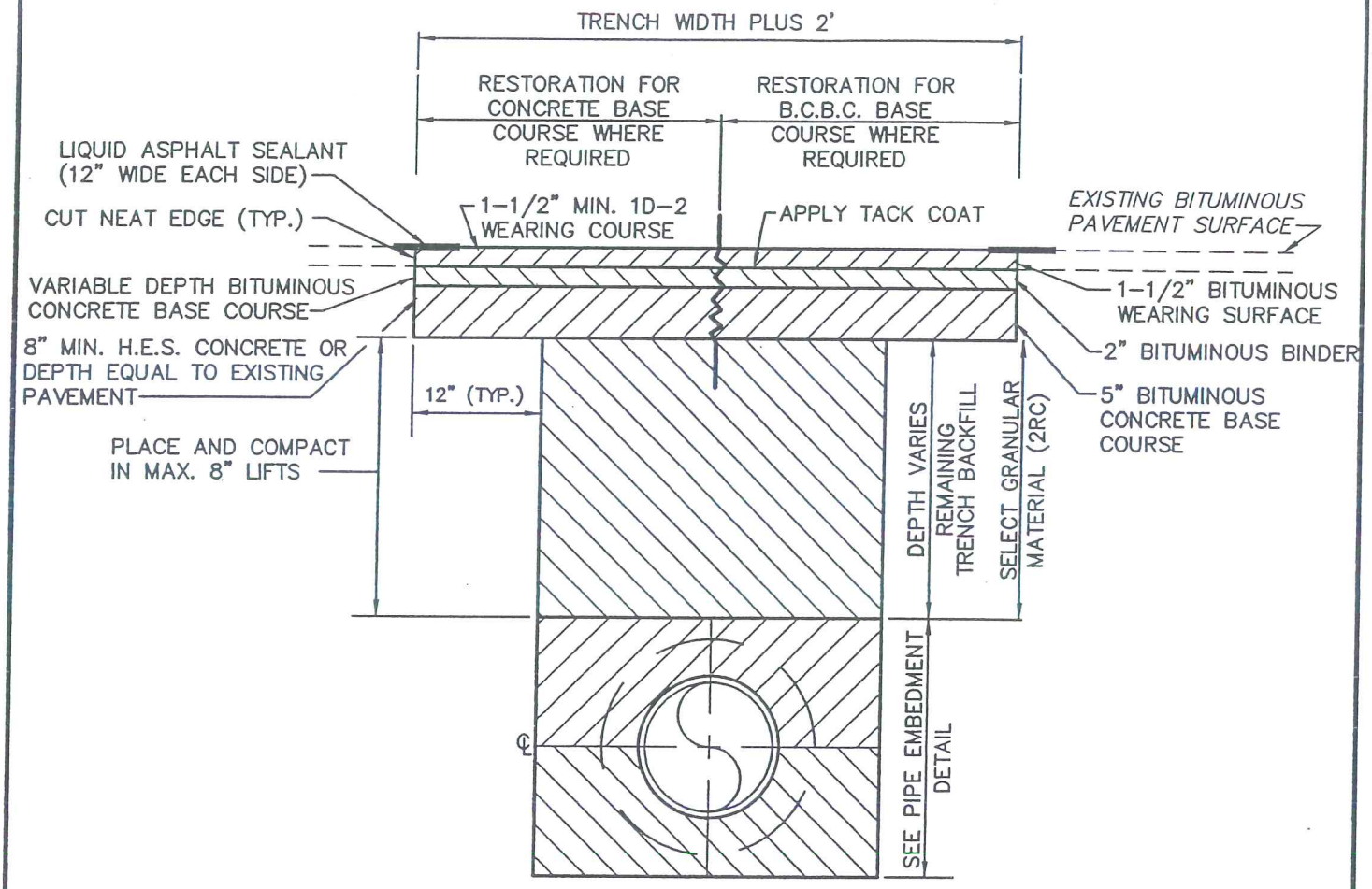
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #5	TRENCH RESTORATION FOR NEW TOWNSHIP ROADS
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



NOTES:

1. FOR WETLANDS AREA, BACKFILL TRENCH MATERIALS IN THE SAME ORDER AND DEPTH AS EXCAVATED.

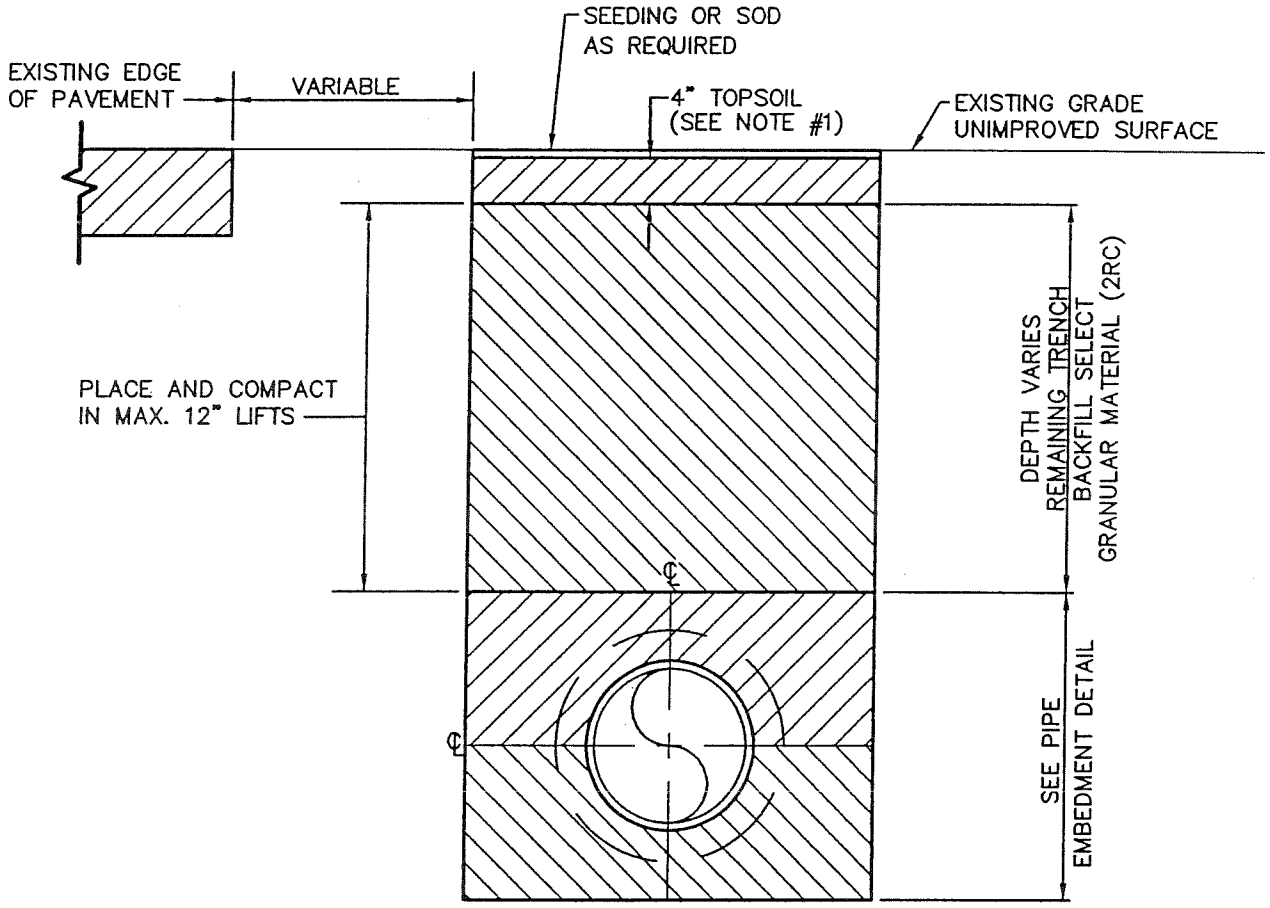
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #6	TRENCH RESTORATION FOR UNIMPROVED SHOULDER OF EXISTING TOWNSHIP ROADS OR EASEMENTS
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



RESTORATION FOR CONCRETE BASE NOTES:

1. SURFACE OF REPLACEMENT CONCRETE TO BE AT SAME ELEVATION AS EXISTING SLAB.
2. FOR LIMITS OF CONCRETE REPLACEMENT, SEE PENNDOT. REG. 459.8 (i)(4).
3. CUT BACK IS NOT REQUIRED BEYOND A TRANSVERSE OR LONGITUDINAL JOINT OR CURB.

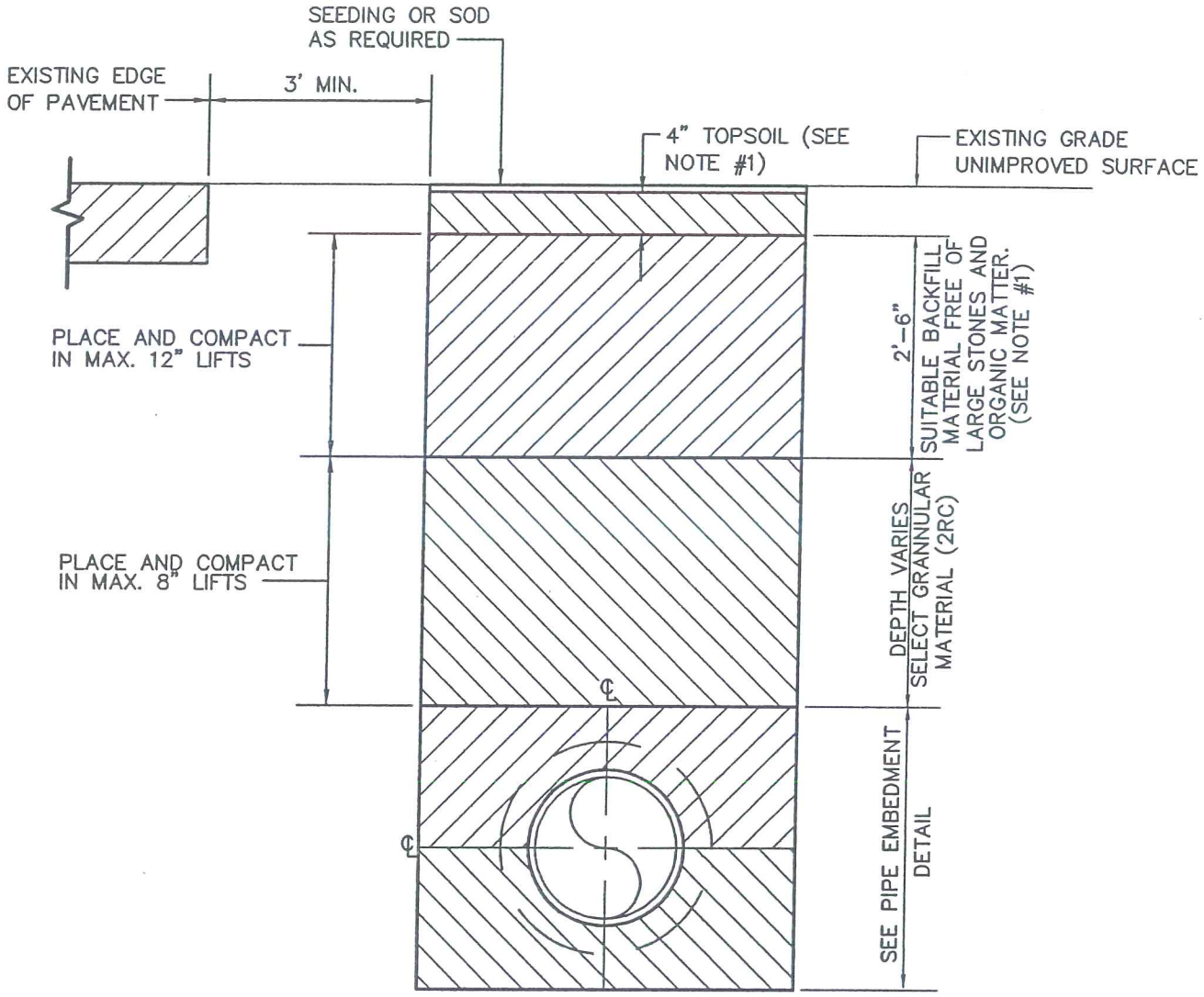
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #7	PERMANENT PAVEMENT AND TRENCH RESTORATION FOR STATE HIGHWAYS
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



NOTES:

1. FOR WETLANDS AREA, BACKFILL TRENCH MATERIALS IN THE SAME ORDER AND DEPTH AS EXCAVATED.

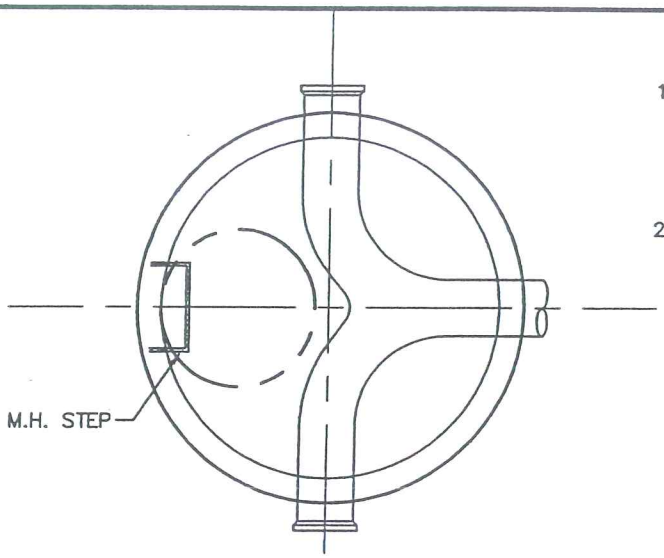
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #8	TRENCH RESTORATION FOR UNIMPROVED SHOULDER OF STATE HIGHWAYS (≤ 3' FROM EDGE OF PAVEMENT)
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



NOTES:

1. FOR WETLANDS AREA, BACKFILL TRENCH MATERIALS IN THE SAME ORDER AND DEPTH AS EXCAVATED.

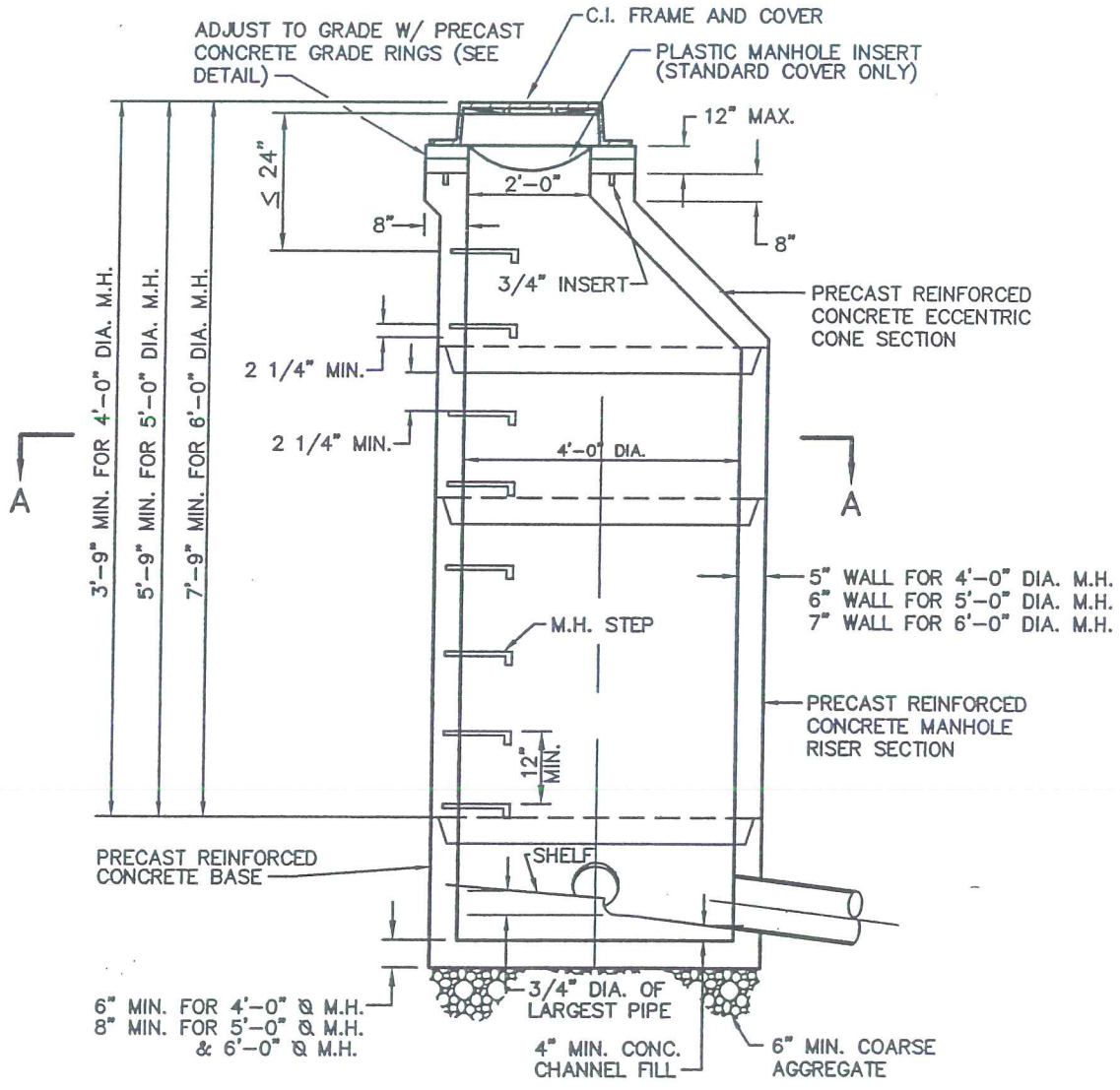
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #9	TRENCH RESTORATION FOR UNIMPROVED SHOULDER OF STATE HIGHWAYS (≥ 3' FROM EDGE OF PAVEMENT)
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



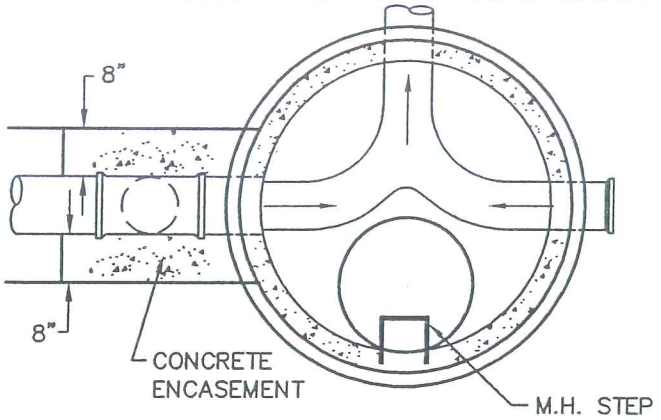
SECTION A – A

NOTES:

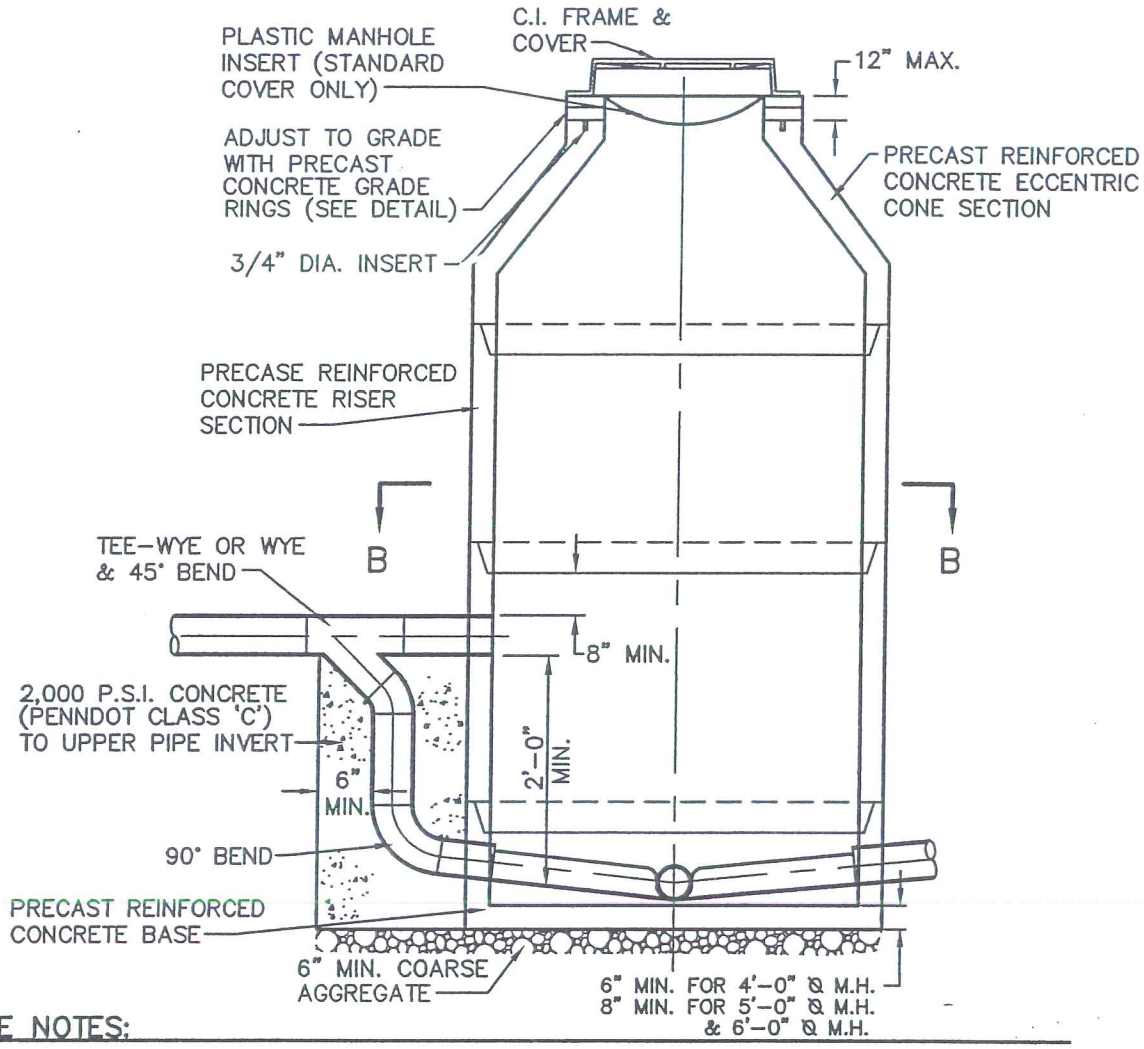
1. FOR MANHOLES HAVING 5' DIAMETER AND 6' DIAMETER BASE, REDUCTION IN DIAMETER TO 4' SHALL START AT THE FIRST JOINT ABOVE THE UPPERMOST PIPE CONNECTION TO WALL, WHERE DEPTH IS SUFFICIENT.
2. 4' DIAMETER – 8" TO 15" PIPES
   5' DIAMETER – 16" TO 27" PIPES
   6' DIAMETER – 30" TO 48" PIPES



LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #10	TYPE "A" STANDARD MANHOLE
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



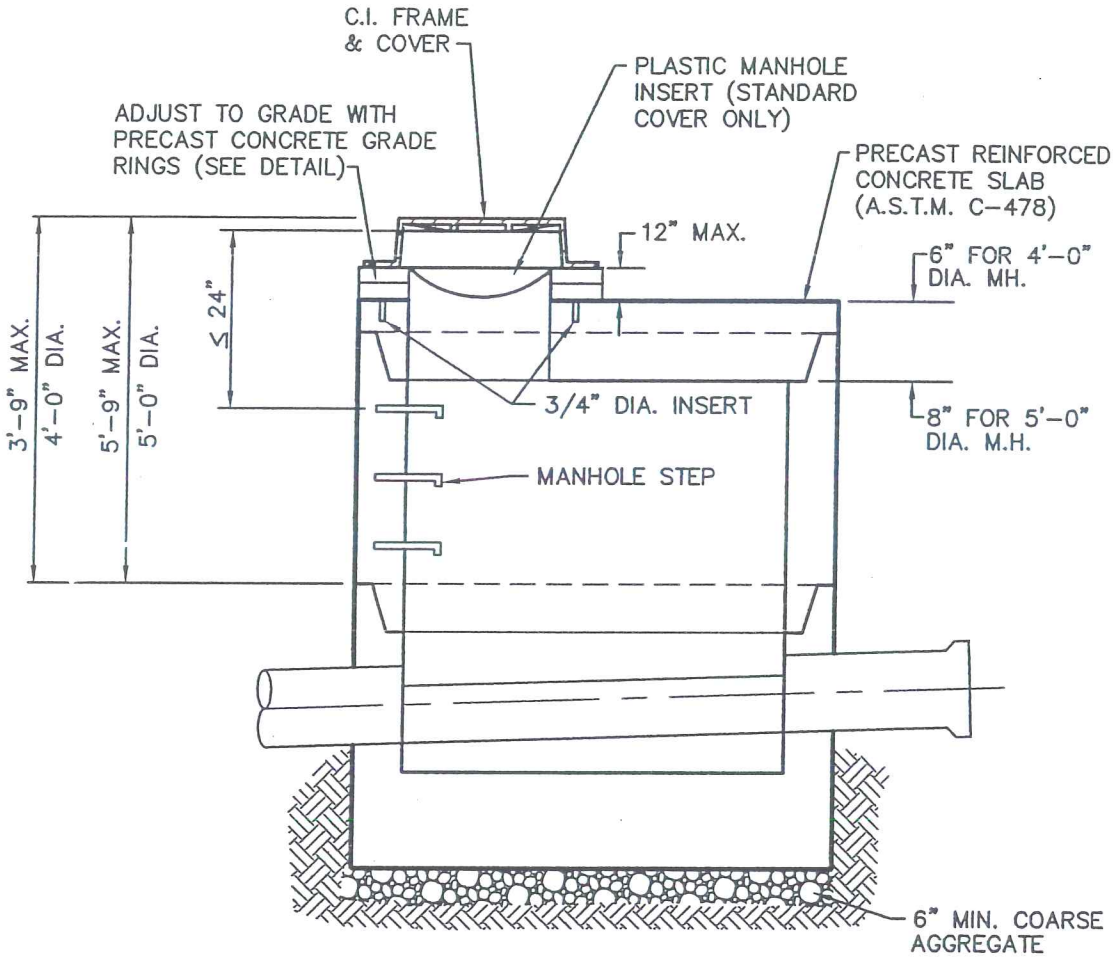
SECTION B–B



MANHOLE NOTES:

1. REFER TO MANHOLE NOTES UNDER "TYPE "A" STANDARD MANHOLE".
2. AN ALTERNATE ARRANGEMENT INVOLVES USE OF A PRECAST BASE WHICH INCLUDES THE 90° BEND ALONG WITH PRECAST CONCRETE COLLARS AROUND THE DROP PIPE TO THE INVERT OF THE UPPER PIPE. ANNULAR SPACE BETWEEN DROP PIPE AND COLLAR TO BE FILLED WITH AASHTO #8 (PENNDOT 1B) COARSE AGGREGATE.

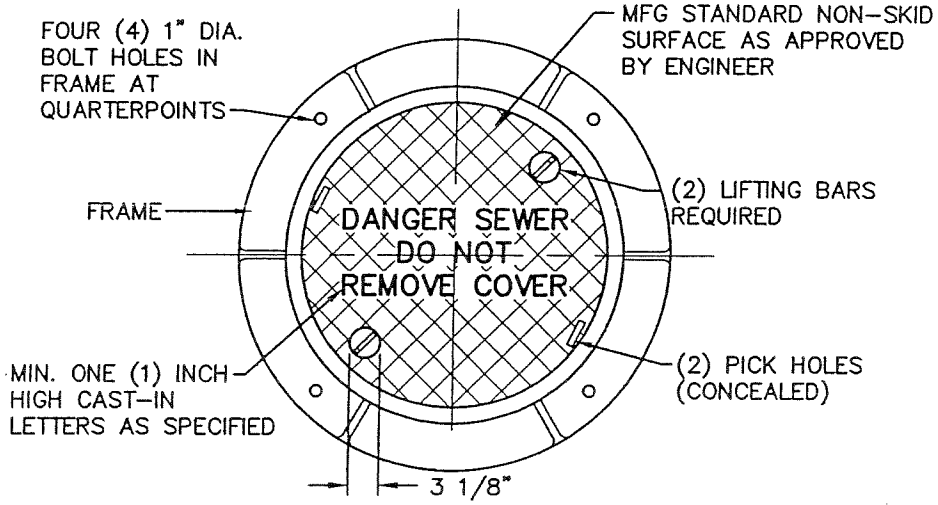
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #11	TYPE "A" DROP MANHOLE
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



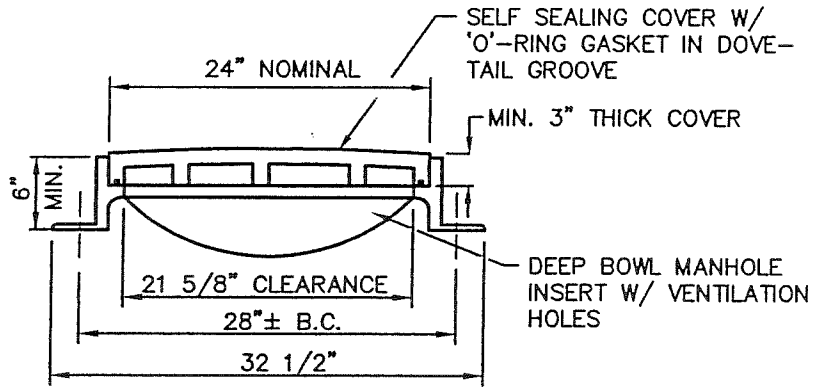
MANHOLE NOTES:

1. TYPE 'B' MANHOLES (SHALLOW TYPE) TO BE PROVIDED WHERE REQUIRED BY DEPTH CONDITIONS. ALL OTHER MANHOLES TO BE TYPE 'A'.
2. TYPE 'B' MANHOLE TO BE THE SAME AS TYPE 'A' EXCEPT AS OTHERWISE NOTED.
3. REFER TO MANHOLE NOTES UNDER TYPE 'A' STANDARD MANHOLE.

LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #12	TYPE "B" STANDARD MANHOLE
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE

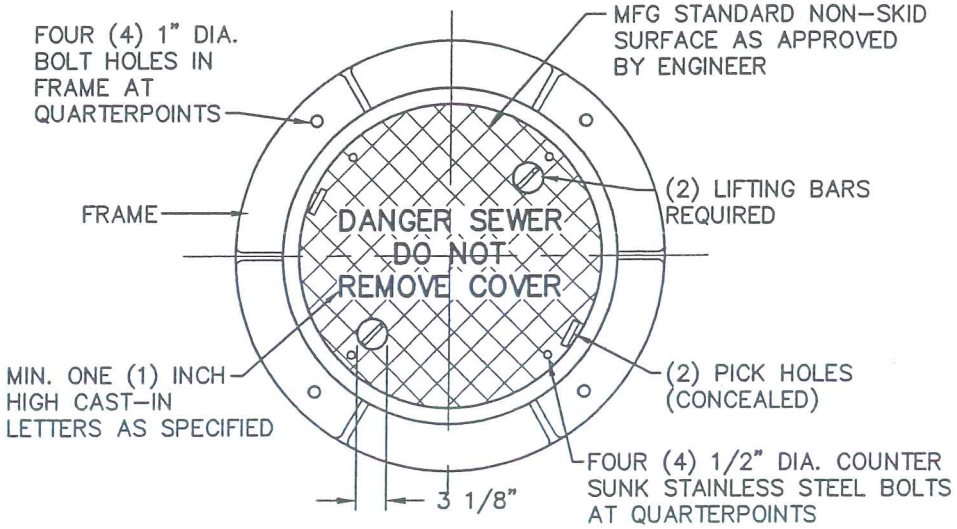


PLAN VIEW

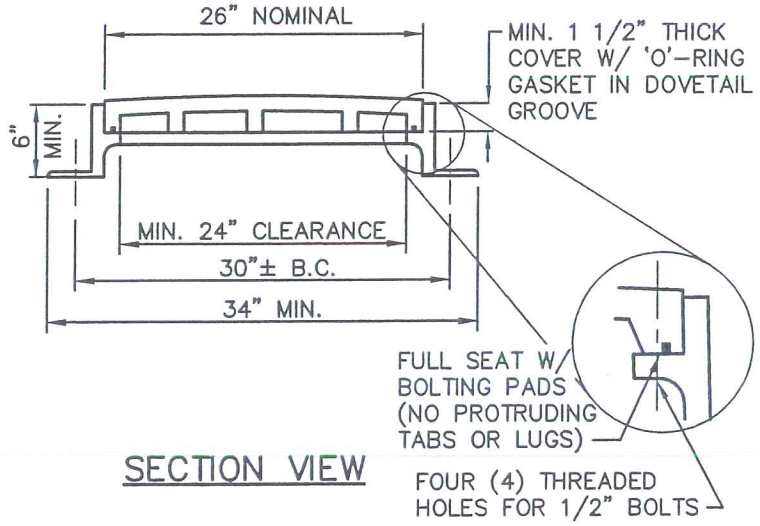


SECTION VIEW

LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #13	STANDARD MANHOLE FRAME & COVER
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE

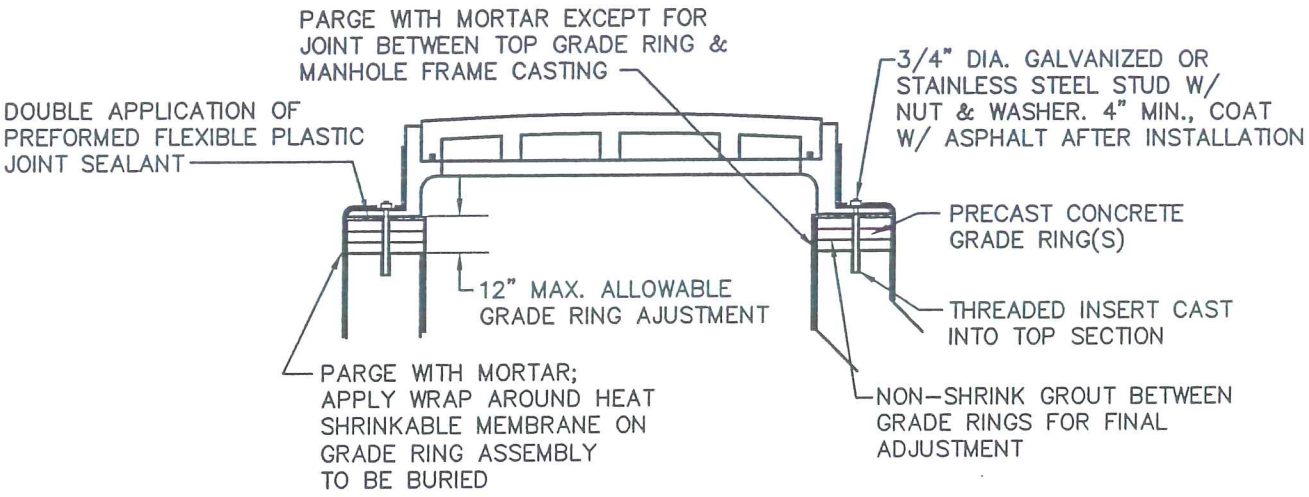


PLAN VIEW



SECTION VIEW

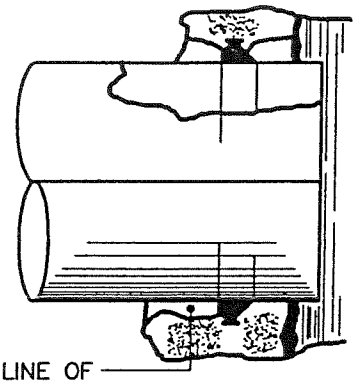
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #14	WATERTIGHT MANHOLE FRAME & COVER
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



GRADE RING NOTES:

1. ALL NON-SHRINK CONCRETE GROUT SHALL BE TROWELED SMOOTH.
2. EXCESS PREFORMED FLEXIBLE PLASTIC JOINT SEALANT SHALL BE NEATLY TRIMMED AT ALL JOINTS.
3. CONCRETE SURFACES SHALL BE CLEAN AND DRY PRIOR TO PARGING AND PRIOR TO APPLICATION OF WRAP AROUND HEAT SHRINKABLE MEMBRANE.

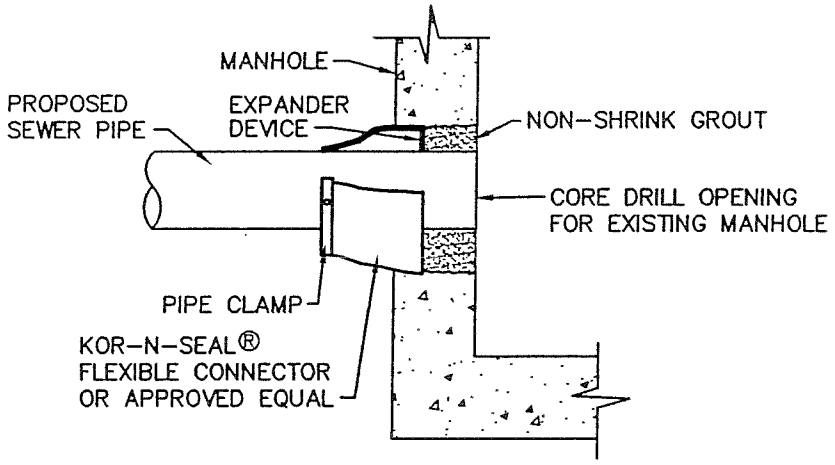
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #15	GRADE RING DETAIL
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



GROUT TO SPRING LINE OF PIPE ON INSIDE WALL (ONLY)

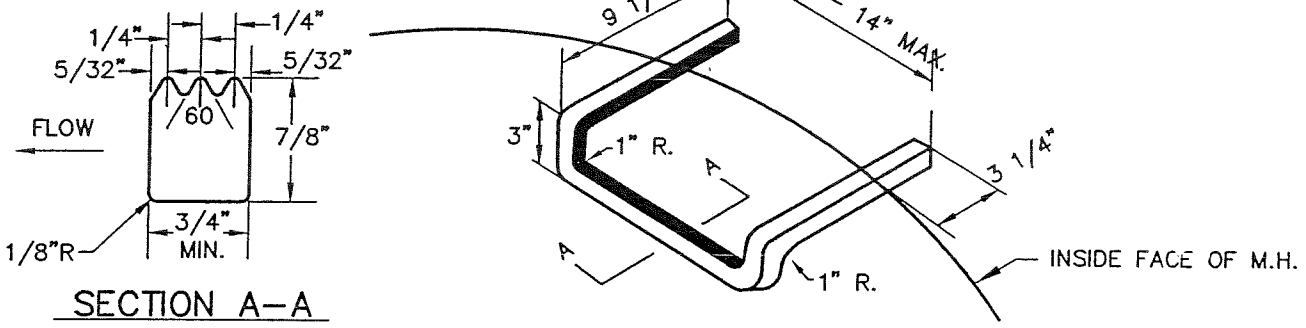
A–LOK GASKET PER A.S.T.M. RUBBER GASKET SPECS. C923 OR EQUAL CAST INTEGRALLY IN MANHOLE WALL AND LOCATED AS REQUIRED.

NEW MANHOLE



CORE DRILL EXISTING MANHOLE

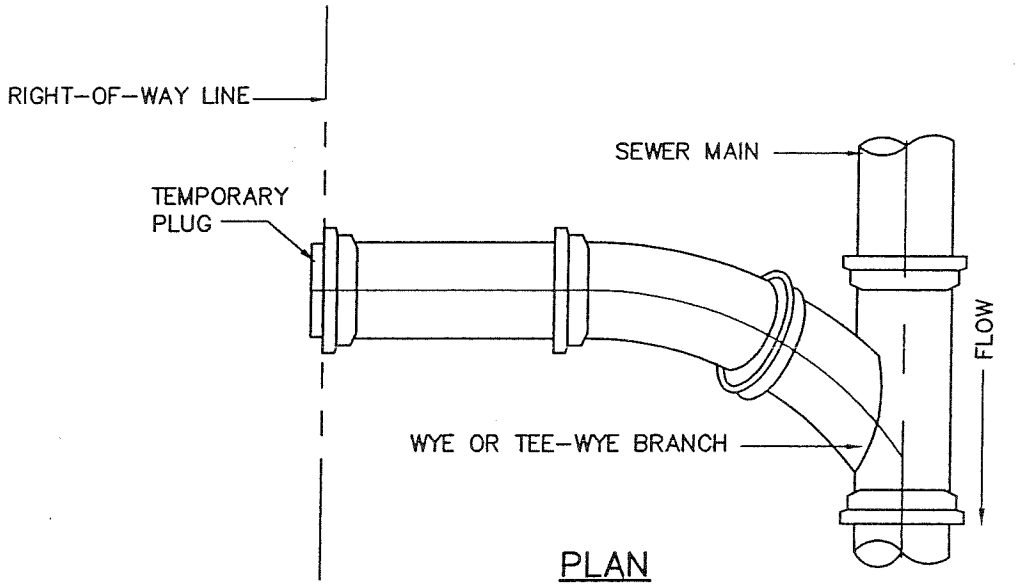
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #16	MANHOLE WALL PENETRATION DETAILS
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



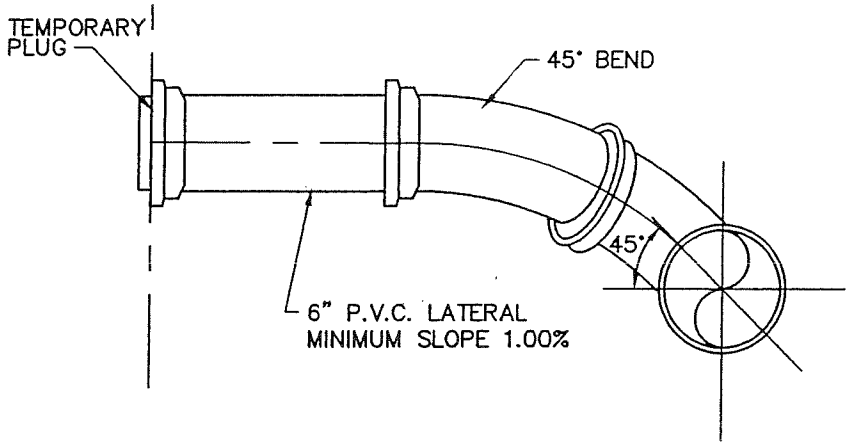
MANHOLE STEP NOTES:

1. STEPS TO BE FABRICATED OF ALUMINUM ALLOY 6061–T6 PORTIONS OF STEPS TO BE EMBEDDED IN WALLS OF MANHOLES OR CHAMBERS TO BE DIPPED IN HEAVY BODIED BITUMINOUS PAINT, OR ELSE PROVIDED WITH PLASTIC INSERT.
2. STEEL REINFORCED POLYPROPYLENE STEPS ARE AN OPTIONAL STYLE.

LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #17	MANHOLE STEP DETAIL
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



PLAN

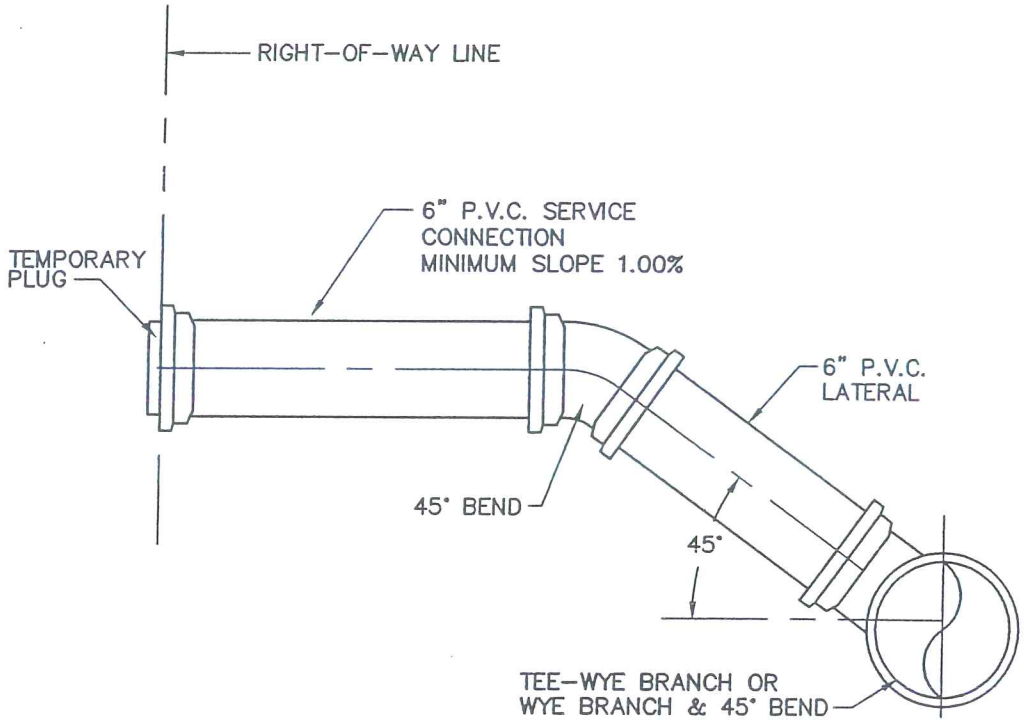


ELEVATION

LATERAL NOTES:

1. TEMPORARY PLUG TO REMAIN IN LATERAL UNTIL CONSTRUCTION OF BUILDING SEWER OCCURS.
2. PIPE TO BE EMBEDED IN AGGREGATE (SEE PIPE EMBEDMENT DETAIL).

LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #18	SHALLOW SEWER LATERAL DETAIL
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE

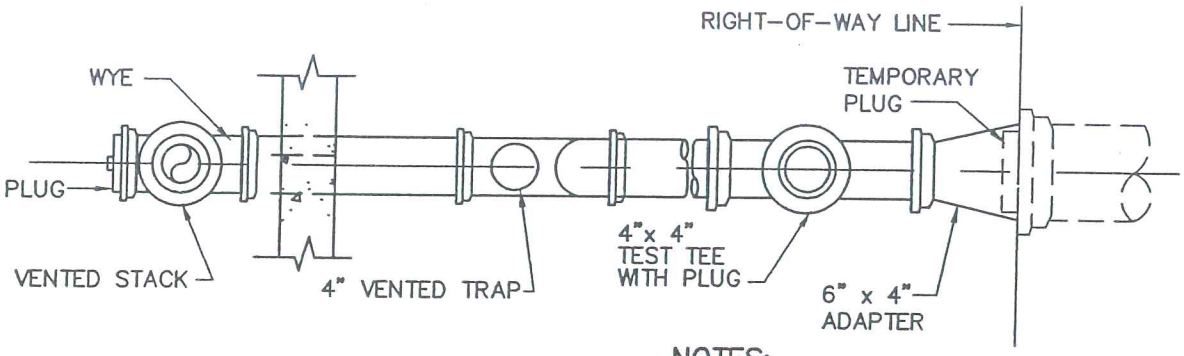


ELEVATION

LATERAL NOTES:

1. TEMPORARY PLUG TO REMAIN IN LATERAL UNTIL CONSTRUCTION OF BUILDING SEWER OCCURS.
2. PIPE TO BE EMBEDED IN AGGREGATE (SEE PIPE EMBEDMENT DETAIL).

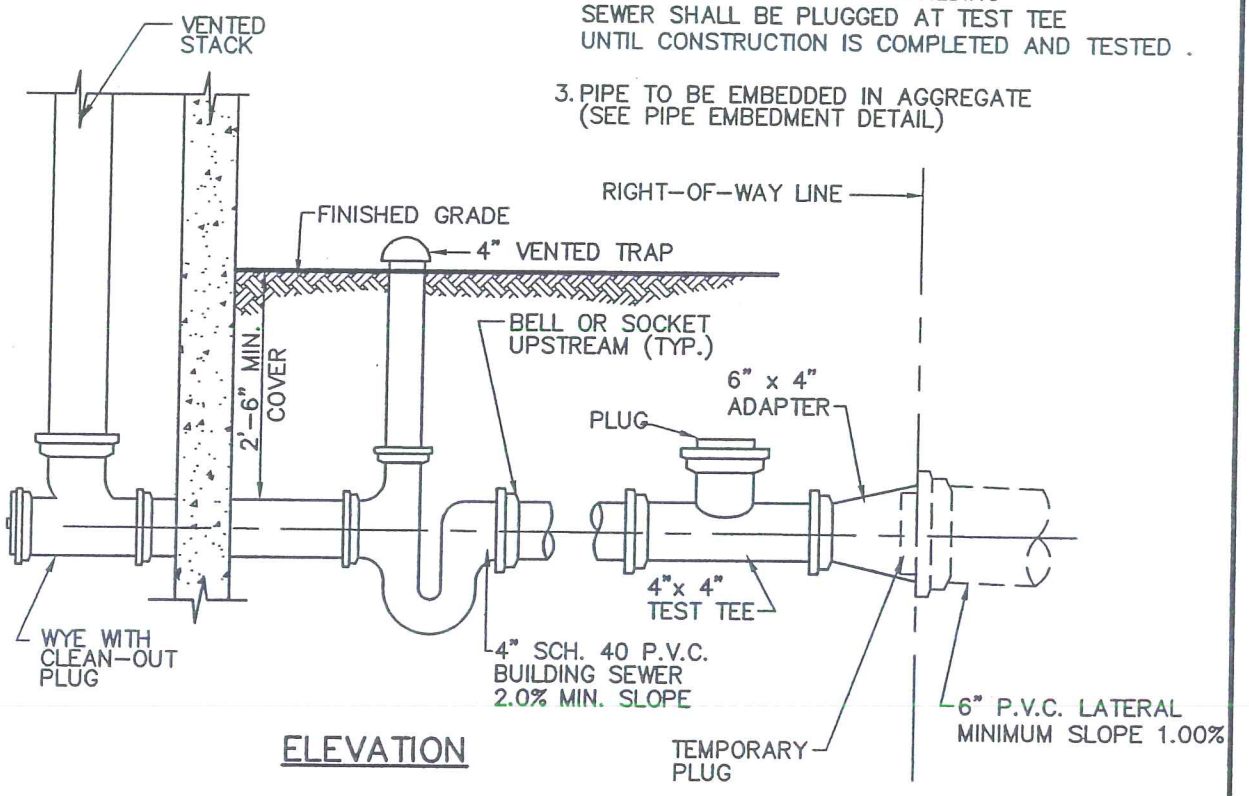
LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #19	DEEP SEWER LATERAL DETAIL
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



PLAN

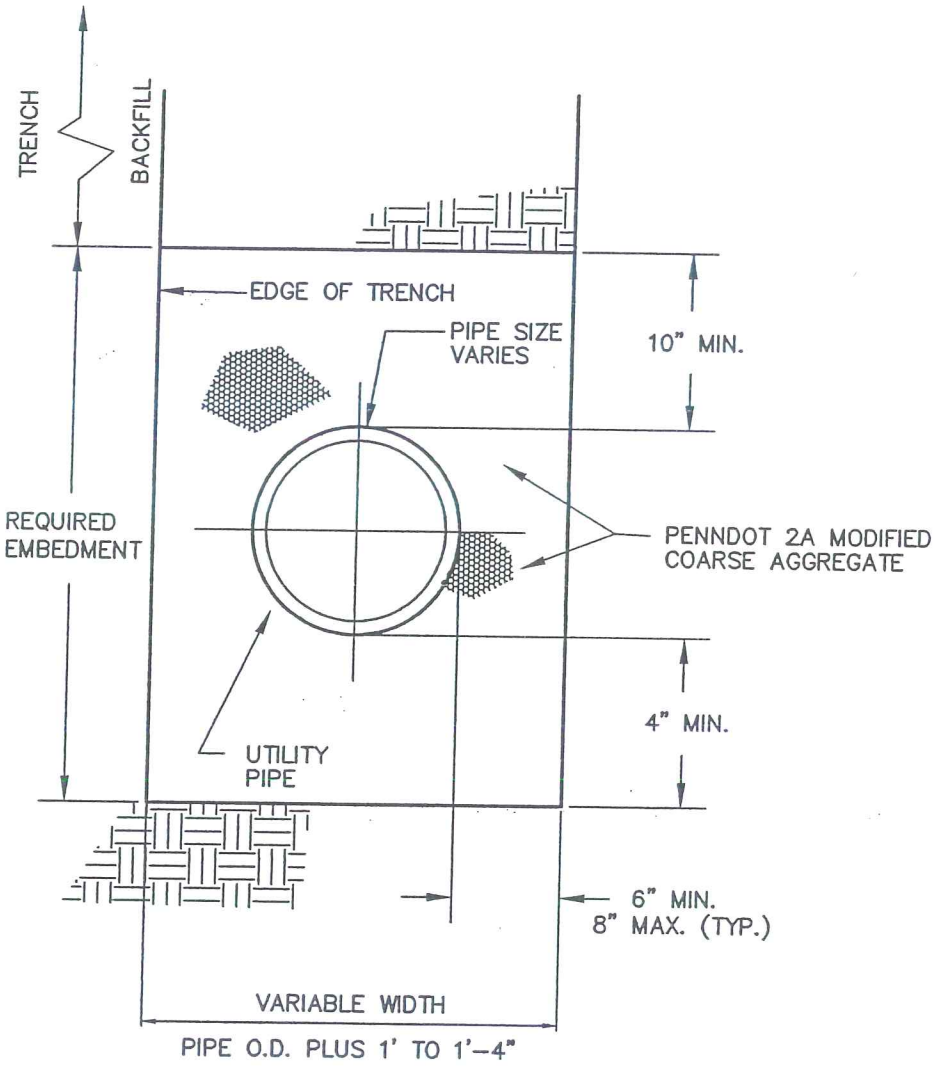
NOTES:

1. BUILDING SEWER FROM RIGHT-OF-WAY LINE TO BUILDING PLUMBING SYSTEM SHALL CONFORM TO THE BOCA NATIONAL PLUMBING CODE ADOPTED BY TOWNSHIP (ORDINANCE 97; 10/15/87).
2. TEMPORARY PIPE PLUG TO REMAIN IN LATERAL UNTIL CONSTRUCTION OF BUILDING SEWER OCCURS. BUILDING SEWER SHALL BE PLUGGED AT TEST TEE UNTIL CONSTRUCTION IS COMPLETED AND TESTED .
3. PIPE TO BE EMBEDDED IN AGGREGATE (SEE PIPE EMBEDMENT DETAIL)



ELEVATION

LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #20	BUILDING SEWER DETAIL
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE



P.V.C. PIPE

LIMERICK TOWNSHIP MUNICIPAL AUTHORITY	DETAIL #21	BUILDING SEWER EMBEDMENT
DATE: REV. FEBRUARY 19, 1999		SCALE: NOT TO SCALE