

SECTION 02055 - REMOVAL AND ABANDONMENT OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Provision for removal and abandonment of valves and valve boxes, capping existing water lines to be abandoned, removal of existing fire hydrants and valves, and abandoning existing water services.
- B. Related Sections:
 - 1. Trenching, Backfilling and Compacting: Section 02221.
 - 2. Cast-In-Place Concrete: Section 03300.

1.02 PROJECT CONDITIONS

- A. Protection: Exercise care during removal work to confine operations to facilities as indicated on Drawings. Physical means and methods used for protection are discretionary, however, assume complete responsibility for replacement and restitution work of whatever nature and at no expense to Authority.
 - 1. Additionally, if public safety is endangered during progress of demolition work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.
 - 2. Signs, signals, and barricades to conform to requirements of Federal, State and local laws, rules, regulations, precautions, orders, and decrees.

1.03 REFERENCES

- A. Commonwealth of Pennsylvania Department of Transportation (PDT), Specifications Publication 408, as supplemented.
 - 1. PDT Section 703.2, Coarse Aggregates.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Type of equipment, machinery, and apparatus (motorized or otherwise) used to perform demolition and removal work is discretionary, but provide type to perform work within limits of Contract requirements.
- B. Aggregate Backfill: No. 2A Coarse Aggregate conforming to PDT Section 703.2.
- C. Class B Concrete: As specified in Section 03300.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to performance of actual work, carefully inspect sites and locate facilities designated to be removed or abandoned.
- B. Do not begin work of this Section without approval to do so by Authority.
- C. Locate existing exposed and buried active utilities and determine requirements for protection.

3.02 PERFORMANCE

- A. Excavation and Backfilling: As specified in Section 02221.
 - 1. In removing existing facilities, should excavation below subgrade for new facilities occur, backfill area excavated below subgrade with Aggregate Backfill or concrete as required by Authority at no additional cost to Authority.
- B. Debris Removal: Dispose of demolition debris off site in a lawfully approved landfill area.
- C. Salvage: Authority has right to claim as salvage, items and materials removed under work of this Section. Move and neatly store removed items claimed as salvage by Authority to a location agreeable to Authority, and in manner approved by Authority.
- D. Capping Existing Facilities:
 - 1. Cap cut ends of water mains to be abandoned.
 - 2. Close existing corporation stops, crimp or cap water services to be abandoned except those on abandoned mains.
- E. Removal and Filling Existing Valve Boxes:
 - 1. Remove valve boxes indicated to be abandoned.
 - 2. Fill with aggregate backfill placed in layers not to exceed 6 inches in depth after compaction.
 - a. Perform compaction by hand.
 - b. Puddling or jetting compacting methods are not permitted.
 - 3. Restore surface to match surrounding area.
- F. Removal of Existing Fire Hydrants and Valves:
 - 1. Remove hydrants and valves where indicated on Drawings.
 - 2. Provide caps on existing lines where hydrants and valves are removed.
 - 3. Remove and store hydrants and valves claimed as salvage by Authority at a location designated by Authority.
 - 4. Restore surface to match surrounding area.

G. Abandoning Existing Mains

1. Transfer services to new water main, connecting to existing service on structure side of existing curb stop.
2. Close existing curb stop and remove existing curb box.
3. Close system valves to isolate main to be abandoned.
4. Cut, cap, and block existing main as detailed on Drawings.
5. Disconnect existing service, crimp or cap service at Contractor's expense.

END OF SECTION

SECTION 02151 - SHORING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for protection of excavations by sheeting and shoring.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Furnish shoring materials and install work conforming to Federal, State and local laws, rules, regulations, requirements, precautions, orders and decrees.
2. Provide material for sheet piling, sheeting, bracing and shoring and drive or set in place in accordance with Federal, State and local laws for excavations and construction; and as required to protect workers and public, or to maintain trench widths specified in Section 02221, regardless if considered necessary by Contractor.

1.03 PROJECT CONDITIONS

A. Responsibility for Condition of Excavation:

1. Failure or refusal of the Authority to suggest use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to suggest sheeting, bracing, struts, or shoring be left in place, does not relieve Contractor of responsibility concerning condition of excavation or of his obligations under Contract, nor impose liability on Authority.
2. Delays, whether caused by action or want of action on part of Contractor, or by act of Authority, or their agents, or employees, resulting in keeping of excavation open longer than would otherwise have been necessary, does not relieve Contractor from necessity of properly and adequately protecting excavation from caving or slipping, nor from his obligations under Contract relating to injury to persons or property, nor entitle him to claims for extra compensation.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Wood Materials: Use wood sheeting, sheet piling, bracing and shoring in good serviceable condition and timbers of sound condition, free from large or loose knots, and of proper dimensions.
- B. Metal Materials: Steel or manufactured aluminum sheet piling and bracing of equal strength may be substituted for wood.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Using skilled labor, drive or set sheeting, sheet piling, braces or shores in place and arranged that they may be withdrawn as excavations are backfilled, without injury to piping and structures, and without injury to or settlement of adjacent structures and pavements.
- B. Drive sheeting in advance of excavation when tight plank or steel sheeting is required. Make joints of tongue and groove or interlocking type and as watertight as possible.
- C. Remove sheeting, bracing and shores as trenches and other excavations are being backfilled, except where and to extent Authority requires, in writing, it be left in place or where permitted to leave in place at Contractor's own request and cost.
 - 1. In withdrawing sheeting and sheet piling, exercise care to ensure that voids or holes left by planks as they are withdrawn are backfilled and thoroughly rammed with thin rammers provided especially for that purpose.
 - 2. Exercise care to carry backfill up evenly on all sides of items installed in excavations.
- D. Cut off sheeting or sheet piling left in place as required by Authority and remove from work portion cut off. No additional compensation allowed for cutting and removal of sheeting or sheet piling left in place.

END OF SECTION

SECTION 02221 - TRENCHING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Excavating trenches for utilities.
- B. Backfilling and compaction.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T 99, Moisture-Density Relations of Soils, Using a 5.5-lb Rammer and a 12-inch Drop.
 - 2. AASHTO T 191, Standard Method of Test for Density of Soil In-Place by the Sand Cone Method.
- B. American Society for Testing and Materials:
 - 1. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb Rammer and 12-inch Drop.
 - 2. ASTM D2167 - Test method for density and unit weight of soil in place by the rubber balloon method.
 - 3. ASTM D 2321, Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
 - 4. ASTM D2922 - Test method for density of soil and soil-aggregate in place by nuclear methods (shallow depth).
- C. Occupational Safety and Health Administration:
 - 1. OSHA 29 CFR, Part 1926, Subpart P, Construction Standards for Excavation
- D. Pennsylvania Department of Transportation:
 - 1. PADOT Publication 408, latest edition
 - a. PADOT Section 703.2, Coarse Aggregate
 - b. PADOT Section 703.3, Select Granular Material
 - 2. PADOT Chapter 459, Occupancy of Highways by Utilities, latest edition
 - 3. PADOT Chapter 203, Work Zone Traffic Control, latest edition

1.03 DEFINITIONS

A. Definitions:

1. UNCLASSIFIED EXCAVATION: Removal of materials of any kind in the excavation, including rock excavation.
2. MISCELLANEOUS UNCLASSIFIED EXCAVATION: Unclassified Excavation required by the ENGINEER and not included in other items for payment.
3. MISCELLANEOUS AGGREGATE BACKFILL: Aggregate backfill required by the ENGINEER and not included in other items of payment.
4. MISCELLANEOUS EARTH BACKFILL: Earth backfill required by the ENGINEER and not included in other items of payment.
5. NATIVE SOIL BACKFILL: Earthen material removed from trench excavation, absent large or sharp rocks, vegetative matter, or unsuitable matter. Native soil shall be considered as “Unregulated Material” as defined by the PA Department of Environmental Protection’s “Management of Fill Policy”, a.k.a. “Safe Fill Policy”.
6. SUBGRADE: Trench bottom prepared as specified to receive first class bedding, concrete cradle or concrete encasement or the bottom of excavations prepared to receive pipe line structures.
7. UTILITY: Any buried pipe, duct, conduit or cable.
8. FINAL RESTORATION ELEVATION: Elevation of bottom of final restoration operation such as bottom of topsoil depth or paving Subgrade.

1.04 SUBMITTALS

A. Submit under provisions of 01300.

B. Samples: Submit aggregate samples when requested by ENGINEER and other required submissions to the ENGINEER's field office.

C. Test Reports:

1. Submit testing laboratory aggregate test reports based on requirements stated in Source Quality Control.
2. Compaction density test reports based on method of density determination as specified in Reference Standards and the method as approved by the ENGINEER.

D. Certificates: Submit certificate from aggregate supplier based on requirements stated in Source Quality Control, when requested by ENGINEER.

E. Bonds and Licenses: Submit evidence of bonds, licenses, and experience prior to commencement of any blasting operations.

- F. **Blasting Plan:** Submit data concerning proposed blasting operations and other utility owners if required.

1.05 **QUALITY ASSURANCE**

- A. **Source Quality Control:**

- 1. **Laboratory Tests:** In accordance with Section 01400, aggregate materials specified herein under Products require advance examination or testing according to methods referenced, or as required by the ENGINEER.
 - a. Testing laboratory shall furnish both ENGINEER and CONTRACTOR two copies of test result reports. Same reports will be considered as sufficient evidence of acceptance or rejection of materials represented.
 - b. Conduct aggregate quality tests in accordance with requirements of appropriate Referenced Standard for such materials.
 - c. The ENGINEER reserves the right to accept aggregate materials based on certification from supplier that the aggregate originates from a source approved by PADOT and that the aggregate complies with specified PADOT requirements.

- B. **Regulatory Requirements**

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

1.06 **PROJECT CONDITIONS**

- A. **Classification of Excavated Materials:** Unclassified excavation as defined herein this Section. No consideration will be given to the nature of the materials encountered in trenching operations or for difficulties encountered during excavating or handling of materials.

- B. **Removal of Obstructions:**

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

concerning obstructions are as follows:

- a. Do not interfere with persons, firms, corporations or utilities employing protective measures, removing, changing or replacing their property or structures, but allow said persons, firms, corporations or utilities to take such measures as they may consider necessary or advisable under the circumstances.
- b. Break through and reconstruct if necessary, the invert or arch of a sewer, culvert or conduit that may be encountered if the said structure is in such a position, in the judgment of the ENGINEER, as not to require its removal, realignment or complete reconstruction.

C. Environmental Requirements:

1. Do not perform trenching, backfilling or compacting when weather conditions or the condition of materials are such, in the opinion of the ENGINEER, that work cannot be performed satisfactorily.
2. Do not use frozen materials as backfill nor wet materials containing moisture in excess of the amount necessary for satisfactory compaction.
3. Prior to use, moisten dry backfill material not having sufficient moisture to obtain satisfactory placement or compaction.
4. Plan work so as to provide adequate protection during storms with provisions available for preventing flood damage. Protect installed piping and other work against damage from uplift due to high ground water levels.
5. Accommodation of Drainage: Keep gutters, sewers, drains and ditches open for surface drainage. No damming or ponding or water in gutters or other waterways will be permitted, except where stream crossings are necessary and then only to an extent which the ENGINEER shall consider necessary. Do not direct water flows across or over pavements except through approved pipes or properly constructed troughs. When so required, provide pipes or troughs of such sizes and lengths as required, and place the same as required at no expense to the OWNER. Perform grading in the vicinity of trenches so that the ground surface is properly pitched to prevent water running into the trenches.
6. Pumping: Keep excavations free from water during the performance of the work under this Contract at no expense to the OWNER. Build dams and other devices necessary for this purpose, and provide and operate pumps of sufficient capacity for dewatering the excavations. Provide for the disposal of the water removed from excavations in such manner as not to cause injury to the public health, to public or private property, to the work of others, to the portion of the work completed or in progress or produce an impediment to the use of streets, roads and highways.
7. When it is necessary to haul soft or wet soil material over roadways, use suitably tight vehicles to prevent spillage. Clear away spillage of materials caused by hauling on roadways.
8. Provide effective dust control by sprinkling water, use of calcium chloride or

- other method approved by ENGINEER. Employ dust control when, where and in a manner required by ENGINEER.
9. Do not dispose of water in trenches by draining through completed portions of sewer piping.
- D. Protection: Assume the risks attending and presence or proximity of overhead or underground public utility and private lines, pipes, conduits and support work for same, existing structures and property of whatever nature. Damages and expenses for direct or indirect injury to such structures or to any person or property by reason of them or by reason of injury to them; whether such structures are or are not shown on the Drawings, by work of this Contract, rests solely with the CONTRACTOR.
1. Outside Rights-of-Way: Take necessary precautions to protect trees, shrubs, lawns and such other landscaping from damage. Complete restitution work for damaged areas.
 2. Pipe Supports: Adequately support underground pipes or conduits exposed as a result of excavations. Provide adequate support along their entire exposed length. Install such supports in such manner that backfilling may be performed without dislodging such pipes or conduits. Place and carefully compact Aggregate Backfill around the supports and leave such supports in place as a guard against breakage due to backfill settlement.
 3. Temporary Protective Construction:
 - a. Temporary Fence Barricade: Erect and maintain substantial temporary fences surrounding excavation to prevent unauthorized persons from entering such areas.
 - b. Barricades: Furnish and erect substantial barricades at crossings of trenches, or along trenches, to protect the traveling public.
 - c. Excavation Covers: Cover open excavation when work therein is suspended or left unattended, including the end of a work day. For such covers, use materials of sufficient strength and weight to prevent their removal by unauthorized persons.
 - d. Remove temporary protective construction at the completion of work on the Project.
- E. Structure Supports: Where passing buildings or any structure which by their construction or position might bring a great pressure upon the trenches, the right is reserved by the ENGINEER to require that such buildings or structures be underpinned or supported and protected, or special sheeting be driven or that short lengths of trench be opened at one time. Failure of ENGINEER to recommend said protection shall not relieve CONTRACTOR of his responsibility to protect structures near the construction.
- F. Accommodation of Traffic: Do not obstruct streets, roads and highways unless owner of street authorizes in writing the complete closing of the street, road or highway. Employ such measures as may be necessary to keep the street, road or

highway open and safe for traffic. Maintain a straight and continuous passageway on sidewalks and over crosswalks, at least three feet wide and free from obstructions. **DO NOT OBSTRUCT FIRE HYDRANTS.**

G. Explosives and Blasting:

1. Blasting will be permitted only in areas permitted by OWNER and where the proximity of structures, underground facilities or public safety does not preclude the use of explosives.
2. The use of explosives shall be governed by the "Regulations for the Storage, Handling and the Use of Explosives" of the Pennsylvania department of Labor and Industry and any other applicable federal, state or local codes that may have jurisdiction.
3. All blasts shall be properly matted and securely covered. The CONTRACTOR shall be solely responsible for injury to persons or property located within or beyond the area or scope of the project that may result from his use of explosives.
4. Blasting work shall be supervised by personnel licensed and experienced in this type of work.
5. Explosives shall be stored in state-approved magazine off the job site and shall be delivered to the site in vehicles clearly marked to indicate cargo.
6. Blasting within State Highway and railroad rights-of-ways are not permitted unless authorized by PADOT or the railroad owner. CONTRACTOR shall be responsible for securing required permits.
7. Notify utility owners having structures or other installations (if any) above or below ground in proximity to the trenching work prior to use of explosives. Such notice must be given sufficiently in advance to enable the utility owners to take such steps as they may deem necessary to protect their property from injury. Such notice shall not relieve the CONTRACTOR of responsibility of damage resulting from his use of explosives. The right is reserved to direct that rock within five (5) feet of pipe, conduit or other structures encountered in the trench be removed by methods other than blasting.
8. Cease blasting operations when street paving adjacent to trench is damaged. Repair damaged street paving. Submit to ENGINEER methods to be used in subsequent blasting. Do not proceed with blasting without written approval of ENGINEER on methods to be used in subsequent blasting.

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

I. Responsibility for Condition of Excavation: Condition and results of excavation are solely the responsibility of the CONTRACTOR. Remove slides and cave-ins at

whatever time and under whatever circumstance they occur.

- J. **Excess Materials:** No right of property in materials is granted to the CONTRACTOR for materials excavated on lands not owned by DEVELOPER. This provision does not relieve the CONTRACTOR of his responsibility to remove and dispose of surplus excavated materials.
- K. **Borrow Material:** When the required quantity of backfill material exceeds the quantity of suitable on site material, provide borrow material. If borrow material is needed, notify the ENGINEER sufficiently in advance to permit the ENGINEER to verify such need and to view the proposed borrow pit to determine the material suitability. Borrow excavation will be subject to the ENGINEER's approval whose written consent shall be obtained prior to its use. CONTRACTOR shall be responsible for all sampling and testing required by ENGINEER to determine suitability.
- L. **Change of Trench Location or Depth:** ENGINEER reserves the right to change the location of a trench from that indicated on the Drawings due to the presence of an obstruction, or for other causes.
- M. **Advance Trenching:** Where existing Utilities or other suspected underground obstructions as indicated on the Drawings are within close proximity of proposed pipelines, uncover and verify the exact location of Utilities and other underground obstructions far enough in advance of pipe laying to allow any changes in pipe alignment or grade required to bypass the obstructions to avoid removing sections of pipe already installed. If any sections of installed pipe must be removed and reinstalled as a result of not verifying Utilities or other underground obstructions far enough in advance, the CONTRACTOR shall remove and reinstall the pipe.

1.07 FIELD MEASUREMENTS

- A. **Verify that survey bench mark, control point, and intended elevations for the Work are as shown on drawings.**

PART 2 - PRODUCTS

2.01 FILL MATERIAL

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

vegetation, lumber, metal and refuse; and free of rock or similar hard objects larger than six inches in greatest dimension. Rock to soil ratio shall not exceed one part rock to three parts soil. Native soil shall be easily compacted with a density of at least 97% of standard proctor, suitable for use as unsettleable backfill in municipal road sub-base areas.

- B. Aggregate Backfill: PADOT 2A Modified Coarse Aggregate conforming to PADOT Publication 408, Section 703.
- C. Pipe Bedding and Initial Backfill:
 - 1. Pipe Bedding: Coarse Aggregate conforming to PADOT Publication 408, Section 703.2
 - a. For piping having a diameter of 24 inches and less use AASHTO No. 8 Coarse Aggregate.
 - b. For pipes having a diameter greater than 24-inches use AASHTO No. 57 Coarse Aggregate.
 - 2. Initial Backfill: Coarse Aggregate conforming to PADOT Publication 408, Section 703.2
 - a. For piping having a diameter of 24 inches and less, use AASHTO No. 8 Coarse Aggregate.
 - b. For pipes having a diameter greater than 24-inches use AASHTO No. 57 Coarse Aggregate.
- D. Concrete Cradle and Encasement: PADOT Publication 408, Section 704, Type A, a 28-day compressive strength of 3,300 psi.
- E. Unsuitable Bearing Replacement: AASHTO No. 3 Coarse Aggregate conforming to PADOT Publication 408, Section 703.2.
- F. Underground Warning Tape: Required for nonmagnetic pipe.
 - 1. Printed polyethylene tape, three inches minimum width, color coded, one inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.
 - 2. Magnetic.

PART 3 - EXECUTION

3.01 PREPARATION

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

- B. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Maintain and protect above and below grade Utilities which are to remain.

3.02 EXCAVATING

- A. Perform sheeting and shoring according to OSHA Standards.
- B. Perform soil erosion and sedimentation control work according to Erosion and Sedimentation Control Plan requirements of the local Soil Conservation District Office having jurisdiction.
- C. General:
 - 1. Excavation shall be performed to the lines and grades indicated on the Drawings or as directed by the ENGINEER.
 - 2. Perform excavation and backfilling using machinery except where hand excavation and backfilling is required or is necessary to protect existing structures, utilities, or other private or public properties.
 - 3. Begin excavation in trenches at the control point having the lower invert and proceed upward.
 - 4. Saw cut existing pavement. Remove pavement according to Warwick Township requirements.
 - 5. Remove rock to Subgrade at least twenty-five (25) feet in advance of pipe laying.
 - 6. Do not interfere with 45 degree bearing splay of foundations.
- D. Subgrade Preparation:
 - 1. Do not excavate below depths indicated or specified except where unsuitable material is encountered at Subgrade.
 - 2. Remove unsuitable material found below Subgrade to a depth determined by ENGINEER and backfill with Unsuitable Bearing Replacement material or as directed by ENGINEER to required Subgrade.
 - 3. Remove rocks or other hard matter protruding through trench bottom at Subgrade which could damage pipe or impede consistent backfilling or compaction. Backfill with AASHTO No. 8 Coarse Aggregate to required Subgrade. Compact in four (4) inch lifts.
 - 4. Remove rock below Subgrade if shattered due to excessive drilling impact or splitting operations and in the opinion of the ENGINEER it is unfit for

foundations. Backfill to Subgrade with Concrete or other material acceptable to the ENGINEER.

E. Excavated Material Storage:

1. Separate and stockpile in designated area, excavated materials suitable for use as backfill. Remove from the site, excess materials and excavated materials not suitable for backfill.
2. In no case shall excavated materials be stockpiled outside of the construction easements or the permanent right-of-way if construction easements are not in place.
3. In streets, roads and highways or in any other locations where working space is limited, remove the excavated materials from the first 100 feet of any opening, when required by the ENGINEER, as soon as such is excavated; store and return same for backfilling when required. In no case will the CONTRACTOR be allowed to cast excavated material beyond the curb or right-of-way lines or on sidewalks or lawns.
4. At all times keep excavated materials at least five (5) feet back from edge of trench to facilitate access.

F. Trench Width and Depth:

1. For full depth of trench, maximum trench pay width is a vertical plane as specified in Table A. If sheeting is required, Table A dimensions shall apply to the inside face of the sheeting.

TABLE A	
Diameter of Pipe	Maximum Trench Pay Width (Outside Diameter of Pipe Barrel Plus)
3 through 24 inches	24-inches

2. No additional compensation will be paid for excavating beyond trench widths specified in Table A above, nor for aggregate backfill utilized when insufficient native soil is available, unless approved otherwise in writing by OWNER.
3. Maintain trenches to comply with State or OSHA regulations.

G. Length of Open Trench:

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

- open trench..
2. The CONTRACTOR shall limit all trench openings to a distance commensurate with all rules of safety.
 3. If the work is stopped either totally or partially, the CONTRACTOR shall refill the trench and temporarily repave over the same at his expense. The trench shall not be opened until he is ready to proceed with the construction of the pipeline.
 4. ENGINEER reserves the right to request trench refilling over completed pipe if in his judgement, such action is necessary.

3.03 PIPE BEDDING

- A. Place Pipe Bedding and Initial Backfill as specified herein unless indicated otherwise on Drawings. Place material in trench for full width. Place on each side of pipe and fittings simultaneously.
- B. Pipe Bedding: Carefully place on undisturbed Subgrade or compacted Subgrade as approved by the ENGINEER, Pipe Bedding material from six (6) inches below outside of pipe barrel to pipe springline. Work Pipe Bedding material by hand under pipe haunching to provide adequate side support. Place in three (3) inch layers (uncompacted).
- C. Initial Backfill: From pipe springline to twelve (12) inches above outside of pipe barrel carefully place Initial Backfill in four (4) inch layers (uncompacted). Place carefully so as not to disturb pipe.

3.04 BACKFILL

- A. Backfill trenches to contours and elevations indicated on Drawings.
- B. Maintain optimum moisture content of fill materials to attain required compaction density.
- C. Do not use frozen backfill materials or place backfill on frozen subgrades or trench subgrades.
- D. Perform backfilling by methods which will result in thorough compaction of backfill material.
- E. Backfill to Final Restoration Elevation: Backfill from one (1) foot above the top of pipe to Final Restoration Elevation using backfill materials specified below. Consolidate backfill materials evenly from center to side of trench to prevent arching.
 1. Within the Right-of-Way Limits of Existing State Highways: Backfill material as specified below unless stated otherwise in the approved PADOT

Highway Occupancy Permit.

- a) Paved Areas: Aggregate Backfill compacted in four inch layers to the bottom of the temporary or permanent paving.
 - b) Unpaved Shoulders: Aggregate Backfill compacted in four inch layers to existing grade.
 - c) Unpaved Areas: Aggregate Backfill compacted in four inch layers to bottom of topsoil. Replace topsoil to approximate depth of existing as final refill operation and crown to such height as required by the ENGINEER. Maintain crowned surface to the satisfaction of ENGINEER, during the guarantee period.
2. Existing and Proposed Township Streets: Native soil or Aggregate Backfill compacted in six inch layers to bottom of stone road sub-based material. Road sub-base shall be well compacted 9" layer of 2A modified stone.
 3. Unpaved Shoulders of Proposed and Existing Township Streets: Backfill compacted in six inch layers to a point 6 inches below the adjacent existing surface. Refill the remaining 6 inches with compacted Aggregate Backfill.
 4. Unimproved Streets: Native soil and Aggregate Backfill compacted in eight inch layers to within 6 inches of existing grade. Refill the remaining 6 inches with compacted PennDOT 2A Aggregate.
 5. Stone Driveways: Backfill compacted in eight inch layers to within 6 inches of existing grade. Refill the remaining 6 inches with compacted PennDOT 2A Aggregate.

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

3.05 COMPACTION

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

1. Within the Right-of-Way limits of existing State Highways and Township Roads.
 - a) Paved Areas: 97%
 - b) Unpaved Areas: 90%
2. Other Areas
 - a) Paved Areas: 95%
 - b) Stone Driveways: 95%
- c) Lawns, Fields: 90%

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

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

- D. The use of puddling or jetting for compacting backfill in trenches is prohibited.
- E. Compaction Tests: During the course of backfilling and compacting, the ENGINEER may at various locations and depths of trenches request that the CONTRACTOR make field tests to verify that specified compactions are being achieved. Perform field density tests according to AASHTO T 191. Take samples for each type of soil encountered to establish proctor parameters. Contractor shall schedule to obtain samples and have testing laboratory proctor results available in a sufficient amount of time in advance of the work.
 - 1. Compaction tests shall be performed every 700 feet of trench unless, if in the ENGINEER's opinion, additional tests are warranted.
- F. If compaction tests indicate that Work does not meet specified requirements, remove Work, replace, compact and retest at no additional cost to the OWNER.

3.06 STREAM CROSSINGS

- A. Excavate trenches in stream crossings to the depth shown on the Drawings or otherwise required by the ENGINEER.
- B. Material excavated may be used as backfill unless specifically prohibited by any governing agency having jurisdiction.
- C. Make all necessary provisions for coffer-damming, dewatering and removal of excess excavated material.
- D. Maintain the flow in the stream at all times.
- E. Where rock is encountered in the stream crossings, do not use forms to construct the concrete encasement; place concrete on firm rock below the pipe and against firm rock on both sides of the pipe to provide a firm bond between the encasement and the rock.
- F. Install concrete encasement to a minimum of five feet back from the top edges of the stream banks.
- G. Construct stream crossing according to approved Stream Crossing Permit.

3.07 CLEAN-UP AND MAINTENANCE

- A. General: During construction, the surfaces of all areas including, but not limited to, roads, streets, and driveways shall be maintained on a daily basis to produce a safe, desirable, and convenient condition. Streets shall be swept and flushed after

backfilling, and re-cleaned as dust, mud, stones and debris caused by the work, or related to the work again accumulates.

- B. Remove surplus excavated materials, rubbish and other construction debris from the site after backfilling is completed.
- C. Construction site shall be left clean at end of each working day to satisfaction of ENGINEER.

END OF SECTION

SECTION 02270 - SLOPE PROTECTION AND EROSION CONTROL**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes: Soil erosion and sedimentation control measures for earthwork activities as specified in various other Sections of the Specifications.
- B. Related Sections:
 - 1. Temporary Environmental Controls: Section 01560.
 - 2. Trenching, Backfilling and Compacting: Section 02221.
 - 3. Seeding: Section 02485.

1.02 REFERENCES

- A. American Society for Testing and Materials:
 - 1. ASTM A 82; Specification for Cold-Drawn Steel Wire for Concrete Reinforcement.
 - 2. ASTM A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. ASTM C97; Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
 - 4. ASTM D751; Standard Test Methods for Coated Fabrics.
 - 5. ASTM D1117; Nonwoven Fabrics, Methods of Testing.
 - 6. ASTM D1682; Standard Test Methods for Breaking Load and Elongation of Textile Fabrics.
 - 7. ASTM D3776, Standard Test Method for Mass Per Unit Area (Weight) of Woven Fabric.
 - 8. ASTM D4355, Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water.
 - 9. ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - 10. ASTM D4632, Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
 - 11. ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - 12. ASTM D4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 - 13. ASTM D4884, Standard Test Method for Seam Strength of Sewn Geotextiles.
- B. Commonwealth of Pennsylvania Department of Transportation (PDT) Specifications, Publication 408.
 - 1. PDT Section 212, Geotextiles
 - 2. PDT Section 703, Aggregates

3. PDT Section 735, Geotextiles
4. PDT Section 804, Seeding and Soil Supplements
5. PDT Section 805, Mulching
6. PDT Section 806, Water Course and Slope Erosion Protection
7. PDT Section 845, Unforeseen Water Pollution Control
8. PDT Section 850, Rock Lining
9. PDT Section 856, Rock Barrier
10. PDT Section 859, Sedimentation Pond
11. PDT Section 860, Sediment Trap
12. PDT Section 861, Cleaning Sedimentation Structures
13. PDT Section 864, Diversion Ditch
14. PDT Section 865, Silt Barrier Fence

C. Commonwealth of Pennsylvania, Department of Environmental Protection, Bureau of Soil and Water Conservation.

1. Erosion and Sediment Pollution Control Program Manual.
 - a. Chapter 5, Standards and Specifications.

1.03 SUBMITTALS

- A. Furnish certificates from manufacturers of following materials, certifying their products meet requirements of these Specifications.
1. Matting for Erosion Control.
 2. Fabric for Silt Barrier Fencing.

1.04 PROJECT CONDITIONS

- A. Environmental Requirements:
1. See Section 01560 for environmental protection, erosion control general requirements and scheduling.

PART 2 - PRODUCTS

2.01 STONE FOR RIPRAP

- A. Provide riprap obtained from an offsite source from an approved PennDOT Type A source. Do not use stone for riprap protection containing boulders, or cobbles from soil or gravel deposits, earth, roots, debris or similar material. Each stone to weigh not less than 162 pounds per cubic foot, based on saturated dry specific gravity, determined in accordance with ASTM C97.
- B. Provide stone that is predominantly angular and blocky in shape rather than elongated, with sharp clean edges at intersection of relatively flat faces. Following shape limitations are specified for stone used for riprap protection.
1. Not more than 25 percent of stones reasonably well distributed throughout gradation to have a length more than 2.5 times breadth or thickness.

2. Do not use stone having a length exceeding 3.0 times its breadth or thickness.

- C. Stone for riprap protection obtained from an offsite source to conform to gradation requirements for Rock Lining as specified in PDT Section 850. "R" classification is as indicated on Drawings. Stone protection material may contain up to 5 percent, by weight of air dried rock, fragments, spalls, and dust with each particle weighing less than permissible minimum stone size and be defined as a stone in stone protection material. In computing percentages by weight of stones in required gradation, do not include weight of a particle weighing less than permissible minimum stone size in total weight.

2.02 BEDDING MATERIAL FOR RIPRAP

- A. Aggregate Bedding Material for Corresponding "R" Classification of Riprap is as follows:

"R" Class	Max. Size	Avg. Size (d50)	Min. Size (d15)
R-3	2"	No. 4	No. 100
R-4	2"	No. 4	No. 100
R-5	2"	No. 4	No. 100
R-6	6.5"	2.5"	No. 16
R-7	6.5"	2.5"	No. 16
R-8	6.5"	2.5"	No. 16

2.03 MATTING FOR EROSION CONTROL

- A. Jute Matting: PDT Section 806.2(a)1.
- B. Wood Excelsior Blanket: PDT Section 806.2(a)2.
- C. Mulch Control Netting: PDT Section 806.2(d).
- D. Nylon Erosion Control Mat: PDT Section 806.2(b)2.
- E. Staples: PDT Section 806.2(e)

2.04 EROSION CONTROL DEVICES

- A. Straw Bale Barriers:
 - 1. Bales: Straw stalks of threshed grain or tall hay grass stalks commercially available locally.
 - 2. Stakes: Wood Stakes. Sound, rough sawn, red or white cedar or hardwood measuring two inches by two inches; of required length, with tapered point.
 - 3. Reinforcement Bars: ASTM A615 (S1), Grade 60, Deformed.
 - 4. Wire: ASTM A82.
- B. Filter Fabric Fence: PDT Section 865.2.
- C. Rock Construction Entrance:
 - 1. Crushed Stone - PDT Section 703.2, AASHTO No. 1.
 - 2. Filter Cloth - PDT Section 735, Class 4.
- D. Sediment Removal Pond for Pumped Water: Erosion and Sedimentation Control Plan Details and Notes.
- E. Pumped Water Sediment Control Device (PWSCD):
 - 1. Nonwoven geotextile fabric sewn with double needle machine using high strength thread.
 - 2. Provide PWSCD with opening large enough to accomodate a 4 inch discharge hose with attached strap to tie off the hose preventing pumped water from escaping from PWSCD without being filtered.
 - 3. Properties:

Property	Test Method	Test Result
Weight	ASTM D3776	10 oz./yd.
Grab Tensile	ASTM D4632	270 lbs.
Puncture	ASTM D4833	150 lbs.
Flow Rate	ASTM D4491	70 gal./min./ft. ²
Permitivity	ASTM D4491	1.3 sec ⁻¹
UV Resistance	ASTM D4355	70%
AOS % Retained	ASTM D4751	100
Seam Strength	ASTM D4884	100 lbs./in.
All properties are minimum average roll value except the weight of the fabric which is given for information only.		

4. Manufacturer:
 - a. ACF Environmental, Dirtbag.
 - b. Or Approved Equal.

F. Inlet Sediment Control Device (ISCD):

1. Woven geotextile fabric sack sewn with double needle machine using high strength thread. Geotextile fabric sack to have an average wide width strength of 100 lb/in per ASTM D4884.
2. Provide ISCD manufactured to fit openings of the inlets.
3. Provide ISCD with integral dump straps, lifting loops and restraining strap.
4. Properties:

Property	Test Method	Test Result
Grab Tensile	ASTM D4632	300 lbs.
Grab Elongation	ASTM D4632	20 Percent
Puncture	ASTM D4833	120 lbs.
Mullen Burst	ASTM D3786	80 psi
Trapezoid Tear	ASTM D4533	120 lbs
UV Resistance	ASTM D4355	80%
Apparent Opening Size	ASTM D4751	40 US Sieve
Flow Rate	ASTM D4491	40 Gal/Min/Sq. Ft.
Permittivity	ASTM D4491	0.55 sec-1
All properties are minimum average roll values.		

4. Manufacturer:
 - a. ACF Environmental, Siltsack.
 - b. Or Approved Equal.

G. Channel Inlet Protection: DEP Erosion and Sediment Pollution Control Program Manual Details and Notes and Detail Drawings.

H. Curbed Roadway Inlet Protection: DEP Erosion and Sediment Pollution Control Program Manual Details and Notes and Detail Drawings.

I. Rock Filters: DEP Erosion and Sediment Pollution Control Program Manual, Chapter 5, Section 11.

J. Sediment Traps: PDT Section 860.2.

2.05 TEMPORARY SEEDING MIXTURES

A. As indicated on the Drawings.

Variety of Seed	Spring Mar. 1-May 15 (lb. per acre)	Summer May 15-Aug. 15 (lb. per acre)	Fall & Winter Aug. 15-Mar. 1 (lb. per acre)
Annual rye grass	20		40
Barley or Oats (local seed)	96		
Millet (Japanese)		35	
Annual rye grass		40	
Winter rye or			168
Winter wheat			180

2.06 SOIL SUPPLEMENT MATERIALS

A. As specified in Section 02260.

2.07 MULCHING MATERIALS

- A. Mulches: As specified in PDT Section 805.2(a)1.
- B. Mulch Binding: As specified in PDT Section 805.2(b).
- C. Wood Chips: Wood chips, recovered from clearing and grubbing operations is acceptable as mulch for seeding and used at a rate of 35 cubic yard per acre.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Bedding Material for Riprap: Place bedding material uniformly on prepared base, in a satisfactory manner, over areas to receive riprap and to a minimum thickness of 6 inches. Repair damage to surface of bedding base during placement of bedding material or riprap before proceeding with work. Compaction of bedding is not required, but finish to present a reasonably even surface, free from wounds or windows.
- B. Riprap: Firmly bed each stone abutting against other stones to form a layer, with interstices filled with suitably sized spalls. Take care in placing stone so that its weight is carried by underlying material and not by adjacent stones. Surface of each stone is not to vary more than four inches from surface plane. Depths of abutting

stones are not to differ by more than 4 inches. Progress by fitting additional and abutting stones with well broken joints so that most compact mass of riprap is developed.

- C. Erosion Control Devices: Provide in place prior to start of construction in any area.
1. Diversion Terraces and Interceptor Terraces:
 - a. Provide diversion and interceptor terraces consisting of low ridges of compacted soil or earthfilled burlap bags installed in series to prevent erosive velocities from developing on long, uninterrupted slopes and to direct surface runoff away from critical, disturbed areas. Intercept runoff at each terrace, then filter through a sediment barrier and direct into a stable, nonerosive or vegetated area. Outlet ends of successive interceptor terraces should alternate from side to side of exposed Right-of-Way. Install diversion terraces prior to excavation and earth moving activities. Install interceptor terraces on sloping terrain during construction, after backfill and final grading, and prior to seeding. Construct diversion and interceptor terraces in accordance with details indicated on Drawings. Spacing and location of interceptor terraces are governed by onsite conditions in accordance with following guidelines.

Typical Spacing for Diversion Terraces	
Slope Above Terrace (%)	Spacing (Ft.)
5 - 15%	150
15 - 30%	100
30% or greater	50 & provide diversion above area to divert runoff

2. Trench Plugs:
 - a. Provide temporary trench plugs at intersections between interceptor terraces and open pipeline trench to prevent unconsolidated soils from being washed down trench during periods of rainfall. Temporary trench plugs consist of eight foot long dams of compacted earth.
 - b. Provide permanent trench plugs on critical slopes and on each side of creek crossings to form a solid barrier against subsurface water movement. Permanent trench plugs consist of earth filled sacks packed tightly around pipe.
3. Rock Check Dams:
 - a. Provide rock check dams as temporary facilities at points to intercept surface runoff from project areas, and are intended for removal of sediment. Construct with a filter blanket of AASHTO No. 57 coarse aggregate on upstream face of rockfill section. Locate rock check dams as indicated on Drawings or directed by Authority and construct in accordance with details indicated on Drawings.

4. Sedimentation Traps:
 - a. Provide sedimentation traps prior to performing excavations. Provide as indicated on Drawings or as directed by Authority to remove sediment from storm water runoff or dewatering activities. Design sediment traps to provide a capacity of 2000 cubic feet per contributing acre.
 - b. Structure discharges to natural water way with outlet works designed to pass a minimum of 2 cubic feet per second for each acre of drainage served plus flow resulting from dewatering activities.
 - c. Remove sediment and restore trap to its original dimensions when sediment has accumulated to 1/2 design depth of trap.
 - d. Remove sedimentation trap from service and stabilize area when disturbed areas have been properly stabilized.
5. Silt Barrier Fence: Install fence near limits of excavation or fills where indicated on Drawings or as directed by Authority to control erosion until disturbed areas are permanently stabilized.
 - a. Construct silt barrier fencing with Class 3 geotextile material with wire or plastic mesh support fencing fastened to support posts. Overall height of fabric above ground to be nominally 18 inches. Provide geotextile material of width required including an 8 inch to 12 inch section for embedment.
 - b. Excavate a trench 6 inches wide by 6 inches deep on fabric side of barrier and along inside of post line.
 - c. Install posts a minimum of 18 inches deep, by an approved method, on downstream edge of trench at a maximum spacing of 10 feet.
 - d. Provide wire or plastic mesh support fence when used, of sufficient height to extend from top of fabric to ground or into excavated trench and be securely fastened to posts. Provide staples for wood posts and tie wires for steel and plastic posts, with a minimum of three fasteners per post.
 - e. Secure geotextile fabric material by fasteners to top of wire mesh and posts, keeping sag to a minimum, and at a maximum spacing of 30 inches. Extend fabric 8 to 12 inches into excavated trench for embedment. Backfill and compact over geotextile material to prevent water from flowing under fabric. Overlap fabric roll ends a minimum of 6 inches at post locations.
 - f. Preassembled silt barrier fence systems to be approved by Authority. Install preassembled fence systems in accordance with manufacturer's recommendations.
 - g. Construct silt barrier fence across a ditch or swale area of sufficient length to eliminate end flow, with ends pointing upstream and upslope.
 - h. Maintain silt barrier fence satisfactorily to keep functional. This includes removal of trapped sediment and cleaning fabric of trapped sediment by tapping fabric material when dry. Replace fabric not functioning due to clogging, damage or deterioration as directed by Authority.
 - i. Remove fencing when no longer required, as determined by Authority. Dispose of fencing materials in a suitable manner and restore area where fence had been erected at no additional cost to Authority.

6. Pumped Water Sediment Control Device (PWSCD):
 - a. Install the PWSCD on a slope. It should be placed so the incoming water flows into the bag and will flow through the PWSCD and then flow off the site without creating more erosion. The neck of the PWSCD should be tied off tightly to stop the water from flowing out of the PWSCD without going through the walls of the bag. To increase the surface area being used, the PWSCD may be placed on a gravel bed to allow water to flow in all directions.
 - b. The PWSCD is considered full and should be disposed when it is impractical for the bag to filter the sediment out at a reasonable flow rate and should be replaced with a new PWSCD.
 - c. Disposal may be accomplished as directed by the Authority. If the site allows, the PWSCD may be buried on site and seeded, visible fabric removed and seeded or removed from site to a proper disposal area.
7. Inlet Sediment Control Device (ISCD):
 - a. Installation and emptying instructions in accordance with manufacturers printed instructions.
8. Temporary Seeding and/or Mulching:
 - a. General: Authority reserves right to direct temporary seeding and/or mulching of disturbed areas in event permanent grading and seeding cannot be immediately performed. Include cost of temporary erosion control measures in appropriate pay item.
 - b. Liming: Lime application rates will be determined on basis of tests performed by Contractor or apply a minimum of 800 pounds of agricultural lime stone per 1000 square yards.
 - c. Fertilizer: Apply fertilizer at a rate of 140 pounds per 1000 square yards of 10-20-20 fertilizer or in conformance with results of soil tests performed.
 - d. Tilling: Till seedbed to a depth of 3 inches prior to seeding. Lime (if required) and fertilizer may be applied during tilling operation.
 - e. Seeding: Type of temporary seed mixture to be used is determined by Authority. Sow seed at rate indicated in Temporary Seeding Mixtures Article. Cover seed with 1/2 inch of topsoil and lightly roll seeded area.
 - f. Mulching: Apply hay or straw mulch at rate of three tons per acre on slopes of 1.5 to 1 or flatter. Apply asphalt material to anchor mulch at rate of 50 gallons per ton on straw or hay mulch. Apply wood cellulose fiber mulch on slopes steeper than 1.5 to 1 at a rate of 1500 pounds per acre. Wood chips, recovered from clearing and grubbing operations, is acceptable as mulch for temporary seeding. Use at a rate of 35 cubic feet per acre in lieu of straw or hay.
9. Mulching Alone: For embankments or cuts 1.5 to 1 or flatter, susceptible to critical erosion during periods of cold weather or other site conditions, Authority may require a three ton per acre application of straw or hay mulch for temporary erosion control and later seeding. Apply asphalt for anchoring mulch at a rate of 50 gallons per ton. Straw or hay may be rolled immediately with a sheepsfoot roller to anchor mulch in lieu of using asphalt. When weather becomes favorable, seed areas provided with a mulch cover alone using normal application rates of

seed, fertilizer and lime. If additional mulch is needed, rate of application and area to be mulched will be as determined by Authority.

10. Matting for Erosion Control: Provide matting in lieu of mulch on slopes 3:1 and steeper or when directed by Authority.
 - a. Prepare area to be covered as a fine seedbed, fertilized and seeded. Place matting immediately and water to give a firm bond to soil and start germination of seed. Either jute or excelsior matting may be used.
 - b. Jute Matting: Lay jute matting snugly to ground with a 4 inch overlap on edges and a 12 inch overlap on ends. Make check slots from a 2 foot wide strip of jute matting folded and buried in a 6 inch deep trench with a 6 inch flap extending on each side of trench. Place check slots perpendicular to water flow, tamped and stapled in place before jute matting is laid. Use check slots for jute matting when slope exceeds a 5 percent grade. On grades or slopes steeper than 5 percent, Authority will determine spacing of check slots.
 - c. Excelsior Matting: Lay excelsior matting with netting on top and fibers in contact with soil over entire area. Butt ends and sides of excelsior blanket snugly and staple. It is not necessary to dig check slots, anchor ditches or bury ends of excelsior matting.
 - d. Staples: Hold matting in place by means of wire staples driven at a 90 degree angle to soil surface. Space staples not more than 3 feet apart in three rows for each strip, with one row along each edge and one row alternately spaced in middle. Space staples 6 inches apart across matting ends and check slots width.

3.02 MAINTENANCE

- A. Begin maintenance operations immediately and continue throughout construction period until Contract is completed. Inspect sediment control structures and repair after each storm.

3.03 SOIL EROSION AND SEDIMENTATION PLAN

- A. An approved Erosion and Sedimentation Control Plan is indicated on Drawings. Should Contractor desire to modify this Plan, obtain necessary approvals prior to implementing any provisions at no additional cost to Authority.

END OF SECTION

SECTION 02314 – BORED PIPE

PART I - GENERAL

1.01 SECTION INCLUDES

- A. Highway borings including casing pipe and spacers.
- B. Boring and receiving pit details.

1.02 RELATED SECTIONS

- A. Section 02221 – Trenching, Backfilling and Compacting
- B. Section 02611 – Sewer Pipe and Fittings

1.03 REFERENCES

- A. American Standard for Testing and Materials (ASTM):
 - 1. ASTM A120 – Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
 - 2. ASTM A123 – Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressure and Forged Steel Shapes, Plates, Bars and Strips.
 - 3. ASTM A139 – Electric-Fusion (Arc) Welded Steel Pipe (Sizes 4-inch and over).
- B. American Welding Society: AWS D1.1 Structural Welding Code.
- C. Commonwealth of Pennsylvania, Pennsylvania Code, Title 67 Department of Transportation, Chapter 459, Occupancy of Highways by Utilities.

1.04 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cuts or other data as required to provide a complete description of products to be installed.
- B. Certificates: Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.

1.05 QUALITY ASSURANCE

A. Workman Qualifications

1. Use only personnel thoroughly trained and experienced in the skills required. The field supervisor of boring operations and the boring machine operator shall have not less than 12 months experience in the operation of the equipment being used.
2. Welds shall be made only by welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code AWS D1.1 of the American Welding Society to perform the type of work required. Submit proof of certification when requested by ENGINEER.

B. Design Criteria

1. Encasing conduit under State Highway shall be of sufficient strength to support all superimposed loads, including an H-20 Truck live loading with 50 percent added for impact.
2. Encasing conduit under railroads shall be of sufficient strength to support all superimposed loads including a Cooper E80 live load with 50 percent added for impact.

C. Regulatory Agency Requirements

1. A PADOT Highway Occupancy Permit (HOP) has been obtained for the construction of the boring, and is contained in this Project Manual. Materials and methods of construction used on PADOT right-of-way shall be subject to the approval of PADOT. CONTRACTOR shall at all times conduct his work and operations fully within PADOT's regulations and requirements. CONTRACTOR must ascertain from PADOT its rules, regulations and requirements, and what, if any, delays may be encountered. If required by PADOT, CONTRACTOR shall submit for approval specific details of the methods of construction he intends to utilize together with any sketches or Drawings.

D. Source Quality Control

1. Inspection and Certification by Manufacturer:
 - a. Steel Pipe: The manufacturer of steel pipe shall furnish a sworn statement that the inspection and all of the specified tests have

been made on the steel pipe as required by ASTM A 139 and the result thereof comply with the requirements of that standard.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

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

1.07 JOB CONDITIONS

- A. Scheduling: CONTRACTOR shall not start work within PADOT right-of-way until he has received authorization to proceed from PADOT. Boring operations, once started, shall be continuous until completed.
- B. Environmental Requirements
 - 1. As specified in Section 02221 – Trenching, Backfilling and Compacting.
- C. Protection: In addition to requirements specified in Section 02221, the following shall apply:
 - 1. Adequately support and protect utilities and facilities that are encountered in, or may be affected by the work.
 - 2. CONTRACTOR shall observe all necessary and appropriate safety precautions when working within PADOT right-of-way.
 - 3. Blasting will not be permitted under or near PADOT right-of-way unless approved by PADOT.
 - 4. All excavations shall be sheeted, shored and braced as required to prevent subsurface subsidence.
 - 5. Boring pits shall be kept dewatered, and pumps shall be attended on a 24-hour basis, if conditions require. Close observation shall be maintained to detect any settlement or displacement of roadway, or embankment during dewatering operations. Dewater into a sediment trap and comply with applicable environmental protection criteria specified elsewhere in Project Manual.

PART 2 - PRODUCTS

2.01 STEEL ENCASEMENT PIPE

A. Steel Pipe

1. Steel encasement pipe shall be the size and wall thickness specified in Part 5 of the American Railway Engineering Specifications for pipelines and shall have a minimum tensile strength of 60,000 psi and a minimum yield point of 35,000 psi. Pipe shall conform to ASTM A135, Grade B; A139, Grade B; or A252, Grade 2. Pipe shall have flame machine cut plain ends, which shall be beveled for field welding and circumferential joints and shall have a protective coating of standard mil primer prior to shipment.

2.02 CARRIER PIPE AND FITTINGS

- A. Carrier pipe and fittings as specified in Section 02611 – Sewer Pipe and Fittings.

2.03 MISCELLANEOUS MATERIAL

- A. Aggregate Backfill: Pennsylvania Department of Highway Standard Specifications, Form 408, Section 703, Select Granular Material.
- B. Brick: ASTM 32, Grade MS, commercially manufactured red brick made from clay or shale and burned.
- C. Mortar: ASTM C270
 1. Acceptable Manufacturers
 - a. Medusa Cement Company; Medusa Waterproofing Paste or Powder.
 - b. Grace Construction Materials; Hydratite.
 - c. Chem-Master Corporation; Hydrolox.
 - d. Or equal.
- D. Casing Spacers
 1. Approved Manufacturers
 - a. Cascade Waterworks Mfg. Co.
 - b. Raci Spacers, Inc.
 - c. Or equal
 2. Carrier pipes shall be supported by casing spacers to prevent direct contact between the carrier pipe and casing pipe. Casing spacers shall be made of high-density polyethylene capable of supporting the carrier pipe and its contents. Casing spacers shall also facilitate installation of pipe within the casing. Spacers shall be made entirely of high-density polyethylene with

metallic parts. Spacers shall be adjustable to fit tightly around O.D. of pipe and remain in position during insertion into casing.

PART 3 EXECUTION

3.01 GENERAL

- A. CONTRACTOR shall construct boring according to details contained on the PADOT HOP or to details contained on Drawings if a PADOT HOP is not required. If solid rock or other obstruction is encountered, the boring may require abandonment. Abandonment of a casing due to an obstruction is identified below.
- B. Obstruction:
 - 1. An obstruction is defined as being any physical object such as water, electric, gas, sewer, telephone lines, manholes, etc., or the presence of solid rock, which may be encountered during installation of the casing pipe. Objects such as boulders, sandstone, shale, etc., encountered during the construction of crossing are not considered as obstructions and shall be removed by CONTRACTOR at no additional cost to OWNER.
 - 2. If an Obstruction is encountered during the installation of the casing pipe, CONTRACTOR shall cease operations and notify ENGINEER immediately. In the event the installation cannot be modified and continued, the casing pipe shall be abandoned in place and filled completely with grout. The additional work to fill the abandoned casing shall be completed as a Change Order as agreed upon by OWNER and CONTRACTOR.
 - 3. If CONTRACTOR is required to shift the location or depth of the crossing because of encountering an Obstruction, all work related to adding fittings, pipe, etc. other than that shown on the Drawings necessary for connecting the mains prior to passing through the casing conduit and all additional excavation will be paid by Change Order.

3.02 INSPECTION

- A. Inspect Materials and Products before installing in conformance with the inspection requirements of the appropriate reference standard.
- B. Remove rejected Materials and Products from the Project site.

3.03 PREPARATION

- A. As specified in Sections 02221 and 02611.

3.04 PREFORMANCE

- A. Excavation and Backfill: As specified in Section 02221 and other requirements specified herein.
1. Encasing pipe shall extend a minimum of 3 feet from the edge of the highway shoulder and 25 feet from the centerline of the outside track unless indicated otherwise on the PADOT Highway Occupancy Permit.
 2. Cut the end of the boring pit away from the boring face perpendicular to the axis of the boring operation to provide a bearing surface for the back stop and blocking.
 3. Construct the back stop of heavy timber or steel beams capable of withstanding the jacking force during the boring operation.
 4. Construct boring pit to length and width as indicated on Drawings or required otherwise to complete the work intended, and to a depth of 1 foot below the invert of the casing pipe.
 5. Install the casing pipe so that there shall be not less cover than shown on the Drawing from the top pavement to the top of casing pipe at it closest point.
 6. If excavation extends below the required subgrade, CONTRACTOR shall backfill the area below the subgrade line with coarse aggregate backfill or with concrete at no additional cost to OWNER.
 7. Sheet and shore the boring and receiving pits as required. Provide a sump pump in pits for dewatering.
 8. After carrier pipe is installed in place and tested, backfill trenches as well as receiving and boring pits as specified in the PADOT HOP or as shown on the Drawings if work is outside of the PADOT right of way.
- B. Boring
1. Install casing pipe by bore and jacking method.
 2. Install casing pipe true to line and grade without hand ahead of the pipe. Bored hole shall be essentially the same as the outside diameter of the casing pipe, and over cutting by the cutting head is not to exceed the outside diameter of the casing pipe by more than one-half inch. If voids should develop, or if bored hole diameter is greater than the outside of diameter of the casing pipe by more than approximately one-inch, employ

grouting or other methods approved by PADOT or Railroad Company to fill such voids.

3. The front of the pipe shall be provided with a device that will positively prevent the auger and cutting head from leading the pipe, so that there will be no unsupported excavation ahead of the pipe. Design the equipment such that the auger and mechanical stop is removable from within the pipe in the event an Obstruction is encountered. Arrange the face of the cutting head to provide reasonable Obstruction to the free flow of soft or poor material.
4. The use of water or other liquids to facilitate casing emplacement and spoil removal is prohibited.
5. If field conditions so require, the boring operation shall be continued without interruption, except to install new lengths of casing pipe. Join the lengths of casing pipe by welding. Completely weld the joints around the circumference of the pipe.

C. Installation and Testing Carrier Pipe

1. Install carrier pipe one pipe length at a time. Push carrier pipe through casing pipe with casing spacers. Assemble joints with retainer glands or restrained joints before pushing.
2. After carrier pipe is completely installed and before sealing ends of casing pipe, test carrier pipe as specified in Section 02611.
3. Upon successfully testing carrier pipe, seal ends of casing pipe as shown on Drawings and as specified below.

D. Closing Encased Pipe: After carrier pipe has been installed and successfully tested, close both ends of encasing conduit with brick and mortar to prevent entrance of material. Make provisions in the closure wall to allow leakage to drain out of the encasing conduit.

E. Cleanup: As specified in Section 02221. State and Municipal Highway and private right-of-way shall be restored to condition equal to or better than that which existed prior to the start of work.

END OF SECTION

SECTION 02500 – PAVING AND SURFACING**PART I - GENERAL****1.01 SECTION INCLUDES**

- A. Removal and Restoration of Paving.
- B. Overlay Paving

1.02 RELATED SECTIONS

- A. Section 02221 – Trenching, Backfilling and Compacting

1.03 REFERENCES

- A. The PADOT Sections noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, latest edition. The referenced pertain only to materials, construction equipment, methods and labor. The payment provisions do not apply to work performed under this Contract.
- B. Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, latest edition.
 - 1. PADOT Section 210 – Subgrade.
 - 2. PADOT Section 301 – Plain Cement Concrete Course.
 - 3. PADOT Section 305 – Bituminous Concrete Base Course.
 - 4. PADOT 350 – Subbase.
 - 5. PADOT Section 401 – Plant Mixed Bituminous Concrete Courses.
 - 6. PADOT Section 420 – Bituminous Wearing Course ID-2 and Bituminous Wearing Course ID-2, RPS.
 - 7. PADOT Section 421 – Bituminous Binder Course ID-2, and Bituminous Binder Course ID-2, RPS.
 - 8. PADOT Section 460 – Bituminous Tack Coat.
 - 9. PADOT Section 461 – Bituminous Prime Coat.

10. PADOT Section 470 – Bituminous Seal Coat.
 11. PADOT Section 480 – Bituminous Surface Treatment.
 12. PADOT Section 491 – Milling of Bituminous Pavement Surfaces
 13. PADOT Section 501 – Reinforced or Plain Cement Concrete Pavements.
 14. PADOT Section 630 – Plain Cement Concrete Curb.
 15. PADOT Section 636 – Bituminous Concrete Curb.
 16. PADOT Section 676 – Cement Concrete Sidewalks.
 17. PADOT Section 703 – Aggregates.
 18. PADOT Section 704 – Cement Concrete.
 19. PADOT Section 721 – Calcium Chloride.
 20. PADOT Section 962 – Painting Traffic Lines and Markings.
- C. Commonwealth of Pennsylvania Department of Transportation, Bulletin 25.
- D. Commonwealth of Pennsylvania Department of Transportation, Bulletin 27.
- E. Commonwealth of Pennsylvania Department of Transportation, Bulletin 43 – Maintenance and Protection of Traffic on Construction Projects.
- F. Commonwealth of Pennsylvania Department of Transportation, Bulletin 90 – Handbook for Work Area Traffic Control.

1.04 DEFINITIONS

- A. Street: Unless otherwise specifically qualified herein, term Street as used in this Section is understood to mean a street, highway, avenue, boulevard, road, alley, lane, driveway, parking lot, or other area used as a way for vehicles.
- B. Specified Maximum Trench Width: Applicable maximum trench width specified in Table A in Section 02221.

1.05 SUBMITTALS

- A. Certificates: Furnish certification from bituminous and aggregate producer attesting that materials conform to requirements of PADOT Specifications.
- B. Material Slips: Furnish certification of the amount of materials utilized from the producer according to PADOT Specifications.

1.06 QUALITY ASSURANCE

- A. Source Quality Control
 - 1. Use materials conforming to PADOT Publication 408 and supplementary bulletins thereto.
 - 2. The quality of the work shall be maintained by using the products of a qualified bituminous concrete producer and qualified plant operating workmen.
 - 3. The bituminous concrete producer shall be a bulk producer regularly engaged in production of hot-mix, hot laid bituminous concrete conforming to the standards referenced herein.
- B. Workmen Qualifications
 - 1. Provide at least one person thoroughly trained and experienced in the skills required who readily understands the design and is completely familiar with the application of bituminous concrete paving work. Said person shall be present at all times during progress of bituminous concrete paving work and shall direct the performance of said work.
 - 2. For actual finishing of bituminous concrete surfaces and operation of the equipment use only personnel thoroughly trained and experienced in the skills required.
- C. Regulatory Requirements
 - 1. Perform work on State Highways according to the PADOT Highway Occupancy Permit obtained by OWNER for the project and the requirements of Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Chapter 459, Occupancy of Highways by Utilities, latest edition

2. Perform work on Municipal Roads according to requirements of the Municipality.

1.07 JOB CONDITIONS

A. Protection

1. Protect and maintain cut pavement edges until permanent replacement pavement is placed.
2. Protect paved surfaces outside of the pavement removal limits. Repair pavement outside removal limits damaged by construction operations at no additional cost to OWNER.
3. Use all means necessary to protect and maintain pavement materials before during and after installation. Protect installed work and materials of all other contractors.

B. Environmental Requirements

1. Do not install aggregate courses when ambient temperature are below or are expected to fall below freezing.
2. Do not use aggregates containing frost nor place aggregate courses on frozen subgrade.
3. Do not place bituminous concrete surface courses of permanent pavement when the ambient temperature is 40 degrees F or lower; nor when the temperature of the pavement base or binder on which it is to be placed is 40 degrees F or lower.
4. Adhere to manufacturer's data on air and surface temperature limits and relative humidity during application and curings of coatings.
5. Do not spray apply paint when wind velocity is above 15 mph.
6. Schedule painting work to avoid dust and airborne contaminants.
7. Apply paint during daylight hours only.

C. Maintenance and Protection of Traffic

1. CONTRACTOR shall be responsible for maintenance, protection and control of traffic in the work area and shall be carried out

according to PADOT Transportation Bulletin 43 and PADOT Publication 90.

2. CONTRACTOR shall maintain two-way traffic to the extent possible. If it becomes necessary to limit traffic movement in both directions to a single lane, provide flagmen to alternate one-way traffic through the constricted area.

- D. Substantial Completion: The Substantial Completion Certificate will not be issued until the work of this Section is completed.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Use means necessary to ensure safe storage and use of paint materials and prompt and safe disposal of waste. Store paint products protected from weather when products may be affected by freezing.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bituminous Materials
 1. Asphalt Cement: AC-20 conforming to PADOT Bulletin 25.
 2. Bituminous Concrete Base Course: Conforming to PADOT Section 305; mixture limited to asphalt cement.
 3. Bituminous Binder Course: Hot mixed, hot laid, Bituminous Binder Course ID-2 conforming to PADOT Section 421, using asphalt cement.
 4. Bituminous Wearing Course: Hot mixed, hot laid, Bituminous Wearing Course ID-2 (SRL-M) conforming to PADOT Section 420.
 5. Temporary Paving: Type 2-P Bituminous Stockpile Patching Material conforming to PADOT Bulletin 27, Section 484.
 6. Bituminous Tack Coat: Class AE-T emulsified asphalt conforming to PADOT Section 460.
 7. Bituminous Prime Coat: Conforming to bituminous material requirements of PADOT Section 461.2(a).

8. Bituminous Seal Coat: Conforming to PADOT Section 470.2.
9. Bituminous Surface Treatment: Conforming to PADOT Section 480.2.
- B. Aggregate Subbase: Type C or better, No. 2A and OGS, Section 703.2.
- C. Aggregate Surface: Select Granular Material (2RC) conforming to PADOT Section 703.3.
- D. Aggregate Base Course
 1. Course Material: Crushed Type A, or better, stone conforming to PADOT Section 703.2 ,AASHTO No.1.
 2. Fine Material: Crushed Type A, or better, stone conforming to PADOT Section 703.2, AASHTO No. 10.
- E. Plain Concrete Cement Base Course
 1. High early strength cement concrete (HES) conforming to PADOT Section 704.
 2. Class A cement concrete (normal strength) conforming to PADOT Section 704.
- F. Traffic Paint: Conforming to PADOT Section 962.2(b).
- G. Calcium Chloride: Conforming to PADOT Section 704.
- H. Bituminous Concrete Curb: Conforming to PADOT Section 636.
- I. Cement Concrete, PADOT Section 704.
 1. Driveways: Class AA.
 2. Curbs, Gutters and Sidewalks: Class A

2.02 PAVEMENT MIXES

- A. Composition of Mixtures: Binder and wearing course mixture composition shall conform to requirements of PADOT Section 401.
 1. Establish a job-mix formula prior to beginning work which shall not be changed during the progress of work without the ENGINEER's approval. Job mixing tolerances shall not be

presumed to permit acceptance of materials whose gradations fall outside the master ranges set in the specified PADOT sections.

2. The approved job-mix formula shall lie within the specification limits and be suitable for the layer thickness and other conditions prevailing. It shall not be changed after work has started without the approval of ENGINEER.

PART 3 - EXECUTION

3.01 PREPARATION

A. Pavement Removal:

1. Cut existing paving to neat lines equidistant from the centerline of the trench.
2. Cut existing paving with a mechanical saw.
3. Remove pavement to a width equal to the Specified Maximum Trench Width plus not less than one (1) foot and not more than two (2) feet on each side of trench.
4. If pavement is removed or disturbed for a greater width without written authorization from ENGINEER, replace such pavement at no additional cost to OWNER.
5. Remove temporary paving and backfill to required depth for installation of permanent pavement replacement and backfill. No additional payment will be made for removing temporary pavement and backfill.

B. Subgrade: Backfill and compact trenches as specified in Section 02221-Trenching, Backfilling and Compacting.

C. Perform paving only after site grading, trenching, etc. have been completed and accepted by ENGINEER.

D. Moisture content of subgrade at time of compaction shall not be more than 2 percentage points above the optimum moisture content.

E. At joints between existing pavement and new paving work, the edges of existing pavements shall be cut and neatly trimmed as approved by ENGINEER. Apply Bituminous Tack Coat, petroleum asphalt at all locations where new bituminous paving joins existing bituminous paving.

- F. Prior to traffic line painting, clean surfaces free of dirt, sand, grease or other matter that may negatively impact application.
- G. Milling: Perform milling operations according to PADOT Section 491. Mill pavement as required to provide the minimum pavement overlay thickness and leveling indicated on the Drawings.

3.02 INSTALLATION

- A. Place temporary and permanent paving materials to widths and thicknesses as indicated on Details contained on Drawings. Thicknesses indicated on Drawings are compacted thicknesses.
- B. Temporary Pavement:
 - 1. General: Install temporary pavement where pavement has been removed.
 - 2. Subgrade:
 - a. Construct subgrade as specified in Section 02221-Trenching, Backfilling and Compacting.
 - b. Tamp and Compact subgrade to satisfaction of ENGINEER prior to paving.
 - 3. Pavement: Place temporary paving according to PADOT Bulletin 27.
- C. Permanent Pavement Replacement, Bituminous Base and Surface
 - 1. General:
 - a. Restore all street paving, shoulders, driveways, and parking areas, including subgrade, and base courses with materials as specified. This includes areas disturbed outside the work area.
 - b. Prepare bituminous concrete mixture, place, compact and protect according to PADOT Sections 305.3 and 401.3.
 - c. Location of types and thicknesses of permanent pavements and restoration are as indicated on Details on Drawings.

- d. Remove temporary paving and saw cut road allowing for cutbacks indicated on Details in Drawings.
- 2. Subgrade:
 - a. Construct subgrade as specified in Section 02221-Trenching, Backfilling and Compacting.
 - b. Tamp and Compact subgrade to satisfaction of ENGINEER prior to paving.
- 3. Plain Cement Concrete Base Course: Construct according to PADOT Section 301.
 - a. Base Course: High Early Strength (HES) or Class A Cement Concrete equal to original pavement thickness or 8-inches minimum to subgrade materials.
 - b. Reinforcement: If trench exceeds four (4) feet in width, or otherwise required, provide No. 6 deformed reinforcing bars installed in concrete base course, placed at 6-inch centers with 2-inches clearance at each end and a 3-inch clearance on bottom.
 - c. Bituminous Tack Coat: Provide over cured cement concrete surfaces according to PADOT Section 305.
- 4. Bituminous Concrete Base Course (BCBC): Construct according to PADOT Section 305 and details shown on Drawings.
- 5. Bituminous Concrete Wearing Course (ID-2): Construct according to PADOT Section 420 and details shown on Drawings.
 - a. On streets to be overlay paved and have excavation for widening or significant leveling, utilize BCBC for fill and leveling course.
 - b. Contractor, at his discretion, may utilize ID-2 as the leveling course material.
- 6. Cement Concrete Pavement: Construct according to PADOT Section 501.
 - a. Replace cement concrete pavement according to details in PADOT Pub. #72 RC Series, RC-26, Concrete Pavement Rehabilitation.

- b. Following concrete curing, apply Bituminous Tack Coat in accordance with PADOT Section 460.
 - c. After tack coat has cured, install bituminous binder and wearing course to conform to existing street binder and wearing course.
- 7. Stabilized Shoulder
 - a. Provide trench backfill to surface of adjacent shoulder.
 - b. Grade, shape, and roll entire width of the shoulder. Replace surface stone to be removed.
 - c. Apply Bituminous Seal Coat as specified in PADOT Section 470.3 to entire width of shoulder.
- 8. Bituminous Tack Coat: Apply to base or binder course prior to wearing course and to seal joints. Apply according to PADOT Section 460.
- 9. Seal joint between new and existing pavement and between joints in wearing course with an application of asphalt cement according to PADOT Section 401.3(j).
- 10. Bituminous Surface Treatment: Construct according to PADOT Section 480.
- D. Unimproved Roads, Driveways and Parking Areas:
 - 1. Backfill as specified in Section 02221 with the exception that the top 6-inches of backfill shall be Select Granular Material.
 - 2. Grade, shape and roll entire width of road or parking area. Replace surface stone removed.
- E. Roadway Traffic Lines and Markings: Apply according to PADOT Section 962.
- F. Cement Concrete Curbs: Replace curbs to shape, thickness, workmanship and finish as original curb unless otherwise required by Authority. Construction methods as specified in PADOT Section 630.
- G. Bituminous Concrete Curb: Construct in accordance with requirements of PADOT Section 636.

- H. Cement Concrete Driveway: Backfill as specified in Section 02221. Replacement concrete shall match workmanship, thickness and finish as original driveway unless otherwise required by Authority.
- I. Cement Concrete Sidewalk: Replace cement concrete sidewalk removed or disturbed with a 4-inch thick crush stone bed and a 4-inch thick concrete surface; width to match existing Construct bed and concrete surface as specified in PDOT Section 676.
- J. Bituminous Concrete Driveway: Provide a 2-inch thick wearing course of ID-2 bituminous concrete with top surface flush with top surface of adjacent existing paving.
- K. Bituminous Concrete Walk: Consists of an Aggregates Base Course and a Bituminous Concrete Wearing Course. Provide Aggregate Base Course not less than 6-inches thick after compaction and top surface not less than 2-inches below surface of adjacent existing paving. Provide Bituminous Concrete Wearing Course consisting of 2-inch thick ID-2 wearing course. Top surface of wearing course shall be flush with surface of adjacent existing paving.
- L. State Highway Guide Rail: Replace guide rail damaged or removed during construction.
 - 1. Provide type and quality of guide rail material as existing.
 - 2. Salvage and reuse of guide rail permitted for reconstruction; however, Authority will inspect guide rail after removal and if determined unsuitable for reuse, it shall be replaced with new guide rail.
 - 3. Perform work to requirements and approval of Pennsylvania Department of Transportation.
- M. Dust Control: Provide effective dust control by sprinkling water, by use of calcium chloride or by other methods approved by Authority. Use dust control measures where, when and in a manner required by Authority.

3.03 OVERLAY PAVING

- A. Preparation: Prior to overlay paving, condition existing surface according to PADOT Section 401.3(f).
- B. Patching Existing Paving:

1. Prior to overlay paving, patch potholes and other damaged areas in existing paving. Location and extent of pavement patching will be determined by Authority.
 2. Prior to overlay paving, level low and depressed areas on roadways. Location and extent of leveling will be determined by Authority
 3. Thoroughly clean and remove loose material, dry and prime with a light coat of emulsified asphalt areas to be patched or leveled.
 4. Use Bituminous Binder Course material placed by hand, spread with rakes, lutes, brooms or shovels to obtain uniform placement. Use hand operated vibratory compactor or similar equipment for compaction. Mechanical pavers or conventional power rollers may be used in areas requiring leveling when approved by Authority.
 5. Cut square and vertical the edges of pavement to provide mechanical shoulder when patch exceeds 1-inch in depth.
- C. Milling of Existing Bituminous Pavement Surface: Perform milling operation in accordance with PADOT Section 491, to a depth of 1-1/2-inch depth, and to limits indicated on Drawings.
- D. Adjustment of Height of Gas and Water Service Valve Boxes, and Frames of Underground Structures:
1. Adjust heights of gas and water service boxes, and frames of other underground utility structures, if existing within street to be overlayed. Adjust heights to proposed finish grade elevations of overlay paving well in advance of placing the paving.
 2. Make necessary arrangements with respective utility companies for adjustment of their service boxes and frames of underground structures.
 3. Do not proceed with overlay paving until heights of service boxes and frames of underground structures have been adjusted to satisfaction of Engineer.
 4. No separate or additional payment will be made for adjusting heights of service boxes, and frames of other underground structures.

- E. Painting of Curbs: Prior to placing bituminous concrete overlay pavement, paint inside faces of existing curbs with a thin application of asphalt cement to provide a closely bonded, watertight joint.
- F. Tack Coat: Prior to placing bituminous concrete overlay pavement, apply a Bituminous Tack Coat consisting of a thin application of emulsified asphalt to existing paved surface at rate and in a manner as specified in PADOT Section 460. Prior to applying tack coat, clean loose and foreign material from existing pavement surface.
- G. Construct joints of overlay pavement according to PADOT Section 401.3(j).
- H. At joint between existing pavement and new paving work, cut and neatly trim edges of existing pavements as approved by Engineer. Cut paving with a mechanical saw. Provide an application of bituminous tack coat at locations where new bituminous paving joins existing bituminous paving.
- I. Limits of Overlay Paving: Provide overlay paving to limits indicated on Drawings and to such additional limits as requested by PADOT.
- J. Installation of Overlay Paving, Bituminous Wearing Course, ID-2:
 - 1. Use materials, composition of mixture and methods to construct bituminous concrete overlay paving according to PADOT Section 420 for Bituminous Wearing Course. ID-2.
 - 2. Minimum thickness of overlay after compaction shall be as indicated on Drawings.
 - 3. Install a leveling course of binder course material in depressions if necessary. Include cost of extra thickness in cost of overlay paving.

3.04 MAINTENANCE

- A. Continuously maintain temporary and permanent paving during construction without additional compensation until it is replaced with permanent paving.
- B. Sweep and flush streets after backfilling. Reclean as dust, mud, stones and debris caused by the work, or related to the work accumulates.
- C. Dust Control: Provide effective dust control by sprinkling water, by use of calcium chloride or by any other methods approved by ENGINEER.

Use dust control measures where, when and in a manner required by OWNER and ENGINEER.

- D. Failure of CONTRACTOR to perform this work shall be cause for ENGINEER to order work to be done by others; and back charge all costs to CONTRACTOR.
- E. All unsatisfactory conditions resulting from work shall be corrected.

END OF SECTION

SECTION 02510 - OVERLAY PAVING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Provision for surface preparation, patching, and bituminous overlay paving of existing pavement.
- B. Related Sections:
 - 1. Paving and Surfacing: Section 02500.

1.02 REFERENCES

- A. PDT Sections referenced below pertain only to materials, construction equipment, methods and labor. Payment provisions do not apply to work performed under this Contract.
- B. Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented:
 - 1. PDT Section 401 Plant Mixed Bituminous Concrete Courses.
 - 2. PDT Section 420 Bituminous Wearing Course ID-2 and Bituminous Wearing Course ID-2, RPS.
 - 3. PDT Section 421 Bituminous Binder Course ID-2 and Bituminous Binder Course ID-2, RPS.
 - 4. PDT Section 460 Bituminous Tack Coat.
 - 5. PDT Section 491 Milling of Bituminous Pavement Surfaces.
- C. Commonwealth of Pennsylvania Department of Transportation Bulletin 25.

1.03 DEFINITIONS

- A. Street: Unless otherwise specifically qualified herein, term Street as used in this Section is understood to mean a street, highway, avenue, boulevard, road, alley, lane, driveway, parking lot, or other area used as a way for vehicles.

1.04 QUALITY ASSURANCE

- A. Source Quality Control: As specified in Section 02500.
- B. Workmen Qualifications: As specified in Section 02500.

- C. Requirements of Regulatory Agencies: As specified in Section 02500 with the following additional requirement.
 - 1. Unless otherwise specified or required by the Authority, overlay paving of streets will not be permitted until all other work to be performed under this contract has been completed.

1.05 PROJECT CONDITIONS

- A. Environmental Requirements: As specified in Section 02500.
- B. Time Requirements: As specified in Section 02500.
- C. Protection:
 - 1. Protect paved surfaces outside of the pavement removal limits. Repair pavement outside removal limits damaged by constructing operations at no additional expense to the Authority.
 - 2. Use all means necessary to protect and maintain pavement materials, before, during, and after installation to protect the installed work and materials of all other contractors.
 - 3. In the event of damage or failure of the work of this section within the Guarantee Period, immediately make repairs and replacements. Upon failure to perform maintenance or repairs within three days after notice from the Authority, the Authority may perform such maintenance or repairs and deduct the costs thereof from any moneys due or to become due the Contractor under the Contract.
 - 4. Assume responsibility for any injury or damage resulting from lack of required maintenance or repairs during Guarantee Period. Indemnify and save harmless the Authority from any and all loss by reason of any suit or action at law, based upon any occurrence or omission occurring during this period.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bituminous Pavements:
 - 1. Asphalt Cement: AC-20 conforming to PDT Bulletin 25.
 - 2. Bituminous Tack Coat: Class AE-T Emulsified Asphalt conforming to PDT Section 460.
 - 3. Binder Course: Hot mixed, hot laid, Bituminous Binder Course ID-2 conforming to PDT Section 421, using asphalt cement.
 - 4. Wearing course: Hot mixed, hot laid.
 - a. Bituminous Wearing Course ID-2: Conforming to PDT Section 420.

2.02 PAVEMENT MIXES

- A. Composition of Mixtures: Provide binder and wearing course mixture composition conforming to requirements of PDT Section 401.
 - 1. Establish a job-mix formula prior to beginning work without changing during progress of work except with Authority's approval. Job-mixing tolerances not to permit acceptance of materials with gradations falling outside master ranges set in specified PDT Sections.
 - 2. Approved job-mix formula to fall within specification limits and be suitable for layer thickness and other conditions prevailing.

PART 3 - EXECUTION

3.01 GENERAL

- A. Method of placing, compacting and protection of in-place bituminous concrete for pavement to comply with PDT Section 401.3.

3.02 PREPARATION

- A. Surface Preparation of Existing Paving:
 - A. Prior to overlay paving, condition existing paving in accordance with PDT Section 401.3(f).
- B. Patching Existing Paving:
 - 1. Prior to overlay paving, patch potholes and other damaged areas in existing paving. Location and extent of pavement patching will be determined by Authority.
 - 2. Prior to overlay paving, level low and depressed areas on roadways. Location and extent of leveling will be determined by Authority.
 - 3. Thoroughly clean and remove loose material, dry and prime with a light coat of emulsified asphalt areas to be patched or leveled.
 - 4. Use Bituminous Binder Course material placed by hand, spread with rakes, lutes, brooms or shovels to obtain uniform placement. Use hand operated vibratory compactor or similar equipment for compaction. Mechanical pavers or conventional power rollers may be used in areas requiring leveling when approved by Authority.
 - 5. Cut square and vertical the edges of pavement to provide mechanical shoulder when patch exceeds 1 inch in depth.
- C. Milling of Bituminous Pavement Surface: Perform milling operation in accordance with PDT Section 491, to a depth of 1-1/2 inch depth, and to limits indicated on Drawings.

- D. Adjustment of Height of Gas and Water Service Boxes and Frames of Underground Structures:
 - 1. Adjust heights of gas and water service boxes, and frames of other underground utility structures, if existing within street to be overlayed. Adjust heights to proposed finish grade elevations of overlay paving well in advance of placing the paving.
 - 2. Make necessary arrangements with respective utility companies for adjustment of their service boxes and frames of underground structures.
 - 3. Do not proceed with overlay paving until heights of service boxes and frames of underground structures have been adjusted to satisfaction of Authority.
 - 4. No separate or additional payment will be made for adjusting heights of service boxes, and frames of other underground structures.
- E. Painting Curbs: Prior to placing bituminous concrete overlay pavement, paint inside faces of existing curbs with a thin application of asphalt cement to provide a closely bonded, watertight joint.
- F. Tack Coat: Prior to placing bituminous concrete overlay pavement, apply a Bituminous Tack Coat consisting of a thin application of emulsified asphalt to existing paved surface at rate and in a manner as specified in PDT Section 460. Prior to applying tack coat, clean loose and foreign material from existing pavement surface.
- G. Construct joints of overlay pavement as specified in PDT Section 401.3 (j).
- H. At joints between existing pavement and new paving work, cut and neatly trim edges of existing pavements as approved by Authority. Cut paving with a mechanical saw. Provide an application of bituminous tack coat at locations where new bituminous paving joins existing bituminous paving.

3.03 INSTALLATION

- A. Limits of Overlay Paving:
 - 1. Provide overlay pavement to limits specified and to such additional limits as required by Pennsylvania Department of Transportation, other agencies having jurisdiction, or Authority.
- B. Overlay Paving, Bituminous Wearing Course ID-2:
 - 1. Use materials, composition of mixture and methods to construct the bituminous concrete overlay paving conforming to all applicable requirements of PDT Section 420 for Bituminous Wearing Course ID-2.
 - 2. The minimum thickness of the overlay pavement after compaction to be as indicated on Drawings. The contours of the surface of the overlay pavement may be the same as the existing street pavement.
 - 3. Install a leveling course of binder course material in depressions if necessary.
 - a. Include the cost of this extra thickness in the cost of the overlay paving. There will be no additional payment made to the Contractor for installing any

leveling course except on roadways indicated to receive such in the Table following this Section.

C. Shoulders:

1. Reconstruct existing shoulders adjoining overlaid State Highways to provide support for the new overlay pavement.
2. Reconstruct shoulders of the type specified in and per requirements of Section 02500.

3.04 MAINTENANCE

- A.** As per requirements of Section 02500 with the exception of maintaining temporary paving.

END OF SECTION

SECTION 02601 - MANHOLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewer manholes and related appurtenances.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A48, Gray Iron Castings, Spec. for.
 - 2. ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes, Spec. for.
 - 3. ASTM A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Spec. for.
 - 4. ASTM C361, Reinforced Concrete Low-Head Pressure Pipe, Spec. for.
 - 5. ASTM C443, Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets, Spec. for.
 - 6. ASTM C478, Precast Reinforced Concrete Manhole Sections, Spec. for.
 - 7. ASTM C923, Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
 - 8. ASTM D2146, Propylene Plastic Molding and Extrusion Materials, Spec. for.
 - 9. ASTM D2240, Rubber Property-Durometer Hardness, Test Method for.
- B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Specifications.
- C. American Water Works Association:
 - 1. AWWA C 302, AWWA Standard for Reinforced Concrete Water

Pipe - Non-Cylinder Type, Not Pre-stressed.

D. Federal Specifications:

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

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

1.03 SUBMITTALS

A. Shop Drawings and Product Data:

1. Submit under provisions of Section 01300.
2. Manufacturer's published detail drawings, modified to suit design conditions if required, and CONTRACTOR prepared drawings as applicable.
3. Manufacturer's descriptive literature and specifications covering the product specified. Include installation information.

B. Certificates:

1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
2. Manufacturer's sworn certification that components and products will be manufactured in accordance with specified reference standards for components and products.
3. Manufacturer's sworn certification that manhole frame and cover tensile test bars were poured from the same iron as castings they represent.
4. Manufacturer's sworn certification that manholes were constructed using Type II Portland cement as specified in Source Quality Control.
5. Manufacturer's sworn certification that manhole frame and cover meets or exceeds AASHTO HS-20 highway loading requirements.

1.04 QUALITY ASSURANCE

- A. Initial Manhole: Construct first manhole in the Project to demonstrate the following, and serve as the minimum acceptable conditions of construction throughout the Project.
 - 1. Demonstrate manhole base construction methods.
 - 2. Demonstrate manhole component sealing in the case of precast reinforced concrete manholes.
 - 3. Demonstrate manhole step alignment.
 - 4. Demonstrate pipe opening sealing.
 - 5. Demonstrate method of adjustment of manhole frame and cover to grade and manhole frame and cover attachment.
 - 6. Demonstrate successful manhole acceptance test.
- B. Shop Inspection:
 - 1. All materials furnished by the CONTRACTOR shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required.
- C. Field Inspection:
 - 1. All materials furnished shall be tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the ENGINEER.
- D. Source Quality Control:
 - 1. Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast reinforced concrete manholes.
 - 2. Obtain certificate of construction compliance with ASTM C478 from the precast reinforced concrete manhole manufacturer.
 - 3. Obtain sworn certification from manufacturer that manholes were constructed using Type II Portland cement.
 - 4. Obtain certificate of material compliance with ASTM A48, Class 30

tensile strength from the manhole frame and cover manufacturer. Furnish certification that tensile test bars were from same pour as castings.

5. Obtain certification from manufacturer that manhole frame and cover meets or exceeds AASHTO HS-20 highway loading requirements.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Transport and handle precast reinforced concrete manhole components and other Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects. Through-wall lifting holes not permitted in manhole component construction.
- B. Store precast reinforced concrete manhole components in accordance with manufacturer's recommendations to prevent joint damage and contamination. Exercise such care in storage of other specified Products as recommended by the respective manufacturers.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements:
 1. In no instance set or construct manhole bases on subgrade containing frost.

PART 2 - PRODUCTS

2.01 BASIC MATERIALS

- A. Cast-In-Place Concrete Products: Form work, Reinforcement, and Cast-In-Place Concrete conforming to requirements of Division 3 Concrete. Type II Portland cement shall be used. Use 4,000 design mix.
- B. Epoxy Bonding Compound:
 1. Manufacturers:
 - a. A. C. Horn EPOXTITE BINDER
 - b. Sika Chemical SIKADUR-HI-MOD
 - c. or equal
 2. Multi-purpose, high-modulus, high-strength, 2-component, solvent free, moisture insensitive, epoxy bonding/grouting adhesive.

- C. Non-Shrink Non-Metallic Grout
 - 1. Manufacturers
 - a. Master Builders, Inc., Masterflow 928
 - b. U.S Grout Corporation, Five Star Products
 - c. or equal
 - 2. Ready mix, ASTM C1107 high precision, natural aggregate grout.
- D. Manhole Steps: Design as shown on Standard Detail Drawings.
 - 1. Aluminum Step: Aluminum Alloy AA Designation 6061-T6, 3/4-inch minimum diameter and 12-inches minimum rung width with drop front to prevent side slipping. Coat that portion of aluminum step being embedded in concrete with heavy-bodied bituminous paint. Aluminum manhole steps No. 12653B by ALCOA or equal.
 - 2. Reinforced Plastic Step: Composed of a 1/2-inch Grade 60, ASTM A615 deformed steel reinforcing bar completely encapsulated in Grade 49108, ASTM D2146 polypropylene copolymer compound, Type II; M. A. Industries, Inc., Type PS2-PF or PS2-PFS; or equal.
 - 3. Manhole step dimensions shall meet requirements of OSHA Standard 1910.27 for fixed ladders.
- E. Manhole Frame and Cover:
 - 1. Manufacturers:
 - a. Modena Foundry, Pattern No. 541-S
 - b. Washington Street Brass and Iron
 - c. Neenah Foundry Company
 - d. or equal
 - 2. General: Gray iron castings conforming to ASTM A48, Class No. 30, designed for AASHTO Highway Loading Class HS-20. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects.
 - a. Finish: Bearing surfaces machined to prevent rocking and rattling under traffic. Casting surfaces shotblast cleaned and coated with asphalt paint, non-tacky drying.

- b. Identification: Cast the letters "SEWER" integrally in center of cover in 2-inch raised letters.
 - c. Frame Hold-down Bolts: Type 316 stainless steel, ASTM A276 bolts and washers.
 - d. Cover Gasket: One piece O-ring gasket factory installed in a machined rectangular or dovetail groove in the cover bearing surface.
 - 1) Gasket material of neoprene composition having good abrasion resistance, low compression set, Type D 40 durometer hardness determined in accordance with ASTM D 2240 and suited for use in sanitary sewer manholes.
 - 2) Gluing of gasket is not permitted.
 - e. Tensile Test Bar: Size B, cast separately, but poured from same iron as castings they represent.
- F. Watertight Manhole Frame and Cover: Gray iron castings conforming to previously specified requirements for Manhole Frame and Cover except that cover shall contain four (4) hold-down bolts.
 - 1. Manufacturers:
 - a. Modena Foundry, Pattern No. 541-WT
 - b. Washington Street Brass and Iron
 - c. Neenah Foundry Company
 - d. Or Equal
 - 2. Cover Hold-down Bolts: ¾- inch diameter minimum type 316 stainless steel, ASTM A276 bolts and washers; or manufacturer's standard bronze bolts and washers. Drill and tap frame to accept cover hold down bolts.
 - 3. Threaded Sleeves: Manhole frame factory fitted with stainless steel or bronze threaded sleeve to accept cover bolts.
- G. Preformed Plastic Sealing Compound:
 - 1. Manufactures:
 - a. K. T. Snyder Company, Inc.; RAM-NEK.
 - b. K. T. Snyder Company, Inc.; RUB'R-NEK.

- c. Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.
 - d. Or Equal.
- 2. Fed. Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound, and shipped protected in a removable two-piece wrapper. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.
- H. Rubber Compression Gasket: Composition conforming to ASTM C 361 or ASTM C 443.
- I. Expandable Sleeve Type Pipe Opening Seal: ASTM C923, consisting of a power sleeve, gasket and two (2) take up clamps. Sleeve is mechanically expanded to compress gasket against receptacle hole in manhole wall. Provide seal equivalent to Press Seal Gasket Corp. PSX Positive Seal Gasketing System.
 - 1. Power Sleeve: Type 304 stainless steel, 85,000 psi yield strength.
 - 2. Gasket: Compound Polyisoprene suitable for use with raw sewage.
 - 3. Take Up Clamps: Type 304 stainless steel with stainless steel screw.
- J. Modular Mechanical Type Pipe Opening Seal: Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with stainless steel bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and the wall opening. The seal shall be constructed so as to provide electric insulation between the pipe and wall to reduce the occurrence of cathodic reaction between the two members. Wall penetration closures shall be "Link-Seal" as manufactured by Thunderline Corp., or equal.
- K. Manhole Adapters: Gasket type waterstop composed of elastomeric polyvinyl chloride (PVC) such as manufactured by Fernco Joint Sealer Co.; CMA Concrete Manhole Adapter. (CMA Waterstop distributed by The General Engineering Company, Frederick, Maryland)
- L. Coatings:
 - 1. Manufacturers

- a. Koppers 300 M Epoxy
 - b. Pennsbury 32-B-4 Epoxy
 - c. Or Equal
2. Apply two (2) coats to outer surface of entire manhole to waterproof manhole.

2.02 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

- A. Materials and Construction: Conforming to requirements specified in ASTM C478 except as follows:
 1. Concrete: Composition and compressive strength conforming to ASTM C478 except use Type II sulfate resistant or Type III high early strength Portland cement in manhole components and increase compressive strength to 4500 psi (at 28 days) in precast bases.
 2. Casting and Curing: Wet cast and steam curing process in accordance with Section 3.6.11 and 3.7.2 of AWWA C302.
 3. Manhole Steps: Factory installed in manhole components, prealigned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Standard Detail Drawings. Materials as previously specified.
 4. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing either a Rubber Compression Gasket or Preformed Plastic Sealing Compound. Materials as previously specified.
 5. Manhole Component Design: Base, tapered and straight riser section, and top section dimensions and diameters, not consistent with ASTM C 478, are as indicated on Drawings.
 6. Lifting Holes and Lugs: Thru-wall holes shall not be permitted in manhole component construction.
 7. PADOT Compliance: In addition to above specifications, manholes for installation within PADOT rights-of-way shall also conform to PADOT Publication 408 specifications.
- B. Precast Bases and Riser Sections: Design, materials and construction as specified previously.

- C. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.
- D. Pipe Opening Seals: Option to install one of the following:
 - 1. Resilient Gasket Type Pipe Opening Seal:
 - a. Manufacturers:
 - 1) A Lok Products Corporation; A LOK Manhole Pipe Seal.
 - 2) Scales Manufacturing Corporation; RES-SEAL.
 - 3) Press Seal Gasket Corporation; PRES-WEDGE II.
 - 4) Thunderline Corporation; LINK-SEAL Modular Wall and Casing Seal.
 - 5) Dual Seal Gaskets Inc.; DUAL SEAL II.
 - b. Cast integrally with manhole component conforming to requirements specified in ASTM C 923.
 - 2. Expandable Sleeve Type Pipe Opening Seal: As previously specified herein this Section.
- E. Precast Top Sections: Designs as shown on Standard Detail Drawings of materials as specified previously herein this Section except additional and differing requirements as follows:
 - 1. Hold Down Bolt Inserts: Factory cast in top section no less than two 3/4-inch diameter threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Threaded inserts of 3-inches depth. Both insert types designed for an ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert location with manhole component manufacturer to assure proper location in top sections.
 - 2. Flat Slab Tops: Thickness versus diameter as indicated on Drawings. Tops factory formed to properly accept and support required manhole frame and cover and formed to join riser section in a matching joint.
 - 3. Eccentric Cone Tops: Manufactured to same minimum wall

thickness and with same area of circumferential steel reinforcement as riser sections.

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

2.03 CONTRACTOR OPTIONS IN PRODUCTS

- A. Manhole Construction Options: Permitted option to construct one type of manhole in the Project of types listed herein, except where required otherwise on Drawings.
 - 1. All-precast reinforced concrete manhole components.
 - 2. All-precast reinforced concrete manhole components except manhole base. Base of cast-in-place concrete.
 - 3. Precast reinforced concrete grade rings used as frame and cover leveling units in any of above manhole construction.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C 478 regarding repairable defects and defects subject to rejection by the ENGINEER.
- B. All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the ENGINEER. All defective materials furnished by the CONTRACTOR shall be promptly removed from the site.

3.02 PREPARATION

- A. Keep pipe and manhole interiors cleared of debris as construction progresses.
- B. Earthwork: Perform earthwork as previously specified in Section 02221 - Trenching, Backfilling and Compacting.

3.03 MANHOLE INSTALLATION

- A. Cast-In-Place Concrete Manhole Base: Construct in accordance with design

and dimensions indicated on Drawings. When necessary to construct wider or deeper manhole bases than indicated or specified, build such bases as required by the ENGINEER.

1. Form and pour concrete in accordance with requirements of Division 3 - Concrete. Additional requirements as follows:
 - a. Vibrate poured concrete using mechanical vibrator of a type and design approved by ENGINEER. Use vibrators of type capable of transmitting vibration to concrete in frequencies of not less than five thousand impulses per minute.
 - b. Form and pour joint monolithically in manhole base top to match joint of adjoining precast riser section. Use template as obtained from precast concrete manhole component manufacturer of manhole components used in the Project.
 2. Install sewer piping in cast-in-place manhole bases prior to pouring the concrete.
 - a. Apply Epoxy Bonding Compound in accordance with manufacturers instructions to pipe at base connection prior to pouring the concrete.
 - b. Install Manhole Adapter on pipes entering and leaving manhole base prior to pouring concrete. Install Manhole Adapter according to manufacturer's written instructions.
- B. Precast Concrete Bases:
1. Install precast bases on aggregate subbase. Materials and thicknesses as shown on the Standard Details.
 2. When pipe opening seal materials create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with preformed plastic sealing compound.
 - a. Tightly caulk sealing compound into annular spaces in a manner to completely fill the spaces and render the installation watertight.
 - b. Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.

- C. Length of Pipe Connections into Manholes:
1. Use pipes no longer than 5-feet in length when connecting into manholes through resilient gasket type pipe opening seals.
 2. For all other pipe connections into manholes, use pipes of such length that a pipe joint is provided at the outside edge of manhole base or wall as applicable. Also use pipes no longer than 6 feet in length for first pipe joined thereto.
- D. Concrete Channel Fill: Field pour concrete channel fill for each manhole base.
1. Form inverts directly in concrete channel fill.
 2. Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.
 3. Make changes in size and grade gradually.
 4. Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.
 5. Make slopes gradual outside the invert channels.
 6. Use 3000 psi Type II concrete as specified in Section 03300 - Cast-In-Place Concrete, unless indicated otherwise on Drawings.
- E. Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps.
1. Install sealing compound in accordance with manufacturer's recommendations, and join sections also in accordance with written instructions of manhole component manufacturer.
 - a. Prime joint surfaces if required by preformed sealing compound manufacturer.
 - b. If sealing compound is installed in advance of section joining leave exposed half of two piece protective wrapper in place until just prior to section joining.

- c. Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.
 - d. To improve workability of "Preformed Plastic Sealing Compound" during cold weather, store such at temperature above 70°F or artificially warm compound in a manner satisfactory to the ENGINEER.
 - e. During warm weather stiffen "Preformed Plastic Sealing Compound" by placing under cold water or by other means as recommended by the compound manufacturer.
 - f. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.
 - g. Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.
- F. Lifting Recess Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into recesses in such manner to render them completely water and air tight. Sealing of lifting recesses with grout not permitted.
- G. Frame and Cover Installation: Where required, make final adjustment of frame to elevation using Precast Grade Rings.
- 1. Set Precast Grade Rings in Non-shrink Non-metallic Grout. Grout thickness shall not exceed 3/4-inch maximum and 3/8-inch minimum. Wet, but do not saturate Precast Grade Rings immediately before laying.
 - 2. Parge the inside and outside of the grade rings to a minimum thickness of 1/2 inch using Non-shrink Non-metallic Grout.
 - 3. Bolt manhole frames only following grout curing period. Install manhole frames on 1/2-inch thick Preformed Plastic Sealing Compound on bearing surface of manhole frame. Remove excess sealing compound as it is squeezed out after manhole frame is bolted in place.
 - 4. Use bolts of sufficient length to properly pass through leveling units, if any, engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer. Tighten manhole frame bolts after grout has

cured.

- H. Waterproofing: Coat entire outer surface of all manhole components including parge grade rings with two (2) coats of a Bitumastic Coating.
- I. Drop Manholes: Construct in accordance with type indicated in Standard Detail. Use same type pipe and fittings in drop connection as used in sewer line from which drop connection is made.
- J. Plugging Pipe Openings: Plug pipe openings in manholes where such openings are required for future pipe connections. Use manufactured units specifically designed for the purpose. Plugs shall be designed to allow for future removal without damage to manhole.

3.04 PIPE CONNECTIONS TO EXISTING MANHOLES

- A. Make connection to existing manhole by core drilling pipe opening in wall at invert elevation to match existing.
- B. Remove existing bench as needed to make new connection. Reconstruct bench and form new flow channel after new pipe has been inserted.
- C. Seal pipe to wall opening using either the Expandable Sleeve Type or Modular Mechanical Type Pipe Opening Seal previously specified.

3.05 CONSTRUCTION OF NEW MANHOLES OVER EXISTING SEWER MAINS

- A. Where new manholes are constructed on top of existing sewer mains, the CONTRACTOR shall have the option to use cast-in-place concrete manhole bases or precast concrete bases, both as previously specified. Construct according to Standard Details and as follows:
 - 1. Replace broken or damage pipe resulting from work with new pipe. New pipe shall be of materials as previously specified. Use couplings compatible with new and existing pipe for making final connections.
 - 2. Connect new pipe to new manhole bases using materials and methods previously specified.
 - 3. Maintain flow of existing sewer during construction and until concrete is properly cured in the case of cast-in-place work and formed inverts.
 - 4. Saw cut existing pipe to be removed. Chipping or breaking pipe with a hammer shall not be permitted.

3.06 FIELD QUALITY CONTROL

- A. General: Test each manhole constructed in the Project by one of the methods specified herein. If the manhole is constructed on an existing sewer where sewage flow must be maintained, the test will be waived.
1. Conduct tests in presence of and to complete satisfaction of the ENGINEER.
 2. Should a manhole not satisfactorily pass testing, discontinue manhole construction in the Project until such manhole does test satisfactorily.
 3. Provide tools, materials (including water), equipment and instruments necessary to conduct manhole testing specified herein.
 4. Prior to testing manholes, thoroughly clean such and seal openings, both to complete satisfaction of the ENGINEER. Seal openings using properly sized plugs.
 5. Perform testing with frames installed. The joint between the manhole and the manhole frame shall be included in the test.
 6. The CONTRACTOR may elect to make a test prior to backfilling for his own purposes; however, the tests of the manholes for acceptance, shall be conducted after the backfilling has been completed.
- B. Vacuum Testing
1. Vacuum Testing Equipment:
 - a. Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from manhole and to monitor vacuum.
 - b. Provide an extra vacuum gauge of known accuracy to frequently check test equipment and apparatus.
 - c. Vacuum testing equipment and associated testing apparatus subject to ENGINEER's approval.
 - d. Provide seal plate with vacuum piping connections for inserting in manhole frame.
 2. Vacuum Test Procedure:
 - a. Perform vacuum testing in accordance with the testing

equipment manufacturer's written instructions.

- b. Draw a vacuum of (-) ten-inches of mercury and close the valves.
- c. Consider manhole acceptable when vacuum does not drop below (-) nine-inches of mercury for the following manhole sizes and times.
 - 1) Four foot diameter - 60 seconds
 - 2) Five foot diameter - 75 seconds
 - 3) Six foot diameter - 90 seconds

C. Exfiltration Test Procedure:

- 1. Completely fill manhole with water.
- 2. Allow water filled manhole to stand twelve hours prior to testing to allow absorbing in materials.
- 3. At commencement of test, fill manhole to top of manhole frame.
- 4. During a consecutive four hour period keep an accurate record of the amount of water to be added because of exfiltration.
- 5. Consider manhole acceptable when exfiltration rate does not exceed a rate of 0.0189 gallons a day per inch of manhole diameter per vertical foot of manhole.

D. Repair and Retest: Determine source or sources of leaks in manholes failing acceptable limits.

- 1. Repair or replace defective materials and workmanship, as is the case, and conduct such additional Manhole Acceptance Tests and such subsequent repairs and retesting as required until manholes meet test requirements.
- 2. Materials and methods used to make manhole repairs must meet with ENGINEER's approval prior to use.
- 3. Make repairs, replacements and retests at no additional expense to OWNER.

END OF SECTION