

SECTION 02 41 16

DEMOLITION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Remove all items shown on the plans including the following:
 - 1. Remove designated concrete, stone, asphalt, utility poles, signs, bollards, etc.

1.02 RELATED WORK

- A. Section 31 23 33: Excavation, Backfill and Compaction

1.03 EXISTING CONDITIONS

- A. Conduct demolition to minimize interference with traffic and other property access. Maintain protected egress and access at all times.
- B. Provide, erect, and maintain temporary barriers and security devices.
- C. Traffic
 - 1. Conduct site preparation, removals and salvaging operations to ensure minimum interference with roads, streets, walks and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
- D. Protection
 - 1. Contractor shall minimize removal of existing asphalt pavement. In the event curb and sidewalk cannot be removed without damaging pavement, restore damaged pavement in accordance with Section 32 12 23.
 - 2. Contractor shall be responsible for the protection of existing facilities and improvements, indicated to remain in place, within the area of the site where his work is being done.
 - 3. Contractor shall be responsible for the protection of existing facilities on adjoining properties.
 - 4. Any disturbances to the work and improvements or any impairments of facilities resulting from work of this Section, shall be promptly restored, repaired or replaced at no extra cost to the owner.
- E. Protection of Existing Utilities
 - 1. Pursuant to the requirements of Pennsylvania Act 172, the Contractor shall contact the Pennsylvania One Call System at 1-800-242-1776 at least three days prior to any excavation work.
 - 2. Utility companies owning services that will be affected by alteration and removal of demolition work shall be notified in advance according to the requirements of the utility.
 - 3. The existence and location of underground utilities are not guaranteed and shall be

investigated and verified in the field by the Contractor before starting work. Excavation in the vicinity of the existing utilities shall be carried on with extreme caution. Utilities encountered on the Owner's property are to be maintained in existing condition unless otherwise indicated on the drawings. All existing underground utilities, storm piping and associated structures designated for removal shall be completely removed in accordance with the utility company or agency having jurisdiction. Underground utilities designated to be abandoned in place shall be properly plugged and abandoned in accordance with the regulations of the utility company or agency having jurisdiction. Material removed shall be disposed of off-site in a lawful manner.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Products and materials utilized in this item of work shall be subject to the approval of the Owner's representative.

2.02 RESTORATION

- A. Products and materials used in restoration and repair of private and public property shall be of a quality equal to or better than the original project or material.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Locate existing active utilities and verify whether each utility will remain in service and therefore requires protection of is part of the demolition and removal activity.
- B. Protect existing items which are not indicated to be altered.
- C. Prior to starting work make arrangements with the proper authorities for turning off and disconnecting utilities in conjunction with demolition activities. Disconnect, remove, and cap designated utility services within demolition areas. Mark location of disconnected utilities. Identify and indicate capping locations on Project Record Documents.
- D. Visit the premises and verify all conditions covering the work of this Section and verify all dimensions. Examine all drawings covering the work of this Section and refer to all other drawings that may affect the work of this Section or require coordination with other trades. Before starting the work of this Section, make a thorough examination of all portions of the premises in which the work of this Section is to be performed. Check all of the work adjoining, adjacent to, and underlying the locations where the work of this Section is to be performed. Report to the Engineer any and all conditions that may interfere with or otherwise affect or prevent the proper execution and/or completion of the work of this Section. Do not commence work until any and all such conditions have been corrected by the trade or trades responsible.
- E. Demolish in an orderly and careful manner. Protect any existing structures to remain from damage.
- F. Do not disturb existing paving unless it becomes necessary to do so in order to complete other work.
- G. Except where noted otherwise, immediately remove demolished materials from site.
- H. Remove materials to be re installed or retained in manner to prevent damage.

- I. Remove and promptly dispose of contaminated, vermin infested, or dangerous materials encountered.
- J. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.
- K. In the event of discrepancy, immediately notify the Engineer. Do not proceed with work of this Section in areas of discrepancy until all such discrepancies have been fully resolved. Should any work performed under this Section expose previously unknown major conditions, all work shall be stopped and the matter reported immediately to the Engineer for instructions. However, the Contractor shall use any measures necessary to insure adequate safety conditions.
- L. Appropriate erosion and sediment control measures (as shown on the Contract Drawings or otherwise required to complete the work) should be installed prior to commencement of work of this Section.

3.03 CLEAN-UP

- A. Execute work in such a manner as to avoid interference with, use of, or passage to and from adjoining spaces and facilities. Do not burn materials or debris on premises. Remove from the site all rubbish and debris resulting from work of this Section.
- B. Do not allow the accumulation of scraps and debris arising from the work of this Section. Maintain the premises in a neat and orderly condition at all times. Daily clean-up of construction areas is required.

3.04 DISPOSAL OF DEBRIS

- A. All items of demolition within the contract limits, including stones, rubbish, utility lines and fixtures, plant material, and similar items shall be, unless otherwise directed, the Contractor's property and shall promptly be removed from the site and disposed of in a legal manner, in a state approved disposal area.

END OF SECTION

SECTION 03 11 00

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Openings for other Work.
- C. Form accessories.
- D. Form stripping.

1.02 RELATED SECTIONS

- A. Related Work Specified Elsewhere.
 - 1. Section 03 30 00: Cast-in-Place Concrete.

1.03 REFERENCES

- A. ACI 318 - Building Code Requirements for Reinforced Concrete.
- B. ACI 347 - Recommended Practice for Concrete Formwork.

1.04 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 347, 301, and 318.

PART 2 PRODUCTS

2.01 WOOD FORM MATERIALS

- A. Form Materials: At the discretion of the Contractor.
- B. Lumber: Hem-Fir species; #2 grade; with grade stamp clearly visible.

2.02 FORMWORK ACCESSORIES

- A. Form Ties: Looped snap-off type, galvanized metal, with 1-1/2" breakback incorporating a water stop washer (required for walls which are to retain liquids) or removable metal type of fixed length; free of defects that could leave holes larger than 1-1/4 inch in concrete surface.
- B. Form Release Agent: Colorless mineral oil which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

- C. Corners: Chamfered, wood strip type; 3/4 x 3/4 inch size, maximum possible lengths.
- D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- E. Water stops: Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50 degrees F to plus 175 degrees F working temperature range, 6 inches wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; manufactured specifically as a water stop at a concrete cold joint.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

- A. Earth forms are not permitted except for footings. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over stressing by construction loads.
- C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Obtain approval before framing openings in structural members which are not indicated on Drawings.
- F. Provide chamfer strips on external corners of walls.
- G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- H. Coordinate this section with other sections of work which require attachment of components to formwork.
- I. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.04 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

- C. Do not apply form release agent where concrete surfaces will receive special or applied coverings which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.06 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.

3.07 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

3.08 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel bars, wire fabric and accessories for cast-in-place concrete.

1.02 RELATED SECTIONS

- A. Related Work Specified Elsewhere.
 - 1. This section not used.

1.03 REFERENCES

- A. ACI 301 - Structural Concrete for Buildings.
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.
- C. ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- D. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- E. ASTM A775 - Epoxy-Coated Reinforcing Steel Bars.
- F. ASTM D3963 - Epoxy-Coated Reinforcing Steel.
- G. CRSI - Concrete Reinforcing Steel Institute - Manual of Practice.
- H. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
- I. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.04 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 - Submittals: Procedures for submittals.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice, ACI 301, and ACI 318. Maintain one copy of each document on site.
- B. Provide Engineer with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.
- C. Design reinforcement under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the Commonwealth of Pennsylvania.
- D. Welders: Certificates: Submit under provisions of Section 01 40 00 Manufacturer's Certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade; deformed billet steel bars, unfinished.
- B. Welded Steel Wire Fabric: ASTM A185 Plain Type in flat sheets, unfinished.

2.02 ACCESSORIES

- A. Tie Wire: Minimum 16 gage annealed type, epoxy coated.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.
- C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

2.03 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI Manual of Practice.
- B. Locate reinforcing splices not indicated on drawings, at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Conform to Act 318 code for concrete cover over reinforcement.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Concrete Curb Ramps and Stairs

1.02 RELATED SECTIONS

- A. Related Work Specified Elsewhere:
 - 1. Section 03 11 00: Concrete Formwork

1.03 REFERENCES

- A. ACI 301: Structural Concrete for Buildings.
- B. ACI 302: Guide for Concrete Floor and Slab Construction.
- C. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
- D. ACI 305R: Hot Weather Concreting.
- E. ACI 306R: Cold Weather Concreting.
- F. ACI 308: Standard Practice for Curing Concrete.
- G. ASTM C31: Practices for Making and Curing Concrete Test Specimens in the Field.
- H. ASTM C33: Concrete Aggregates.
- I. ASTM C39: Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- J. ASTM C42: Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- K. ASTM C94: Ready-Mixed Concrete.
- L. ASTM C150: Portland Cement.
- M. ASTM C172: Method of Sampling Fresh Mixed Concrete.
- N. ASTM C260: Air Entraining Admixtures for Concrete.
- O. ASTM C494: Chemical Admixtures for Concrete.
- P. ASTM C618: Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- Q. ASTM D1751: Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

1.04 SUBMITTALS FOR REVIEW

- A. Product Data: Provide concrete delivery form.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301.
- B. Maintain one copy of each document on-site.
- C. Acquire cement and aggregate from same source for all Work.
- D. Conform to ACI 305R when concreting during hot weather.
- E. Conform to ACI 306R when concreting during cold weather.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I – Normal.
- B. Fine and Coarse Aggregates: ASTM C33.
- C. Water: Clean and not detrimental to concrete.

2.02 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Chemical: ASTM C494 – Type A – Water Reducing, Type C – Accelerating, Type E – Water Reducing and Accelerating.
- C. Fly Ash: ASTM C618.

2.03 ACCESSORIES

- A. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.04 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, 1/4 inch thick; tongue and groove profile.

2.05 CONCRETE MIX

- A. Mix concrete in accordance with ACI 304 and Section 704, PennDOT Publication 408 Specifications. Deliver concrete in accordance with ASTM C94 and Section 704, PennDOT Publication 408 Specifications.
- B. Select proportions for normal weight concrete in accordance with ACI 301 Method 1.
- C. Provide concrete to meet the criteria in Section 704 of PennDOT Publication 408 for the applicable Class of concrete for the use. Supply Class A and/or Class AA concrete as necessary to comply with the Contract Documents, including Drawings.

- D. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.
- E. Use calcium chloride only when approved by Engineer.
- F. Use set retarding admixtures during hot weather only when approved by Engineer.
- G. Add air entraining agent to normal weight concrete mix for work exposed to exterior.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify site conditions in accordance with the Contract Documents.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.02 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- C. Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304.
- B. All concrete work must be ADA compliant.**
- C. Notify Engineer minimum 24 hours prior to commencement of operations.
- D. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.

3.04 CONCRETE FINISHING

- A. Broom finish.

3.05 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

3.06 FIELD QUALITY CONTROL

- A. Sample concrete in accordance with ASTM C172. One test for slump, air entrainment and air and concrete temperature will be taken from each concrete delivery
- B. A minimum of four (4) – 6"x12" or 6 (6) – 4"x8" concrete test cylinders will be prepared and cured in accordance with ASTM C31 for every 50 or less cubic yards of each class of concrete placed.
- C. Cylinders shall be tested in accordance with ASTM C39 at the following schedule:
1 @ 7 days, 2 @ 28 days and 1 held in reserve for 6"x12" cylinders and 2 @ 7 days, 2 @ 28 days and 2 held in reserve for 4"x8" cylinders.
- D. A minimum of one (1) additional set of test cylinders will be taken during cold weather or hot weather concreting or if high-early strength concrete is used, and be cured on job site under same conditions as concrete it represents.
- E. If test cylinders fail to meet strength requirements, the Resident Project Representative may require core tests in accordance with ASTM C42 at the expense of Contractor.

3.07 PATCHING

- A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.
- C. Patch imperfections in accordance with ACI 301.
- D. Remove or break off form ties for walls and seal openings with non-shrink grout providing a smooth finish.

3.08 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by the Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION

SECTION 10 14 53

TRAFFIC SIGNAGE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. This work is the furnishing and installation of fabricated aluminum signs of the type indicated on breakaway steel post system.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Materials used shall be in accordance with Sections 1103.04, 1103.08, and 1103.11 of PennDOT Publication 408.

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. General

Install as shown on the PennDOT Standard Drawings and project specific Drawings. Erect posts plumb using a method that does not twist, bend or otherwise deform the posts. Before erection, correct twisted, bent, or deformed posts. Erect signs by a method that does not twist, bend, or otherwise deform the signs. Level, correctly align, and then center signs on the posts and properly fasten. Repair or replace damage posts and signs.

Fasten the signs to the posts with the necessary hardware as detailed in PennDOT Publication 111M TC 8700 Standard Series and Publication 408 Section 931.

- B. Location

The indicated location of sign installations is approximate with the exact location established at the site. Mark longitudinal and lateral location by stake or paint marks with an identifying symbol.

END OF SECTION

SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. This work required under this section consists of furnishing all labor, materials, equipment, services and items necessary to install all site furnishings as noted on the construction plan set. These site furnishings include: Concrete Benches, Owner-supplied shade sail, trash can enclosure, bollards, etc.

1.02 RELATED SECTIONS

- A. 32 13 20 - Concrete Paving
- B. 31 23 10 - Excavation, Backfill and Subgrade Preparation for Pavement

1.03 SUBMITTALS

- A. Product data for each item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, and finishes.
- B. Physical component samples of materials and finishes for each type of site furnishing.
- C. Samples of trash receptacles with modifications as indicated on drawings if a selected alternate.

1.04 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry for freestanding benches and trash receptacles. Coordinate delivery with other work to avoid delay.
- B. Single-Source Responsibility: Provide products of same manufacturer for each type of site furnishing.

1.05 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of items.

PART 2 - PRODUCTS

2.01 TRASH RECEPTACLES

- A. 40 GALLON TRASH RECEPTACLE – Model #436-40, as manufactured by Dumor, Inc., P.O. Box 142, Mifflintown, PA 17059, Phone: 800-598-4018, www.dumor.com. Provide as shown on plans and details. Trash receptacles shall be embedded in manufacturer's

- recommended concrete footing.
- 2.02 PLAYGROUND BORDER
- A. PLASTIC PLAYGROUND BORDER – Model #ZZXX9409, ZZXX9410, ZZXX9430, ZZXX9450, as manufactured by Playworld, 1000 Buffalo Road, Lewisburg, PA 17837, Phone: 800-233-8404, www.playworldsystems.com. Border materials to be supplied by Bristol Township. Township to install around playground as shown on plans and per the manufacturer's recommendations.
- 2.03 BOLLARDS
- A. 36" HIGH 4" 40 STEEL BOLLARD W/FOLD DOWN MOUNT – Model #R-7901, as manufactured by Reliance Foundry, Surrey, British Columbia, Canada, Phone: (888) 735-5680, www.Reliance-Foundry.com , or approved equal. Provide as shown on plans and details. Bollards shall be surface mounted to concrete pavement using manufacturer's recommended anchors. Steel shall be polyester powder coated as indicated on plans.

FABRICATION

- A. No names or labels are permitted on exposed faces of units. On either interior surface not exposed to view or on back surface, provide identification of item either by a printed, waterproof label or a stamped nameplate indicating manufacturer's name and product model number.

PART 3 - EXECUTION

- 3.01 INSTALLATION
- A. Install site furnishings according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
- 3.02 ADJUSTING AND CLEANING
- A. Adjust site furnishings for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 12 93 00

SECTION 26 05 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Existing Site Conditions.
- B. Compliance with Codes, Standards and Regulations.
- C. Electrical Abbreviations, References and Definitions.
- D. Submittals.
- E. Alternates.
- F. Accuracy of Plans.
- G. Testing.
- H. Inspection Authority.
- I. General installation requirements.

1.02 RELATED SECTIONS

Related Work Specified Elsewhere:

- 1. Section 26 05 19: Wire and Cable
- 2. Section 26 05 33: Electrical Conduit

1.03 EXISTING SITE CONDITIONS

- A. The existing electrical service is terminated at Utility Pole #6 as shown in Drawings. New Electrical Cabinet shall be installed for the proposed lighting throughout the playground.
- B. All evaluations from information available on the record drawings must be field verified by Contractor to ensure accuracy.

1.04 COMPLIANCE WITH CODES, STANDARDS AND REGULATIONS

- A. All electrical installations shall conform with all applicable codes and standards. The construction of the systems indicated and called for in these Specifications shall be performed in accordance with standard practices. Contractor shall be responsible for obtaining the necessary information to comply with these requirements.
- B. Contractor shall give all notices and comply with all laws, ordinances, codes, rules and regulations bearing on the conduct of the work as specified. If the Contractor observes that the drawings and/or Specifications are at variance therewith, he shall promptly notify Engineer in writing of any necessary changes of work.

C. Requirements of the following organizations shall be considered minimum:

1. National Electrical Code.
2. National Electrical Safety Code.
3. Local Utility Company.
4. Local Telephone Company.
5. OSHA.
6. Local State, City and County Codes.
7. American National Standards Institute (ANSI).
8. Underwriters' Laboratories, Inc. (UL).

1.05 ELECTRICAL ABBREVIATIONS, REFERENCES, AND DEFINITIONS

A. References to technical societies, trade organizations, and governmental agencies in the Electrical Division are in accordance with the following:

1. ANSI: American National Standards Institute.
2. ASTM: American Society of Testing Materials.
3. IEEE: Institute of Electrical and Electronics Engineers.
4. NEC: National Electrical Code.
5. NEMA: National Electrical Manufacturers Association.
6. NFPA: National Fire Protection Association.
7. OSHA: Occupational Safety and Health Administration.
8. UL: Underwriters' Laboratories, Inc.

1.06 SUBMITTALS

- A. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
- B. Prepare and submit to Engineer layout and detail drawings of all work showing the proposed installation including actual conduit routing, number and size of conductors, and required construction details.

1.07 ALTERNATES

- A. In order to define equipment requirements, the Specifications have been written to describe materials and/or products of the first-named manufacturer.
- B. Equivalent or better products of other unnamed manufacturers may be acceptable provided that:
 1. It meets all of the specified requirements for the item.
 2. Use of such substitute will not involve additional cost to Owner.
 3. Such substitute will not materially alter basic architectural or engineering design

- concept.
- 1.08 ACCURACY OF PLANS
- A. The Plans are diagrammatic and indicate the general arrangement of electrical work. Contractor shall be responsible for all roughing-in of electrical equipment and electrical connections including wiring, conduit and outlets.
 - B. Contractor shall install Work in the locations shown on drawings, unless prevented by Project conditions.
 - C. Electrical riser and schematic diagrams generally indicate wiring to be used in various systems. Provide all work shown on diagrams whether or not it is duplicated on the Plans.
- 1.09 TESTING
- A. Contractor shall arrange to pay for all tests. Notify Engineer three (3) working days before tests are made. Conduct tests in presence of Engineer or authorized representative. Repeat tests after defects are corrected.
 - B. Prior to tests, provide feeders and branch circuits continuous from main distribution panel to outlets, fixtures and equipment.
 - 1. Demonstrate system is free from short circuits and properly grounded.
 - 2. Test lighting circuits for correct operation after lamps are installed.
 - 3. Check all motors for correct rotation.
 - 4. Test load balance as specified herein.
 - C. When controls and instrumentation have been completely erected, Contractor shall notify Engineer, who will designate a time to make such tests as are required, and operate the item to his satisfaction. All testing shall be done in the presence of Engineer. "Completely erected" shall mean that the installation is erected, all necessary adjustments have been made, all required connections have been made.
 - D. Contractor shall furnish labor, and all other materials, equipment and instruments necessary for all acceptance tests.
 - E. Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when Owner accepts the operation thereof.
- 1.10 INSPECTION AUTHORITY
- A. Permits and licenses necessary for the execution of this work shall be secured and paid for by Contractor.
 - B. Contractor shall arrange for all inspections specified herein or required by all agencies having jurisdiction.
 - C. Obtain and deliver a final Certificate of Approval from the NEC Inspection Authority having jurisdiction. Make delivery to the Engineer for transmittal to Owner upon completion of the work and before final payment.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 WORK SEQUENCE - NOT USED

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Before ordering any material or doing any work, Contractor shall verify all measurements and elevations at the building site and shall be responsible for the correctness of same. Any difference which may be found between field measurements and elevations and those indicated shall be promptly submitted to Engineer for adjustment and approval before proceeding with the work.
- B. The arrangement of conduit, raceways, junction boxes, etc. shall be considered approximate except where dimensioned. The work shall be installed generally as indicated and as directed by the Engineer during construction.
- C. Material and equipment shall be installed in accordance with manufacturer's written instructions and recommendations. Contractor shall submit such data to the Engineer prior to installation, and it shall be considered a part of these Specifications.
- D. All equipment shall be installed in such a manner as to provide access for routine maintenance.

END OF SECTION

SECTION 26 05 19

WIRE AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Regulatory requirements
- B. Project conditions
- C. Coordination
- D. Products
 - 1. Building wire and cable
 - 2. Wiring connectors
 - 3. Splicing materials
 - 4. Terminal connectors
 - 5. Tape
- E. Execution
 - 1. Examination
 - 2. Preparation
 - 3. Wiring methods
 - 4. Installation
- F. Interface with other products
- G. Field quality control

1.02 RELATED SECTIONS

Related Work Specified Elsewhere:

- 1. Section 26 05 00: Basic Electrical Requirements
- 2. Section 26 05 33: Electrical Conduit

1.03 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc.

1.04 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.07 COORDINATION

- A. Determine required separation between cable and other work.
- B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

1.01 BUILDING WIRE AND CABLE

- A. Standards: NEC Article No. 310 UL.
- B. Conductor: Copper; stranded for all sizes.
- C. Insulation: 600 volts; ZHHW for general use, THHN or TFN for lighting fixture use.
- D. Minimum size: #12 for all other unless otherwise noted.
- E. Other types: As indicated or required.
- F. Exercise care in storage and installation of wire and cable to avoid damage to conductors and their covering. Use an approved pulling compound as lubricant for pulling wires into raceway.
- G. Manufacturers - Triangle, General Cable, General Electric, Anaconda, Phelps Dodge or equal.

2.02 WIRING CONNECTORS

- A. Standards: NEC Article No. 110.
- B. Application: Conductors #8 and smaller, stranded copper.
- C. Description: Solderless pressure connector consisting of spiral in metal cup or crimped metal sleeve, with skirted insulating cap.

2.03 SPLICING MATERIALS

- A. Manufacturer: T & B, O-Z, Burndy, 3-M or equal.
- B. Standards: NEC Article No. 110.
- C. Application: Conductors #6 and larger, solid and stranded copper.
- D. Description: Solderless pressure connector, bolted saddle clamp type.
- E. Insulation: Insulating filler and vinyl tape for dry locations, Thomas Betts Shrink - Kon Series "HS" for wet locations.

2.04 TERMINAL CONNECTORS

- A. Manufacturer: AMP: Type PIDG or equal.
- B. Standards: NEC Article No. 100.
- C. Application: All conductor sizes where screw or stud terminals are used, for solid and stranded conductors.

- D. Description: Pre-insulated; crimp type; vinyl insulation, color coded, for size; high conductivity copper per QQ-C-576; tin plated per MIL-T-10727.
- E. Performance: constructed to firmly grip the conductor and the wire insulation with a support sleeve to prevent insulation from slipping or moving due to crimping, heat, cycling and/or vibration.

2.05 TAPE

- A. Manufacturer: 3-M "scotch" or equal.
- B. Manufacturer's Designation: #33.
- C. Material: Seven (7) mil vinyl plastic
- D. Performance: Provide electrical insulation and mechanical protection in continuous temperature environment up to 105 degrees C.
- E. Application: For circuits 600 volts and below.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire (and cable) has been completed.

3.02 PREPARATION

- A. Use an approved pulling compound as a lubricant for pulling wires into the raceway.
- B. Completely and thoroughly swab raceway before installing wire.

3.03 WIRING METHODS

- A. Use wiring methods indicated on Drawings and required by NEC.

3.04 INSTALLATION

- A. Install products in accordance with manufacturers instructions.
- B. Use stranded conductor for feeders and branch circuits 10 AWG and smaller.
- C. Use stranded conductors for control circuits.
- D. Use conductor not smaller than 12 AWG for power and lighting circuits.
- E. Use conductor not smaller than 12 AWG for control circuits.
- F. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet.
- G. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet.

- H. Pull all conductors into raceway at same time.
- I. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- J. Protect exposed cable from damage.
- K. Support conductors in vertical raceways in accordance with NEC requirements.
- L. Provide manufactured clamps or compression fittings in bottom of panel boards if space permits, or provide separate pull boxes for such fittings where indicated.
- M. Neatly train and lace wiring inside boxes, equipment, and panel boards.
- N. Clean conductor surfaces before installing lugs and connectors.
- O. Make splices, taps, and terminations to carry full amp capacity of conductors with no perceptible temperature rise.
- P. Cable Terminations and Connections
 - 1. Use insulated crimp type terminals on all control wiring, terminating at terminal blocks.
 - 2. Use proper crimping tools as recommended by manufacturer for crimp type terminals and/or connectors.
- Q. Branch Circuits
 - 1. Provide one neutral conductor for each 3 phase, 4 wire home run to a panel board.
 - 2. Avoid excessive voltage drop by using #10 wire for 120 volt circuits that exceed 75 feet to outlet at center of load.
 - 3. Make panel connections so that circuit protectors are in logical operating sequence, and so that loads are reasonably balanced across all phases.
- R. Oversized Wiring
 - 1. Where oversized wiring has been indicated to overcome voltage drop and does not fit properly into the equipment served, provide a suitable junction box adjacent to the equipment for the change of wire size.
 - 2. Provide reduced wire size from junction box to equipment. Keep the reduced wire size as large as possible, but in no case use wire of amp capacity less than that required by NEC to feed the equipment.
- S. Taping
 - 1. Apply two layers of plastic electrical tape at all equipment terminals, lugs, connections or splices.
- T. Tagging
 - 1. All wiring provided and/or installed by Contractor shall include numeric tagging at each end.

3.05 INTERFACE WITH OTHER PRODUCTS

- A. Identify and tag all wire and cables.
- B. Identify each conductor with its circuit number or other designation.

3.06 FIELD QUALITY CONTROL

- A. Perform field megger tests and inspection for all power wiring. Instruments wiring does not require megger testing.
- B. Inspect wire and cable for physical damage and proper connection.

END OF SECTION

SECTION 26 05 33

ELECTRICAL CONDUIT

PART 1 - GENERAL

1.01 Furnish PVC and fiberglass conduit, conduit fittings, elbows and cement produced by the same manufacturer.

1.02 MATERIAL

A. Provide protective coating for non-concrete encased underground metal conduit as follows:

1. Bitumastic No. 505 - Koppers Co., Inc.
2. Scotchkote Protective Resin No. 302 - 3M Co.
3. Type TC Mastic - Tapecoat Co., Inc.
4. or approved equivalent

B. When metal conduit bodies and fittings are specified, and hot dipped galvanized parts are not available, apply two (2) coats of zinc paint in accordance with PennDOT Publication 408, Section 1105.02(s)2.

C. Direct Burial:

1. Polyvinyl Chloride (PVC) Conduit: Schedule 40; 90C, UL-listed; conforming to NEMA Standard TC-2 (EPC-40-PVC).
2. Fiberglass Reinforced Epoxy Conduit: UL-rated; conforming to NEMA Standard TC-14, Part B; and meeting the following requirements:
 - a. Filament Wound
 - b. Minimum glass content of 68%
 - c. Minimum tensile strength of 11,000 psi
 - d. Containing carbon black for ultra-violet protection
3. Concrete Encased and Exposed:
 - a. Rigid Steel Conduit: Hot dipped galvanized, inside and outside; and manufactured to conform to the requirements of ANSI Specification C80.1 and Federal Specification WW-C-581. Provide hot-dipped galvanized and conduit bodies and fittings.
 - b. Polyvinyl Chloride (PVC) Conduit: As specified for direct burial conduit.
 - c. I.M.C.: Hot-dipped, galvanized conduit, ASTM-A513 and A135. Provide hot-dipped galvanized conduit bodies and fittings.
 - d. Jacked, Augered and Bored Conduit: Rigid steel conduit, as specified for concrete encased or exposed conduit.

END OF SECTION

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. Clearing
2. Grubbing
3. Stripping and stockpiling topsoil
4. Debris disposal

B. Definitions:

1. Clearing is defined as the removal of trees, brush, down timber, rotten wood, rubbish, any other vegetation, and objectionable material at or above original ground elevation not designated to be saved. Clearing also includes removal of fences, walls, guard posts, guard rail, signs, and other obstructions interfering with the proposed work.
2. Grubbing is defined as the removal from below the surface of the natural ground of stumps, roots and stubs, brush, organic materials and debris.

1.02 RELATED SECTIONS

A. Related Work Specified Elsewhere:

1. Section 01 57 13: Soil Erosion and Sediment Control
2. Section 31 23 33: Excavation, Backfill and Compaction
3. Section 32 92 00: Finish Grading, Seeding and Sodding

1.03 JOB CONDITIONS

- A. Contractor may clear all obstructions within the permanent and temporary construction easements and within the limit of disturbance of Owner's property as absolutely necessary to perform the construction work. Contractor shall leave as many trees as possible within the temporary construction easements and shall not disturb portions of Owner's property beyond the limit of disturbance. Removal of trees shall be coordinated with the Resident Project Representative.

1.04 SUBMITTALS

A. Agreements for Disposal of Debris:

1. Arrange for disposal of debris resulting from clearing and grubbing to locations outside Owner's property, easements and public right-of-ways and obtain a written agreement with the owners of each property where the debris will be deposited.
2. Submit two (2) copies of the agreement with each property owner releasing Owner from responsibility in connection with the disposal of the debris.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Temporary Fencing:
 - 1. Undamaged picket snow fence, 4' high, formed of wooden slats, tightly woven with wire cable or orange, open mesh plastic construction fencing, 4' high, or other acceptable, highly visible, weather resistant, easily maintained fencing that provides a substantial barrier.
 - 2. Soil-set fence posts, studded "T" type, 6' high.
- B. Tree Wound Dressing:
 - 1. Antiseptic and waterproof, asphalt base.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Notify Engineer at least 48 hours prior to beginning any clearing work.
- B. Protect benchmarks, utilities, existing trees, shrubs and other landscape features designated for preservation with temporary fencing or barricades satisfactory to the Resident Project Representative. No material shall be stored or construction operation carried on within four (4) feet of any tree to be saved or within the tree protection fence.

3.02 UTILITY RELOCATIONS

- A. Inform all companies, individuals and others owning or controlling facilities or structures within the limits of the work which have to be relocated, adjusted or reconstructed in sufficient time for the utility to organize and perform such work in conjunction with or in advance of Contractor's operations.
- B. Comply with the provisions of PA Act 287 (1974) as last amended by PA Act 121 (2008).

3.03 CLEARING

- A. Confine clearing as required to within the limits of the public right-of-ways, easements and Owner's property. Attention is called to Paragraph 1.03 of this Section.
- B. Fell trees in a manner that will avoid damage to trees, shrubs, and other installations which are to be retained.
- C. Where stumps are not required to be grubbed, flushcut with ground elevation.

3.04 GRUBBING

- A. Turf clearing and grubbing shall be staged to limit exposure and potential erosion. [For utility construction, stages shall be limited to that length of trench which may be installed and backfilled in one (1)day.]
- B. Grub areas within the construction limits to remove roots and other objectionable material to a minimum depth of 8".
- C. Remove all stumps within the cleared areas unless otherwise authorized by the Resident Project Representative.

3.05 STRIPPING AND STOCKPILING TOPSOIL

- A. Stripping of topsoil shall be staged to limit exposure and potential erosion. [For utility construction, stages shall be limited to that length of trench which may be installed and backfilled in one (1) day.]
- B. Strip topsoil to whatever depth it may occur from areas to be excavated, filled, or graded and stockpile at a location approved by the Resident Project Representative for use in finish grading.
- C. Topsoil shall not be used as backfill or removed from the site.

3.06 DEBRIS DISPOSAL

- A. Trees, logs, branches, brush, stumps, and other debris resulting from clearing and grubbing operations associated with the Work on the Project site and/or within off-site easements/public right-of-ways shall become the property of Contractor and shall be disposed of legally.
- B. Debris resulting from the clearing and grubbing work shall not be deposited or buried on the Project site, easements or public right-of-ways.
- C. Open burning of debris is prohibited.

3.07 RESTORATION

- A. Repair all injuries to bark, trunk, limbs, and roots of remaining plants by properly dressing, cutting, tracing and painting, using approved arboricultural practices and materials.
- B. Replace trees, shrubs and plants designated to be saved which are permanently injured or die during the Contract or the maintenance period as a result of construction operations with like species acceptable to the property owner.
- C. Remove protective fences, enclosures and guards upon the completion of the project.
- D. Restore guard posts, guard rail, signs and other interferences to the condition equal to that existing before construction operations.

END OF SECTION

SECTION 31 20 00

EARTHWORK

PART 1 - GENERAL

1.01 SECTION DESCRIPTION:

- A. Site grading, removal of topsoil and subsoil, building excavating and backfill.
- B. Preparing of subgrade for site structures, walks and pavements.

1.02 RELATED INFORMATION

A. Related Work Specified Elsewhere:

- 1. Section 01 57 13: Soil Erosion and Sediment Control
- 2. Section 31 11 00: Clearing and Grubbing
- 3. Section 31 23 33: Excavation, Backfill and Compaction
- 4. Section 32 12 00: Bituminous Concrete Paving
- 5. Section 32 93 00: Landscaping

1.03 QUALITY ASSURANCE

A. Testing Agency

- 1. Any required compaction testing for this Project shall be performed by a soils testing agency engaged and paid for by Contractor. Quality assurance testing shall be coordinated with Resident Project Representative.

B. Reference Standards:

- 1. Pennsylvania Department of Transportation
Publication 408 Specifications
- 2. American Society for Testing and Materials (ASTM):
 - ASTM D422 Test Method for Particle-Size Analysis of Soils
 - ASTM D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.-lbf/ft³)
 - ASTM D2922 Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)
 - ASTM D4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

C. Compaction Testing:

- 1. Conduct compaction tests at locations as directed by the Resident Project Representative during grading operations.

1.04 SUBMITTALS

- A. Submit certified test reports on borrow material. Test reports shall include grain size distribution (ASTM D422), Atterberg limits (ASTM D4318) and moisture density relationship (ASTM D1557).
- B. Submit certified compaction testing results from the soils testing agency for any required compaction testing.

1.05 JOB CONDITIONS

- A. All earthwork shall be performed in accordance with conditions outlined in Section 01 57 13, Soil Erosion and Sediment Control and the Drawings.
- B. Site disturbance and earth moving shall proceed in accordance with the sequence shown on the Drawings.
- C. Contractor may conduct earthwork activities within the contract limit lines as shown on the Drawings.
- D. Prior to earth moving activities, all topsoil shall be stripped and stockpiled in accordance with the Project Drawings.
- E. Classification of Excavation:
 - 1. All excavation work performed under this contract is UNCLASSIFIED.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. Topsoil: Excavated or imported friable loam that is reasonably free of subsoil, clay lumps, brush, roots, weeds, other objectionable vegetation, stones or other foreign material.
- B. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand.
- C. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2 inch sieve and not more than 5 percent passing a No. 8 sieve. PennDOT No. 2B or AASHTO No. 57 coarse aggregate, Table C, Section 703.2, Publication 408 Specifications.
- D. Fill Materials: Satisfactory on-site soil materials comprised of less than 40% by weight larger than 3/4 inches in diameter, free of particles larger than 4 inches, and free of debris, slag, waste, frozen material, excessive moisture, organics, or other deleterious material.

PART 3 - EXECUTION

3.01 STORAGE OF EXCAVATED MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill. Place, grade and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

3.02 EXCAVATION FOR SITE STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from site structures to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. In the event that fill deposits or other unsuitable bearing materials are encountered at the given elevations, they shall be over-excavated and replaced with structural backfill as specified hereinafter.
 1. Excavations for site structures: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
- B. In the event bedrock is encountered at the footing subgrade elevation, it shall be over-excavated to a level 12 inches below the plan site structure subgrade elevation and 12 inches beyond the perimeter of the site structure on all sides. Bedrock encountered within four (4) inches of the base of the site structure shall be removed to at least six (6) inches below the base elevation for the site structure. The over-excavations specified above shall be restored to the subgrade elevation with PA No. 2A or 2RC processed aggregate which is placed and compacted as specified hereinafter.
- C. Any soft, weak and/or unstable soil encountered at the footing subgrade elevation shall be overexcavated to satisfactory bearing material. Subsequently, the overexcavation shall be backfilled to the plan subgrade elevation with either lean concrete or PA No. 2A or 2RC processed aggregate.

3.03 EXCAVATION FOR PAVEMENTS

- A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.04 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.05 BACKFILL AND FILL

- A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
 1. Under grassed area, use satisfactory excavated or borrow material.
 2. Under walks and pavements, use subbase material, satisfactory excavated or borrow material, or a combination.
 3. Under steps, use subbase material.
 4. Under site structures, use drainage fill material for 6" or 8" drainage course as shown on the Drawings. Below drainage course, provide satisfactory soil material.
 5. For utility and pipe trenches see Section 31 23 33.

- B. Backfill site structure excavation as promptly as work permits, but not until completion of the following:
1. Acceptance of construction below finish grade including, where applicable, dampproofing, water-proofing and perimeter insulation.
 2. Removal of concrete formwork.
 3. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structure and remove in manner to prevent settlement of the structure, or leave in place if required.
 4. Removal of trash and debris from excavation.
 5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.06 PLACEMENT AND COMPACTION

- A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, pavement sections, topsoil and organic and deleterious materials from ground surface prior to placement of fills (See Section 31 11 00). Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
1. When existing ground surface has a density less than that specified under 3.06.E. for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
 2. After stripping and rough excavation grading, areas to provide support for the foundations, floor slab, structural fill and pavement shall be carefully inspected for soft surficial soils and proofrolled with a fully loaded triaxle dump truck or similar approved equipment. Proofrolling shall be performed under the observation of the soils testing agency. The proofroller shall make at least eight passes over each location, with the last two passes perpendicular to the first two. Any areas which wave, rut or deflect excessively and continue to do so after several passes of the proofroller shall be undercut to stable soils or as directed by the geotechnical engineer. The undercut areas shall be backfilled in thin lifts with suitable compacted refill materials.
 3. The stripping and proofrolling operations shall be delayed in areas where the construction will not proceed immediately to a finished surface so that the exposed subgrade will not deteriorate under the effects of weather and construction traffic.
- B. Place backfill and fill materials in layers not more than 8 inches in loose thickness for material compacted by heavy compaction equipment, and not more than 6 inches in loose thickness for material compacted by hand-operated tampers.
- C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen or contain frost or ice.
- D. Place backfill and fill materials evenly adjacent to structures to required elevations. Prevent wedging action of backfill against structures by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

- E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Resident Project Representative if soil density tests indicate inadequate compaction.
1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density, in accordance with ASTM D1557 (Modified Proctor):
 - a. Under structures, building slabs and steps, and pavements, compact top 12 inches of subgrade and each layer of backfill or fill material at 95% (Modified Effort) of the maximum density, at or near the optimum moisture content.
 - b. Non-structural areas which lie within five (5) feet of building, pavement and structural areas at 93% (Modified Effort) of the maximum density at or near the optimum moisture content.
 - c. Detention basin berms, compact each layer of fill material at 95% (Modified Effort) of the maximum density, at or near the optimum moisture content.
 - d. Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 90% (Modified Effort) of the maximum density at or near the optimum moisture content.
 - e. Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 93% (Modified Effort) of the maximum density, at or near the optimum moisture content.
 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 - b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.07 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent low points as shown on the Drawings. Finish surfaces free from irregular surface changes and as follows:
 1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
 2. Walks: Shape surface of areas under walks to line, grade and cross section, with finish surface not more than 0.10 foot above or below required subgrade elevation.

3. Pavements: Shape surface of areas under pavement to line, grade and cross section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
- C. Grading Surface of Fill under Site Structure Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.
 - D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.
- 3.08 SITE STRUCTURE SLAB DRAINAGE COURSE
- A. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness over subgrade surface to support concrete site structure slabs.
 - B. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated thickness.
 1. When compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.
- 3.09 EROSION CONTROL
- A. Provide erosion control methods in accordance with Section 01 57 13 and the Project Drawings.
- 3.10 MAINTENANCE
- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
 - B. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.
 - C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.
 - D. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact and replace surface treatment. Restore appearance, quality and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- 3.11 DISPOSAL OF EXCESS AND WASTE MATERIALS
- A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

END OF SECTION

SECTION 31 23 16.26

ROCK REMOVAL

PART 1 GENERAL

1.01 SECTION DESCRIPTION:

A. The Work of This Section Includes:

1. Removal of identified and discovered rock during excavation.
2. Mechanical methods to assist rock removal.

1.02 RELATED INFORMATION

A. Related Work Specified Elsewhere:

1. Section 31 20 00: Earthwork
2. Section 31 23 33: Excavation, Backfill & Compaction

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. National Fire Protection Association (NFPA): NFPA 495 - Code for Manufacture, Transportation, Storage, and Use of Explosive Materials

B. Seismic Monitoring Firm: Company specializing in seismic surveys with five (5) years documented experience.

1.04 DEFINITIONS

A. Rock: Solid mineral material of a size that cannot be removed with a "Trac-Hoe" style machine with a minimum weight of 70,000 pounds (without use of drilling and wedging, blasting, and/or mechanical surface impact equipment).

1.05 REGULATORY REQUIREMENTS

A. Obtain all required permits from various local and/or State agencies among which are those noted in Items B, C and D of Paragraph 1.23 of the Supplementary Conditions (Document 00 73 00).

B. Comply with all permit conditions including timely notifications to all required agencies/officials.

1.06 PROJECT CONDITIONS

A. Rock excavation within ten (10) feet of underground utilities or structures shall be done by hand with exercise of utmost care to avoid disturbance.

B. Special care shall be exercised in areas where high tension power lines are located.

C. Paving shall be pre-cut before blasting within roads to prevent paving from heaving beyond normal trench width.

1.07 SCHEDULING

- A. Schedule Work under the provisions of Section 01 33 00 concerning the submittal for a Construction Progress Schedule.
- B. Schedule Work to avoid disruption to occupied buildings nearby.

PART 2 PRODUCTS

Section not used.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions and note subsurface irregularities affecting work of this section.

3.02 PREPARATION

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

3.03 ROCK REMOVAL BY A MECHANICAL METHOD

- A. Excavate and remove rock by the mechanical method.
- B. Drill holes and utilize expansive tools, wedges, and/or mechanical disintegration compound to fracture rock.
- C. Cut away rock at bottom of excavation to form level bearing.
- D. Remove shaled layers to provide sound and unshattered base for footings and foundations.
- E. In utility trenches, excavate to 6 inches below invert elevation of pipe and 12-16 inches wider than pipe outside diameter (minimum 6 inches on each side).
- F. Shattered or fractured rock may be allowed by Owner as trench backfill where native backfill material is permitted provided that the size requirement in Section 31 23 33 (Item 2.03) is achieved. Otherwise, excavated rock must be removed from site.
- G. Correct unrequired rock removal in accordance with the requirements of Section 31 23 33.

3.04 FIELD QUALITY CONTROL

- A. Contractor shall provide for visual inspection by Resident Project Representative all trench bottoms, foundation bearing surfaces and cavities formed by removed rock prior to further construction.

END OF SECTION

SECTION 31 23 33

EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of this Section Includes:

1. Excavation, backfill and compaction associated with utility construction, including such related features as protection of adjacent utilities and structures, maintenance and protection of traffic, cutting paved surfaces, support of excavation, control of excavated materials, dewatering, pipe bedding, disposal of excavated materials, rough grading and restoration.
2. Excavation, backfill and compaction associated with construction or installation of structures including such related features as protection of adjacent utilities and structures, support of excavation, control of excavated materials, dewatering, structure bedding, disposal of excavated material, rough grading and restoration.

1.02 RELATED SECTIONS

A. Related Work Specified Elsewhere:

1. Section 01 56 39: Landscape Protection
2. Section 01 57 13: Soil Erosion and Sediment Control
3. Section 03 30 00: Concrete Work for Structures
4. Section 31 11 00: Clearing and Grubbing
5. Section 31 20 00: Earthwork
6. Section 32 12 00: Bituminous Concrete Paving
7. Section 32 93 00: Landscaping
8. Section 33 12 13: Water Service Connections

1.03 QUALITY ASSURANCE

A. Testing Agent:

1. Compaction testing for this Work shall be performed by Contractor throughout the duration of the project for all structural components such as parking lots, trails, slabs, etc. and at the discretion of the Resident Project Representative.
2. Contractor shall pay the cost of one series of tests on the area being evaluated. Contractor shall also pay the cost for additional testing as required in the event of improper performance of the Work.

B. Reference Standards:

1. Pennsylvania Department of Transportation:

Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)
Publication 408 Specifications
Pennsylvania Test Method, PTM 106
Pennsylvania Test Method, PTM 402

Publication 203, Work Zone Traffic Control

2. American Society for Testing and Materials (ASTM):

- ASTM D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft.- lbf/ft³)
- ASTM D2922 Standard Test Method for Density of Soil and Soil - Aggregate in Place by Nuclear Methods (Shallow Depth)

C. Compaction Testing:

1. Conduct compaction tests at locations during backfilling at locations on 50 foot centers (1 per 2,500 square feet) or closer as required for every 12 inches of fill placed.

1.04 SUBMITTALS

A. Certificates:

1. Submit certification attesting that the composition analysis of pipe embedment and select material stone backfill materials meet specification requirements in accordance with Section 01 33 00.
2. Submit certified compaction testing results from the soils testing agency for any required compaction testing in accordance with Section 01 33 00.

1.05 JOB CONDITIONS

A. Classification of Excavation:

1. All excavation work performed under this contract is UNCLASSIFIED.

B. Compaction of Backfill:

1. Excavations shall be backfilled in lifts not exceeding compacted thicknesses noted in Paragraph 3.11C. Each lift shall be individually compacted.
2. The following percentages of maximum dry density shall be achieved:

	Modified Effort <u>ASTM D1557</u>
• Building Foundation and Structural Slab-on-Grade	95%
• Exterior Side of Structure Walls	95% to point 5' from building wall, then 90%
• Trench Backfill under Pavement (not including base course materials)	95%
• Trench Backfill within Unpaved Areas	90%

3. Contractor shall maintain moisture content of backfill materials at or near the optimum moisture content to attain the required compaction density.
- C. Control of Traffic:
1. Employ traffic control measures in accordance with Pennsylvania Department of Transportation Publication 203, "Work Zone Traffic Control" and as shown on Drawings.
 2. See Section 01 55 26 - Traffic Regulation.
- D. Protection of Existing Utilities and Structures:
1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Pennsylvania Act 287 (1974) as last amended by Pennsylvania Act 121 (2008), advise each Utility at least three (3) working days in advance of intent to excavate, do demolition work or use explosives and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
 2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.
 3. Immediately report to the Utility and the Resident Project Representative any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
 4. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.
- E. Protection of Trees and Shrubs
1. Any trees and/or shrubs to be protected which are damaged or destroyed during construction shall be replaced in kind as required by Owner.

PART 2 - PRODUCTS

2.01 PIPE BEDDING OR EMBEDMENT MATERIAL

- A. PVC Pipe or PE Pipe:
1. Bedding to Springline of Pipe: AASHTO No. 8 (former PennDOT No. 1B) coarse aggregate or AASHTO No. 57 (former PennDOT No. 2B) coarse aggregate if trench water present, Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.
 2. Springline of Pipe to 12" over Pipe: PennDOT Select Granular Material (2RC), Section 703.3, Publication 408 Specifications (required for State Highways); PennDOT No. 2A coarse aggregate (required for Township Roads); AASHTO No. 8 (former PennDOT 1B) coarse aggregate or AASHTO #57 (former PennDOT 2B) coarse aggregate if trench water present (for easements), Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.

B. Ductile Iron Pipe or Steel Pipe:

1. Bedding to Springline of Pipe: AASHTO No. 8 (former PennDOT No. 1B) coarse aggregate or AASHTO No. 57 (former PennDOT No. 2B) coarse aggregate if trench water present, Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.
2. Springline of Pipe to 12" over Pipe: PennDOT Select Granular Material (2RC), Section 703.3, Publication 408 Specifications (required for State Highways); PennDOT No. 2A coarse aggregate (required for Township Roads), Table C, Section 703.2, Publication 408 Specifications; excavated material, if free of stone larger than 2" and free of wet, frozen or organic material (for easements). Do not use slag or cinders.

C. Copper Service Line:

1. Stone screenings or PennDOT Fine Aggregate, Type B Bituminous Concrete Sand #3, Section 703.1, Publication 408 Specifications.

D. Concrete Pipe (Reinforced or Non-Reinforced):

1. Bedding to Springline of Pipe: AASHTO No. 57 (former PennDOT 2B), Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.
2. Springline of Pipe to 12" over Pipe: PennDOT Select Granular Material (2RC), Section 703.3, Publication 408 Specifications (required for State Highways); PennDOT No. 2A coarse aggregate (required for Township Roads), Table C, Section 703.2, Publication 408 Specifications; excavated material, if free of stone larger than 2" and free of wet, frozen or organic material (for easements). Do not use slag or cinders.

E. Corrugated Galvanized Steel Pipe:

1. Bedding to Springline of Pipe: AASHTO No. 57 (former PennDOT 2B), Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.
2. Springline of Pipe to 12" over Pipe: PennDOT Select Granular Material (2RC), Section 703.3, Publication 408 Specifications (required for State Highways); PennDOT No. 2A coarse aggregate (required for Township Roads), Table C, Section 703.2, Publication 408 Specifications; excavated material, if free of stone larger than 2" and free of wet, frozen or organic material (for easements). Do not use slag or cinders.

2.02 SLAB OR BASE MATERIAL

A. Concrete Slab or Precast Base:

1. AASHTO No. 8 (former PennDOT No. 1B) coarse aggregate or AASHTO No. 57 (former PennDOT No. 2B) coarse aggregate if trench water present, Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders.

2.03 BACKFILL MATERIAL

A. State Highways and Shoulders:

1. From top of pipe bedding or embedment material to subgrade elevation: PennDOT Select Granular Material (2RC), Section 703.3, Publication 408 Specifications.

- B. Existing Municipal Streets, Parking Areas and Driveways (All Paved Surfaces):
 - 1. From top of pipe bedding or embedment material to subgrade elevation: Same as for State Highways and Shoulders or PennDOT No. 2A coarse aggregate, Table C, Section 703.2, Publication 408 Specifications.
- C. New Municipal Streets, Parking Areas and Driveways (All Paved Surfaces):
 - 1. From top of pipe bedding or embedment material to 12" over top of pipe: Excavated material if free of stones larger than 2" in size and free of wet, frozen, or organic materials.
 - 2. From top of pipe embedment or 12" over top of pipe to subgrade elevation: Excavated material if free of stones larger than 8" in size and free of wet, frozen, or organic materials.
- D. Unimproved Areas:
 - 1. From top of pipe bedding or embedment material to 12" over top of pipe: Excavated material if free of stones larger than 2" in size and free of wet, frozen, or organic materials.
 - 2. From top of pipe embedment or 12" over top of pipe to subgrade elevation: Excavated material if free of stones larger than 8" in size and free of wet, frozen, or organic materials.

PART 3 - EXECUTION

3.01 EXAMINATION & PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Notify Engineer of unexpected subsurface conditions and discontinue work in area until notified to resume work.
- C. Maintain and protect existing utilities identified by utility users within the Work area (see paragraph 1.05E).
- D. Verify that structure walls are braced to support surcharge forces imposed by backfilling operations.

3.02 PROTECTION OF ADJACENT WORK

- A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.
- B. Grade excavation top perimeter to prevent surface water runoff into excavation or to adjacent properties.

3.03 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Coordinate the work to insure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the roadway is authorized.
- B. Maintain access to all streets and private drives.

- C. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices as required to conform with construction operations and to keep traffic flowing with minimum restrictions.
- D. Comply with State and local Municipal codes, permits and regulations.
- E. See Section 01 55 26 on Traffic Regulation

3.04 CUTTING PAVED SURFACES

- A. Where installation of pipelines, structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the edge of the excavation. Cut offsets at right angles to the edge of the excavation.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.
- C. The requirement for neat line cuts, in other than state highways, may be waived if the final paving restoration indicates overlay beyond the width of the excavation.

3.05 EXCAVATION

- A. Depth of Excavation:
 - 1. Gravity Pipelines:
 - a. Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.
 - b. Excavation for laterals to shallow sewers shall provide a straight uniform grade from the main pipeline to the required elevation at the right-of-way line, plus that excavation necessary for placement of pipe bedding material.
 - c. Excavation for laterals to deep sewers shall provide a straight grade at 45° from horizontal from the main pipeline to the required elevation, then continuing at a straight uniform grade to the required elevation at the right-of-way line, plus the excavation necessary for placement of pipe bedding material.
 - 2. Pressure Pipelines:
 - a. Excavate trenches to the minimum depth necessary to place required pipe bedding material and to provide four (4) feet from the top of the pipe to the finished ground elevation, except where specific depths are otherwise shown on the Drawings.
 - 3. Structures:
 - a. Excavate to the minimum depth necessary to install footings, concrete slab or precast base plus that excavation necessary to place the required base material as shown on the Drawings.
 - 4. Where unsuitable bearing material including shattered rock due to drilling or blasting

operations is encountered in the bottom of the excavation, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete/ concrete cradle can be placed. If no concrete/ concrete cradle is to be installed, refill the excavation to required grade with pipe bedding/ embedment or slab/base material as appropriate.

5. Where Contractor, by error or intent, excavates beyond the minimum required depth, backfill the excavation to the required depth with pipe bedding/embedment or slab/base material as appropriate.

B. Width of Excavation:

1. Gravity and Pressure Pipelines:

- a. Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe, and for placing and compacting pipe embedment under, around and over the pipe, but not less than 6" or more than 12" on each side of the pipe.
- b. Shape trench walls completely vertical from trench bottom to at least two (2) feet above the top of the pipe.
- c. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.

2. Structures:

- a. Excavate to the minimum distance necessary for placement/installation of the footings, concrete slab, walls or prefabricated structures and to permit proper backfill procedures to be performed.

C. Length of Open Trench:

1. Do not advance trenching operations more than 200' ahead of completed pipeline provided the PennDOT Highway Occupancy Permit and/or local Municipal Road Opening Permit does not impose a more restrictive requirement.
2. Backfill completed construction and any open trench in advance of construction at the end of each working day except for a limited area (no greater than 10 LF) at the end of pipe construction which may remain open but shall be protected by fencing or other secure means acceptable to Owner.

3.06 SUPPORT OF EXCAVATION

- A. Support excavations with sheeting, shoring, and bracing or in the case of pipeline construction, a "trench box" as required to comply with Federal and State laws and codes.
- B. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of Contractor in any other manner, shall be repaired at Contractor's expense.
- C. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the

Resident Project Representative.

- D. The neglect, failure or refusal of the Resident Project Representative to order the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to order sheeting, bracing, struts, or shoring to be left in place, or the giving or failure to give orders or directions as to the manner or methods of placing or driving sheetings, bracing, jacks, wales, stringers, etc., shall not in any way or to any extent relieve Contractor of any responsibility concerning the condition of excavation or of any of his obligations under the Contract, nor shall any delay, whether caused by any action or want of action on the part of Contractor, or by any act of Owner and Engineer or their agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve Contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of their obligations under the Contract relating to injury of persons or property, nor entitle them to any claim for extra compensation.

3.07 CONTROL OF EXCAVATED MATERIAL

- A. Keep the ground surface, within a minimum of 2' of the sides of the excavation, free of excavated material.
- B. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.
- C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural water courses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.
- D. In areas where excavations parallel or cross streams, ensure that no material slides, is washed, or dumped into the stream course. Remove diversion structures and/or cofferdams immediately upon completion of construction within the stream.

3.08 DEWATERING

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- D. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control. (See Section 01 57 13).

3.09 PIPE LAYING

- A. Provide required pipe bedding placed in accordance with the Drawings and Specifications (Paragraph 2.01). A minimum bedding depth of 6" shall be provided when bedding is required.
- B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.
- C. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

3.10 STRUCTURE PLACEMENT/INSTALLATION

- A. Provide required base material in accordance with the Drawings and Specifications (Paragraph 2.02).

3.11 BACKFILLING EXCAVATIONS

A. Pipeline Trench:

1. After pipe installation and inspection, provide material to complete the pipe embedment in accordance with the Drawings and Specifications.
2. Unless otherwise shown on the Drawings, the following bedding or embedment requirements using the material noted in Paragraph 2.01 shall apply:
 - a. Water Mains, Sanitary Sewers, Laterals and Sewage Force Mains (DIP): pipe bedding to 12" above the crown of pipe (State highway or local municipal road); pipe bedding to springline of pipe (easement or grassed area).
 - b. Sanitary Sewers, Laterals, Force Mains and Water Lines (PVC or PE): pipe embedment to 12" above the crown of pipe.
 - c. Air Mains (Steel or DIP): pipe bedding to springline of pipe.
 - d. Copper Service Lines: pipe embedment to 6" above crown of pipe.
 - e. Storm Sewer (Concrete): pipe bedding to springline of pipe.
 - f. Storm Sewers (Corrugated Metal Pipe): pipe bedding to springline of pipe.
3. The material shall be hand-placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified compaction around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material in accordance with the Drawings and any relevant permit conditions. Employ a placement method so not to disturb or damage the utility line in the trench. Use of a Hydra-hammer or jumping-jack type compaction device is not permitted within two (2) feet of the utility line. A vibratory plate type compaction device and/or trench roller is acceptable. Vibratory compaction equipment or trench rollers shall be used for the lifts of coarse aggregate backfill within existing streets and paved areas. Any settlement which occurs because of consolidation of the backfill during the construction period or during the required maintenance period shall be corrected by Contractor.

B. Structure Excavation:

1. After structure installation and inspection, backfill the excavation with specified backfill material in accordance with the Drawings. Employ a placement method so not to disturb or damage foundation perimeter drainage, foundation damp proofing or water proofing and protective cover or utility lines. Backfill against supported foundation walls; backfill simultaneously on each side of unsupported foundation walls. Pipelines entering the structure must be provided with the specified bedding material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified compaction around and under the haunches of the pipe. Use of a Hydra-hammer or jumping-jack type compaction device is not permitted within two (2)

feet of a pipeline. A vibratory plate type compaction device and/or trench roller is acceptable and shall be used for the lifts of coarse aggregate backfill within existing paved areas. Any settlement which occurs because of consolidation of the backfill during the construction period or during the required maintenance period shall be corrected by Contractor.

C. Lift Thickness Limitations:

1. Lift thicknesses shall be limited to six (6) inches for pipe embedment, eight (8) inches maximum for pipeline trenches within paved areas and twelve (12) inches maximum for pipeline trenches in non-paved areas and for structure excavations. Lift thicknesses shall also comply with requirements imposed by any State Highway Occupancy Permit. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations for the compaction equipment to be utilized. Compaction equipment shall not be used over the pipe until sufficient backfill has been placed to ensure that such equipment will not damage or disturb the pipe.
2. Lift thickness limitations specified for State highways, shoulders, or embankments govern over the compaction equipment manufacturer's recommendations.

D. Unsuitable Backfill Material and/or Compaction:

1. Where the Resident Project Representative deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with suitable backfill material.
2. If, during progress of the Work, tests indicate that compacted materials do not meet specified requirements, remove defective material, replace and retest at no cost to Owner, as directed by the Resident Project Representative.

3.12 DISPOSAL OF EXCAVATED MATERIAL

- A. Excavated material remaining after completion of backfilling shall remain the property of Contractor, removed from the construction area, and disposed of legally. Contractor shall either allow saturated soils to sufficiently dry prior to any hauling off-site or else use a sealed, watertight truck.

3.13 ROUGH AND FINE GRADING

- A. Grade areas disturbed by construction to a uniform finish. Form the bases for terraces, banks, lawns and paved areas.
- B. Grade areas to be paved to depths required for placing subbase and paving materials. Top surface of exposed subgrade to be plus or minus one inch.
- C. Grade areas to be topsoiled and seeded to 4" below indicated finish contours.
- D. Slope grade away from structures at a minimum 2 inches in 10 feet unless otherwise noted on Drawings.

3.14 RESTORATION OF UNPAVED SURFACES

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.

B. Restore grassed areas in accordance with Section 32 93 00, Landscaping.

3.15 RESTORATION OF PAVED SURFACES

A. See Sections 32 12 00.

END OF SECTION

SECTION 32 01 16.71

MILLING OF BITUMINOUS PAVEMENT SURFACE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Milling of Bituminous Pavement Surface

1.02 DESCRIPTION OF WORK

- A. This work is the milling of an existing bituminous pavement surface, with specified equipment, to a depth of 1-½ inches at the roads specified. Milling shall be completed in accordance with PennDOT Publication 408, Section 491.

PART 2 PRODUCTS

- A. SECTION NOT USED

PART 3 EXECUTION

3.01 EQUIPMENT

- A. Use a milling machine designed and built for this type of work. Provide a machine with an effective automatic grade and slope control system and having the capacity to mill concrete patches.

3.02 MILLING OPERATION

- A. Mill so the finished surface is free from gouges, grooves, and ridges and is in accordance with the specified surface tolerance requirements, or as directed.
- B. To facilitate traffic control, pick up and move milled material, as specified, immediately after the milling operations.
- C. Use care to remove the existing bituminous material around all utility facilities within the work areas.
- D. Repair or replace, to the satisfaction of the utility owner, utility facilities which are damaged by the milling operation.
- E. Control the rate of milling to avoid tearing of the mat, which results in chunky and non-uniformly milled material.
- F. Separate oversized and chunky milled material as directed.
- G. Keep the milled pavement surface free of all loose materials and dust.
- H. Do not allow traffic to drive on any milled surface for more than 6 calendar days. Install the overlay bituminous wearing course within 7 calendar days from the start of the milling operation.

3.03 SURFACE TOLERANCE

- A. Test the finished surface with a ten (10) foot straightedge whenever Engineer suspects an area is deficient or irregular.
- B. Use the straightedge at transverse joints and paving notches.
- C. Hold the straightedge in successive positions parallel to the road centerline, in contact with the surface, and check the whole area from one side to the other, as necessary.
- D. Advance along the pavement in stages of not more than one-half the length of the straightedge.
- E. Correct irregularities of more than 3/16 inch.
- F. For irregularities which develop before completion of rolling, correct by loosening surface mixture and removing or adding material, as required.
- G. If irregularities or defects that cannot be corrected remain after final compaction, the affected area will be considered defective.

3.04 DISPOSITION OF MILLED MATERIAL

- A. Satisfactorily dispose of the milled material.

END OF SECTION

MILLING OF BITUMINOUS PAVEMENT SURFACE

32 01 16.71-1

SECTION 32 01 17.61

POLYMER MODIFIED ASPHALT JOINT AND CRACK SEALING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Asphaltic Joint and Crack Sealing

1.02 DESCRIPTION OF WORK

- A. This work is the cleaning and sealing of pavement surface joints associated with the removal and replacement of concrete curb and curb ramps with polymer modified asphalt.

PART 2 PRODUCTS

2.01 ASPHALT CEMENT PG 64-22

- A. Obtain material meeting the requirements of PennDOT Bulletin 25 from a producer listed in Bulletin 15.

- 1. Quality Control Section 01 40 00

- 2. Certification

- a. General

- 1) When a bituminous material tank is filled, submit a copy of the required test results to the MTD for verification of compliance with Department specifications.
- 2) Specify the type of material, tank number, and company lot number of the certificate for cross-reference to the bill of lading.
- 3) Have a responsible company official sign the certificate.
- 4) Obtain a verification sample from each batch. A batch is a tank completely filled, partially filled, or refilled with a blend of residual and new material.
- 5) Test one-half (1/2) sample and forward the results to the MTD. Forward the remaining one-half (1/2) sample to the MTD for testing. The MTD will evaluate quality control on the basis of three (3) consecutive verification samples.

- b. Levels of Certification

- 1) Use the same levels of certification as specified in PennDOT Publication 408, Section 701.1(b)2, except substitute the word "batch" for the word "silo."

- c. Handling and Transportation, Section 01 60 00

- 1) Furnish the vendor's bill of lading for each shipment (one copy retained by the vendor and one copy included with the shipment to the project). Use a form acceptable to the MTD, containing the following information:

- a) Statement that material has been testing and meets Department specifications.
- b) Class of Material
- c) Tank Number
- d) Company Batch Number
- e) Date of Shipment
- f) Producer's Name and Location
- g) Name and Location of Consignee, (Bituminous Concrete Plant or Maintenance District)
- h) Mix or Application Temperatures, Minimum and Maximum

- i) Viscosity at 140F
- j) Penetration at 77F
- k) Trailer Number
- l) Specific Gravity of Asphalt Cement at 77F
- m) Statement that the material is compatible with job aggregate E-4, E-5, E-10, E-11, E-12, MC-400, and MC-800
- n) Percent Bitumen Residue by Weight (for liquid bituminous materials only)
- o) Quality of Material
- p) Statement that the shipment container was determined to be reasonably free of contamination immediately prior to loading

PART 3 EXECUTION

3.01 GENERAL

- A. Provide a mixture of asphalt cement and reclaimed granulated rubber, combined to the specified proportions, or furnish a premixed composition as specified in Section 469.2(c) or (d).

3.02 MIXING PROCEDURES

- A. Combine the PG 64-22 and reclaimed granulated rubber to obtain a mixture having proportions of two (2 lbs) pounds of RGR per gallon of asphalt cement. Blend the PG 64-22 and reclaimed granulated rubber in an oil-jacketed double wall kettle (indirect heating) equipped with agitator and two (2") inch hot asphalt pump. Provide separate thermometers for oil bath. Heat and agitate the mixture with the temperature range of 350F - 380F for thirty (30) minutes. Do not allow the operating temperature in the kettle to exceed 400F.
- B. For premixed material, as specified in Section 469.2(c) or (d), obtain the safe heating temperature range and recommended pouring temperature from the manufacturer's shipping container. Place the material within this temperature range, and as close as possible to the recommended pouring temperature. Maintain a safe heating temperature. Do not maintain any single batch of material at the pouring temperature for more than four (4) hours. Reheat only in accordance with manufacturer's recommendations.

3.03 SURFACE PREPARATION

- A. Apply sealer only after joints and adjacent pavement surfaces are clean, dry, and free of any loose material and debris. Clean the pavement for four (4") to six (6") inches on either side of the joint. Air blast joints immediately prior to sealing. Use a compressed air stream of at least 100 psi measured at the source, or use a hot compressed air lance for cleaning and drying damp cracks in the bituminous pavements. Care should be taken to ensure that damage to the surrounding pavement area from overheating does not occur. Seal joints (1/8) to one (1") inch wide with polymer modified asphalt.

3.04 SEALING

- A. Apply polymer modified asphalt to prepared joints, level with the pavement surface, using a wand followed by a standard "V" shaped asphalt squeegee. Leave no more than 1/8 inch buildup. Do not place sealer when the air temperature is below 40F or above 90F, unless otherwise permitted by the Engineer if the hot compressed air lance used can sufficiently warm the crack to ensure adhesion between the pavement and the sealer. Do not place bituminous overlay within seventy-two (72) hours of sealing unless permitted by Engineer.

END OF SECTION

SECTION 32 05 19.13

GEOTEXTILE

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

- A. This work shall consist of furnishing and placing a Class 4 geotextile for use as a permeable separator to prevent inter-mixing of dissimilar material such as subgrades and surfaced or unsurfaced pavement materials as defined in PennDOT Publication 408 Section 212.3.e. The geotextile shall be designed to allow passage of water while retaining in situ-soil. This specification does not address geotextiles used for reinforcement.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Geotextile shall be composed of synthetic fibers formed into a woven fabric. Fibers used in the manufacture of the geotextile shall be composed of at least 85% weight by polyolefins, polyesters or polyamides. The geotextile shall be resistant to chemical attack, rot and mildew and shall have no tears or defects that will adversely alter its physical properties. The geotextile shall be Amaco Style 2000, ProPex® or approved equal meeting the physical requirements specified in Table 1.

- B. TABLE 1: PHYSICAL REQUIREMENTS OF PAVING FABRIC

Properties	Test Method	American Standard
Grab Tensile	ASTM D 4632	140 lb.
Grab Elongation	ASTM D 4632	15%
Mullen Burst	ASTM D 3786	325 psi
Puncture	ASTM D 4833	65 lb.
Trapezoidal Tear	ASTM D 4533	45 lb.
UV Resistance	ASTM D 4355	70% at 500 hr.
AOS	ASTM D 4751	30 sieve
Flow Rate	ASTM D 4491	4 gal./min./sq.ft.

PART 3 - EXECUTION

3.01 SHIPPING & STORAGE

- A. The geotextile shall be kept dry and wrapped such that it is protected from the elements during shipping and storage. If stored outdoors, the geotextile shall be elevated and protected with a waterproof cover. At no time shall the geotextile be exposed to ultraviolet light for a period exceeding 14 days. The geotextile rolls shall be labeled in accordance with ASTM D 4873-88, "Standard Guide for Identification, Storage and Handling of Geotextiles."

3.02 SITE PREPARATION

- A. The installation area shall be prepared by clearing all debris or obstructions that may damage the geotextile.

3.03 GEOTEXTILE PLACEMENT

- A. Place the fabric on a prepared subgrade area covering the full width of the subbase layer being protected. Place fabric in a loose and unstretched condition to minimize shifting, puncture, and/or tearing of the fabric. Overlap fabric roll-ends and edges a minimum of 300 mm (12 inches) with adjacent material. Place subbase material within 2 weeks after placement of fabric to minimize exposure. Place subbase material in a manner to minimize slippage of the fabric.
- B. Damaged geotextiles, as identified by the Engineer, shall be replaced immediately.

END OF SECTION

SECTION 32 12 00

BITUMINOUS CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of this Section Includes:
 - 1. Asphalt paving of roadways.

1.02 SYSTEM DESCRIPTION

- A. Paving: Designed for traffic anticipated on the roadways.

1.03 RELATED SECTIONS

- A. Section not used

1.04 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. Pennsylvania Department of Transportation:
 - a. Publication 408 Specifications
 - b. Publication 27 – Specification for Bituminous Mixtures (Bulletin 27)
- B. Perform Work in accordance with the latest edition of PennDOT Publication 408.
- C. Mixing Plant: Conform to PennDOT Bulletin 27, chapter 1 Standards.
- D. Conform to applicable Township standards for paving work on public property.

1.05 SUBMITTALS

- A. Certificates:

Submit certification from bituminous and aggregate suppliers attesting that materials conform to the State Specifications in accordance with Section 01 33 00.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when base surface temperature is less than 40 degrees F or base surface is wet or frozen.

1.07 JOB CONDITIONS

- A. Restore existing paving outside the limits of the Work that is damaged by Contractor's operations, to its original condition at the expense of Contractor.

PART 2 PRODUCTS

2.01 PAVING MATERIALS

- A. Bituminous Concrete Base Course: PennDOT Superpave (Section 313 & 316 of Publication 408).
- B. Binder Course: PennDOT Superpave (Section 410 & 413 of Publication 408).
- C. Wearing Course: PennDOT Superpave (Section 410 & 413 of Publication 408).
- D. Tack Coat: Per Section 460 of PennDOT Publication 408, except revise the first sentence to read: Emulsified Asphalt, Class E-8 (AASHTO CSS-1h or SS-1h)
- E. Joint Seal: Asphalt PG 64S-22 Sealant (Publication 408).

2.02 SUBBASE COURSE MATERIALS

- A. Coarse Aggregate: PennDOT No. 2A (Section 703.2 of Publication 408).

2.03 PAINTING MATERIALS

- A. Sections 962, PennDOT Publication 408.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify gradients and elevations of area to be paved.
- B. Trim existing paving with minimum one (1) foot cutbacks to remove damaged areas. Cut straight joint lines and right angle offsets.
- C. Remove any temporary paving material.
- D. Proof-roll subgrade (10 ton roller) and replace any soft or unsuitable material with coarse aggregate. Verify compacted subgrade is dry and ready to support paving and imposed loads.
- E. Apply tack coat in accordance with PennDOT Publication 408 requirements prior to placing an overlay over existing paving or prior to placing a wearing course over a previous placed binder course.
- F. Coat surfaces of any manhole or catch basin frames with oil to prevent bond with asphalt paving.

3.02 SUBBASE COURSE

- A. Place PennDOT No. 2A coarse aggregate in continuous layers not exceeding 6 inches loose depth, and compact (10 ton roller) to required contours and elevations.

3.03 PLACING ASPHALT PAVEMENT

- A. Place bituminous concrete base course on surface of compacted subbase course to compacted thickness (10 ton roller where possible; minimum 5 ton roller in trenches) as shown on Drawings.
- B. Place binder and wearing courses to compacted thicknesses (10 ton roller except minimum 5 ton roller for binder course in trenches) as shown on the Drawings. Apply tack coat on completed binder course before placing wearing course should there be a delay between completion of binder course and placement of wearing course.
- C. Place wearing course overlay to compacted thickness (10 ton roller) as and where shown on the Drawings.
- D. Compact pavement by rolling to achieve even and smooth finish, without roller marks. Hand compact in areas inaccessible to rolling equipment.
- E. Where proposed asphalt paving adjoins existing asphalt paving, seal the joint with hot bituminous material in accordance with PennDOT Publication 408 requirements.
- F. Provide painted markings where shown on Drawings.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Compacted Scheduled Thickness: Within 1/4 inch of design thickness.
- C. Variation from True Elevation: Within 1/2 inch.

END OF SECTION

SECTION 32 12 23

RESTORATION OF PAVED SURFACES

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

- A. The Work of This Section Includes:
1. Temporary Paving
 2. Permanent Paving
 3. Asphalt Overlay
 4. Shoulder Restoration
 5. Driveways
 6. Concrete Curb and Gutter Repairs
 7. Stormwater Inlets and Piping
 8. Street Signage

1.02 RELATED SECTIONS

- A. Related Work specified elsewhere:
1. Section 01 55 26: Traffic Regulation
 2. Section 32 12 00: Bituminous Concrete Paving

1.03 QUALITY ASSURANCE

- A. Referenced Standards:
1. Pennsylvania Department of Transportation:
 - a. Publication 408 Specifications
 - b. Publication 27 - Specification for Bituminous Mixtures (Bulletin 27)
 - c. Publication 37 - Specification for Bituminous Materials (Bulletin 25)
 - d. Publication 213 – Temporary Traffic Control Guidelines

1.04 SUBMITTALS

- A. Certificates:
1. Submit certification from bituminous and aggregate suppliers attesting that materials conform to the State Specifications in accordance with Section 01 33 00.
 2. Submit a PennDOT approved Job Mix Formula for each bituminous concrete mix required.
 3. Submit a PennDOT approved Mix Design for each concrete class and use required.

1.05 JOB CONDITIONS

- A. Control of Traffic:
1. Take measures to control traffic during repaving operations. Do not allow traffic on repaved areas until authorized by the Resident Project Representative.
 2. Employ traffic control measures in accordance with the requirements of Section 01 55 26 including pertinent permits by PennDOT and local municipal agencies having jurisdiction.
- B. Restore existing paving outside the limits of the Work, that is damaged by Contractor's operations, to its original condition at the expense of Contractor.

PART 2 - PRODUCTS

2.01 BITUMINOUS PAVING MATERIALS AND AGGREGATES

- A. Base Course: PennDOT Superpave (Section 313 & 316 of Publication 408).
- B. Binder Course: PennDOT Superpave (Section 410 & 413 of Publication 408).
- C. Leveling Course: PennDOT Superpave (Section 410 & 413 of Publication 408).
- D. Wearing Course: PennDOT Superpave (Section 410 & 413 of Publication 408).
- E. Tack Coat: Per Section 460 of PennDOT Publication 408, except revise the first sentence to read: Emulsified Asphalt, Class E-8 (AASHTO CSS-1h or SS-1h)
- F. Joint Seal: Asphalt PG 64-22 Sealant (Publication 408).
- G. Coarse Aggregate: PennDOT No. 2A (Section 703 of Publication 408).

PART 3 - EXECUTION

3.01 TEMPORARY PAVING

- A. Provide temporary paving immediately upon completion of trench backfilling. Unpaved trenches shall not remain unpaved longer than ten (10) working days after backfilling.
- B. Complete trench backfill with coarse aggregate in accordance with the Drawings and Publication 408 requirements.
- C. Trim existing paving with minimum one (1) foot cutbacks to remove damaged areas. Cut straight joint lines and right angle offsets.
- D. Place temporary paving material consisting of bituminous concrete base course to the required depth shown on the Drawings for the entire width of the trench. Place with a maximum lift thickness of three (3) inches and compact each lift individually using a trench roller (minimum 5 ton).
- E. Continuously maintain temporary paving to the satisfaction of the Resident Project Representative and the State and local municipal road departments having jurisdiction. Temporary paving on State roads must remain in place for a minimum of ninety (90) days.

3.02 PERMANENT PAVING

- A. Place bituminous concrete base course on surface of compacted subbase course to compacted thickness (10 ton roller where possible; minimum 5 ton roller in trenches) as shown on Drawings.
- B. Place binder and wearing courses to compacted thicknesses (10 ton roller except minimum 5 ton roller for binder course in trenches) as shown on the Drawings. Apply tack coat, per Section 32 12 00, on completed binder course before placing wearing course should there be a delay between completion of binder course and placement of wearing course.
- C. Place wearing course overlay to compacted thickness (10 ton roller) as and where shown on the Drawings.
- D. Compact pavement by rolling to achieve even and smooth finish, without roller marks. Hand compact in areas inaccessible to rolling equipment.
- E. Where proposed asphalt paving adjoins existing asphalt paving, seal the joint with Asphalt PG 64-22 Sealant in accordance with Publication 408 Specifications.
- F. Replace pavement markings in their former location which were covered or destroyed.
- G. Maintain permanent paving to the satisfaction of the Resident Project Representative and the local municipal and State road departments having jurisdiction throughout the Contract maintenance period.

3.03 ASPHALT OVERLAY

- A. Where indicated on the Drawings, or directed by the Resident Project Representative, place an asphalt overlay.
- B. Construct in accordance with Publication 408 Specifications.
- C. Replace pavement markings in their former location which were covered or destroyed.

3.04 SHOULDER RESTORATION

- A. Restore shoulders in accordance with the Drawings.

3.05 DRIVEWAYS

- A. Trim concrete and bituminous driveway surfaces to remove damaged areas. Saw cut straight joint lines parallel to the centerline of the trench. Cut offsets at right angles to the trench centerline.
- B. Restore existing portland cement concrete driveways with a 6" layer of concrete reinforced with 6 x 6 10/10 wire mesh.
- C. Restore existing blacktop driveways in kind or with minimum 1-1/2" layer wearing course over 6" layer of 2A aggregate.
- D. Restore earth driveways with a 6" layer of 2A stone backfill.
- E. Restore stone or gravel driveways in kind.
- F. Restore brick driveways with like bricks placed on a 4" thick wet sand bed. Place bricks in like pattern and spacing.
- G. Restore cobblestone driveways with cobblestone placed on a 4" thick wet sand bed. Place cobblestones in like pattern and spacing.

3.06 CONCRETE CURB AND GUTTER REPAIRS

- A. Replace curbs and gutters damaged by construction to match existing.
- B. Reconstruct curbs and gutters to the first expansion joint on either side of the damaged portion. Install expansion joint material.

3.07 STORMWATER INLETS AND PIPING

- A. Repair or replace storm water inlets and piping damaged by construction to match existing inlets.
- B. The Resident Project Representative will determine whether the frame and grate assembly of each affected storm water inlet is suitable for reuse once it has been removed by Contractor.
- C. Construct or repair storm water inlets and piping in accordance with relevant section of Publication 408 Specifications.

3.08 STREET SIGNAGE

- A. Reinstall any signage removed to allow for construction activities at the original location.

END OF SECTION

SECTION 32 13 13

PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. Concrete Sidewalks/Steps
2. Concrete Curbs
3. Concrete Driveway Aprons
4. Concrete Pads

1.02 RELATED SECTIONS

A. Related Work Specified Elsewhere

1. Section 31 20 00: Earthwork
2. Section 31 23 33: Excavation, Backfill & Compaction
3. Section 32 12 23: Restoration of Paved Surfaces
4. Section 32 92 00: Finish Grading, Seeding & Sodding

1.03 QUALITY ASSURANCE

A. Reference Standards

1. American Concrete Institute
ACI 301, 318
2. American Society for Testing and Materials (ASTM):
A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C31 Practices for Making and Curing Concrete Test Specimens in the Field
C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
C42 Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C172 Method of Sampling Freshly Mixed Concrete
C260 Specification for Air-Entraining Admixtures for Concrete
D946 Specification for Penetration - Graded Asphalt Cement for Use in Pavement Construction
3. Pennsylvania Department of Transportation
Publication 408 Specifications

B. Testing Laboratory

1. Compressive strength tests shall be performed by an independent testing laboratory engaged by and paid for by Owner.

1.04 SUBMITTALS

A. Certificates:

1. Submit certification from the concrete producer attesting that the concrete conforms to Section 704, Publication 408 Specifications for the class of concrete being used.
2. Submit certified results of compressive strength tests performed by an independent testing laboratory.
3. Submit a PennDOT approved Mix Design for each concrete class and use required.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Forms:

1. Forms shall be straight, free from warp and of sufficient strength to resist the pressure of concrete without springing. Forms and template which are worn, bent, warped or broken shall not be used.
2. For sidewalks, steps, pads and driveway aprons, use forms of wood or steel profiled to suit conditions.
3. For curbs, use forms of steel except for sharp curves and short tangent sections where wood forms may be used when approved by the Resident Project Representative. Metal forms shall be of approved sections and shall have a flat surface on top and wood forms shall be of a depth equal to the depth of the curb, designed to permit secure fastening of the face and back forms at the tops. These fastenings shall be constructed in a manner that will not obstruct satisfactory finishing and edging of the top of the curb but will permit removal of the inside or face forms. The outside or back forms shall be straight from top to bottom. The inside of the face forms shall have a batter from the top of the curb to the finished surface line of the pavement, as indicated on the drawings, and shall be straight from this line to the bottom.

B. Expansion Joint Filler: 1/2" thickness conforming to Section 705.1, Publication 408 Specifications.

C. Joint Sealing Material: Liquid Asphalt Cement, ASTM D-946. PG 64-22 Sealant (Publication 408)

D. Concrete Curing Material/Compound: Section 711.1 and 711.2(a), Publication 408 Specifications.

E. Coarse Aggregate: AASHTO No. 57, Publication 408 Specifications.

F. Reinforcement Bars: ASTM A615; Grade 60, deformed billet steel bars, finish conforming to Section 709.1, Publication 408 Specifications and Bulletin 15.

G. Welded Steel Wire Fabric: Deformed type; unfinished, coiled rolls, conforming to gage and mesh size as noted on the Drawings and Sections 709.3 and 709.4, Publication 408 Specifications and Bulletin 15.

2.02 CONCRETE MIX

A. Conforming to Section 704, Publication 408 Specifications.

1. Requirements for State approved batch plants, design computations and plant inspection shall apply. The acceptability of concrete will be based on conformance with the Cement Concrete Criteria specified below and the results of the specified tests.

B. Cement Concrete Criteria:

1. All Concrete shall be Class A.
 - a. Compressive strength @ 7 days: 2750 psi
 - b. Compressive strength @ 28 days: 3,000 psi
 - c. Slump: 3±1" except for slip forming of curbs which shall be a maximum of 1-1/2"
 - d. The air content of air-entrained concrete shall be 6% ± 1% by volume. Air-Entraining Agents shall conform to ASTM C260
2. All Concrete shall be Class A as defined by PennDOT Publication 408, Section 704.
3. **Concrete design mix shall be submitted to Engineer for approval prior to work commencement. No concrete shall be placed until Engineer has approved the design mix.**

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Subgrade Preparation

1. Verify gradients and elevations of subgrade.
2. Soft, spongy, organic or other unsuitable material shall be removed from the subgrade and replaced with dry, firm material.
3. Compact subbase and/or subgrade to a firm unyielding surface at the required depth below the finished line and grade of the required construction work as shown on the Drawings.

B. Aggregate Placement

1. Spread aggregate on prepared subgrade to form a bed of the required depth as shown on Drawings.
2. Compact aggregate thoroughly using mechanical tamping device.

3.02 FORMING

A. Sidewalks, Steps, Pads and Driveway Aprons

1. Place and secure forms to correct location, dimension and grade in a manner to prevent settlement or displacement. Provide sufficient horizontal and vertical support.
2. Radial forms shall be used for all sidewalks with a radius of less than 250 feet.
3. Clean and treat all forms and templates with an approved material as required to prevent the concrete from adhering thereto. Oil, bituminous paper or other material which will adhere to or discolor the concrete shall not be used.
4. Form sidewalks to provide for separate slabs twenty-four (24) feet in length.
5. Place premolded expansion joint filler in joints between slabs, adjacent to existing structures, between the sidewalk and driveway apron, and between the driveway apron and concrete curb.
6. Place premolded expansion joint material vertical in position, in straight lines for the full depth

of the concrete.

B. Curbs

1. Place and secure forms to correct location, dimension and grade in a manner to prevent settlement or displacement. Provide sufficient horizontal and vertical support.
2. Clean and treat all forms and templates with an approved material as required to prevent the concrete from adhering thereto. Oil, bituminous paper or other material which will adhere to or discolor the concrete shall not be used.
3. Provide construction joints in uniform lengths not exceeding 15.5 feet except where shorter sections are necessary for closures or curves. No section shall be less than four (4) feet. Saw cut joints may be provided in lieu of hand-formed construction joints.
4. Place premolded expansion joint material, cut to conform to the cross sectional area at all structures and at the end of the day's work.

3.03 REINFORCEMENT

A. Sidewalks, Steps, Pads and Driveway Aprons

1. Place welded wire fabric at the mid-height of sidewalks and driveway aprons.
2. Interrupt reinforcement at expansion joints.

B. Curbs

1. Place steel reinforcement at driveway depressions as noted on the Drawings.
2. Interrupt reinforcement at expansion joints.

3.04 PLACING AND FINISHING CONCRETE

A. General

1. Moisten subbase/subgrade to minimize absorption of water from fresh concrete.
2. For use, proportioning, mixing and placing, and quality of concrete, follow applicable sections of ACI 318.
3. Place concrete in accordance with ACI 301 and PennDOT Publication 408.
4. Do not disturb formwork components or reinforcement during placement of concrete.
5. Place concrete continuously between predetermined joints.
6. Apply Aquaron 2000 or equal to all new concrete surfaces immediately upon removal of the formwork. Apply, cure and protect exposed concrete construction as specified in Section 501.3(k), Publication 408 Specifications.

B. Field Tests of Concrete During Construction

1. Each 50 cubic yards or fraction thereof of each class of concrete will be tested for compressive strength. Retain an independent testing laboratory to test cylinders at the expense of CONTRACTOR.

- a. Sample concrete in accordance with ASTM C172. One test for slump, air entrainment and air and concrete temperature will be taken from each concrete delivery.
 - b. Prepare and cure one set of four (4) test cylinders in accordance with ASTM C31.
 - c. Test cylinders in accordance with ASTM C39 at the following schedule: 1 @ 7 days, 2 @ 28 days and 1 held in reserve.
 - d. One additional set of test cylinders will be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.
2. If test cylinders fail to meet strength requirements, the Resident Project Representative may require core tests in accordance with ASTM C42 at the expense of CONTRACTOR.

C. Sidewalks, Steps, Pads and Driveway Aprons

1. Provide a slope on sidewalks of towards the street as indicated on the Drawings.
2. Finish surface to a semi-smooth condition.
3. Divide sidewalk slabs between expansion joints into blocks four (4) feet in length by scoring transversely. Divide the width of the driveway apron equally. Score the concrete around any obstructions or structures within the sidewalk area. The scoring shall consist of a block eight (8) inches wider than the maximum dimension of the structure at the sidewalk elevation. Scoring shall extend for a depth of at least one-quarter (1/4) of the thickness of the concrete slab.

D. Curbs

1. Place concrete in the forms in horizontal layers not exceeding five (5) inches and spade sufficiently to eliminate all voids. A vibrator may be used when approved by the Resident Project Representative.
2. Provide drainage openings through curb at the elevation and of the size required as shown on the Drawings or as directed by the Resident Project Representative.
3. Provide depressed curb where shown on the Drawings or as directed by the Resident Project Representative.
4. Finish top surface of the curb true to line and grade in a smooth, neat and even manner.
5. Round the edges of the face and back of the top surface of the curb to a radius of not more than 3/4 inch and 1/4 inch respectively while the concrete is still plastic.
6. Saw cut joints where construction joints have not been hand-formed. Sawing of joints shall be done as soon as practicable after the concrete has set sufficiently to preclude raveling during the sawing operation and before any shrinkage cracking occurs. The saw cut depth may be decreased at the edge adjacent to the pavement to obtain a maximum depth that will avoid damage to the pavement. Provide tooled edges on construction joints.

3.05 RESTORATION

A. Backfilling

1. Perform backfilling in accordance as required adjacent to the construction following removal of forms in such a way as to not disturb the concrete construction and in accordance with

Bristol Township Specifications and Design Standards and PennDOT Publication 408.

B. Final Grading and Seeding or Sodding

1. Perform final grading and provide seeding or sodding as noted on the Drawings.

C. Concrete Joints at Asphalt Paving

1. Sealing material shall be applied at the joint between the concrete and asphalt paving.

END OF SECTION

SECTION 32 17 23.14

PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. This work is the application of traffic lines and markings.

PART 2 PRODUCTS

- A. Materials used shall be in accordance with Section 962 of PennDOT Publication 408.

PART 3 EXECUTION

3.01 GENERAL

- A. Apply in accordance with 67 Pa Code, Chapter 211, Subchapter K.

3.02 EQUIPMENT

- A. Line Application: Use a machine that is capable of:
 - 1. applying 4-inch parallel lines, in either solid or broken patterns or various combinations thereof.
 - 2. automatically and continuously measuring the length of each line placed to the nearest foot.
- B. Legend Application: This includes crosswalks, intersections, stop lines, and other miscellaneous items.
Legend application shall not be performed with hand brushes or rollers.
- C. Application Rates
 - 1. Paint: Dispense in a wet film thickness of 15 mils, except at edge which may be 12 mils.
- D. Surface Preparation: Clean and dry roadway surface at the direction of Engineer. Blow or sweep any loose dirt or debris from the roadway.
- E. Temperature Restrictions: Do not apply any type of pavement markings when the temperature is below 40F.
- F. Protection of Painted Surfaces
 - 1. Type I Conventional Traffic Paint: Provide satisfactory protection for center lines, lane lines, edge lines, crosswalks, stop bars, symbols and legends for at least 30 minutes or until paint is dry and track free from vehicular traffic.
 - 2. Type II Low Heat Traffic Paint: Provide satisfactory protection for center lines, lane lines and edge lines until the paint is dry and track free from vehicular traffic.
 - 3. Repaint marked or damages areas as directed by Engineer.
- G. Defective Work: Remove any traffic markings which are incorrectly placed as directed by Engineer.

END OF SECTION

SECTION 32 17 23.33

HOT THERMOPLASTIC PAVEMENT MARKINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. This Work is the furnishing and installation of thermoplastic traffic lines and markings, of the indicated type and color with a surface application of glass beads. Thermoplastic pavement markings shall be used for all stop bars, crosswalks, legends, and arrows.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials used shall be in accordance with Section 960 of PennDOT Publication 408, dated 2011 and the latest supplements thereof. All materials shall be provided from a source listed in Bulletin 15 and conforming to AASHTO M 249.
- B. Glass beads shall conform to Section 1103.14, Type A, of PennDOT Publication 408, dated 2011 and the latest supplements thereof.

PART 3 EXECUTION

3.01 GENERAL

- A. Apply in accordance with applicable 67 Pa Code and PennDOT standards.
- B. Employ traffic control measures in accordance with MUTCD Chapter 6 and PennDOT Publication 213, Work Zone Traffic Control Manual, at all times.
- C. Construction shall be in accordance with PennDOT Publication 111, Traffic Control – Pavement Markings and Signing Standards

3.02 CONSTRUCTION

- A. Application for Hot Thermoplastic:
 - 1. Surface Preparation: For proper adhesion, perform surface preparation of the road surface and provide the pretreatment according to Bulletin 15 or recommended by the manufacturer. Clean the roadway surface where the hot thermoplastic pavement markings will be applied. Remove all surface treatment, laitance, curing compound, or any contaminants that would hinder adhesion. Clear any loose dirt and other debris from the application area. **Surface preparation is incidental to the application of hot thermoplastic pavement markings, except for the removal of any pavement markings as specified by Engineer.** Identify the location of the final pavement markings by applying spots on the pavement at 40-foot intervals. The Owner or Engineer will approve the locations. Apply on dry pavement when the air and roadway temperatures are between 50F and 90F and when the wind speed is less than 20 miles per hour.
 - 2. Thermoplastic: Uniformly apply the markings at a minimum thickness of 90 mils ± 3 mils. A tolerance of ± 1/4 inch from the specified width will be allowed provided the variation is gradual and does not detract from the general appearance. For skip line patterns maintain a tolerance of ± 6 inches for each 40-foot cycle and ± 3 inch for each 10-foot skip line.
 - 3. Glass Beads: Apply glass beads immediately after application of the markings at a minimum rate of 10 pounds per 100 square feet of markings. Uniformly distribute glass beads on the surface. Provide markings with an average minimum initial retroreflectivity of 300 mcd/m²/lux for white and 250 mcd/m²/lux for yellow. Under the direction and supervision of the Representative, measure retroreflectivity with a 30-meter geometry retroreflectometer, conforming to ASTM E-1710 within 21 days after installation in accordance with PTM No. 431.
- B. Protection of Surfaces
 - 1. Provide satisfactory protection for pavement markings for at least 30 minutes or until material has dried sufficiently to prevent dirt pick-up and tracking from vehicular traffic.

2. Defective Markings: Repaint marked or damaged areas as directed by Engineer. Remove any markings placed incorrectly and replace them as directed by Engineer. Repair those markings, which after application and drying, are determined to be defective by Engineer. Complete this work at no additional cost to Owner. Major problem areas and method of repair include the following:
 - (a) Insufficient thickness or line width, uneven cross-section—Prepare defective material by grinding or blast cleaning to remove a substantial amount of beads and the marking surface is roughened. Remove loose particles and debris with compressed air. Restripe the cleaned surface as specified in Sections 960.3(b) and (c).
 - (b) Inadequate retroreflectivity, glass bead coverage or retention—Remove defective markings and clean pavement surface, including 1 foot beyond each end of the affected area. Remove loose particles and debris with compressed air. Restripe the marking on the cleaned surface as specified in Sections 960.3(b) and (c).
3. Guarantee: Where directed, remove and replace material that has not remained within close conformity to location or has not remained effective in performing useful service for a period of 180 days from the date of acceptance. The minimum acceptable service is as follows:
 - (a) Longitudinal Markings. 90% of material remains in each 1,000-foot section of marking where the intersection unit is defined as material on an approach leg within 160 feet of the intersection.
 - (b) Transverse Markings, Legends, and Symbols. 90% of material remains for each individual legend, symbol, crosswalk, or stop line.

END OF SECTION

SECTION 32 17 26.13

ADA DETECTABLE WARNING SURFACE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. This Work is the installation of ADA/PennDOT compliant detectable warning surfaces (DWS) at locations specified in the field and on the drawings.

1.02 SUBMITTALS

- A. Certifications: Submit certifications that all tiles will meet or exceed designated specifications.
- B. Qualifications of Installer:
 - 1. Installer shall have a minimum of five (5) years of experience with tile installations.
 - 2. Installer shall submit for approval, a list of projects similar in nature and size that establishes his/her ability to complete this project. A resume for the project superintendent should be submitted to establish his/her ability to complete the project. If for any reason, the qualifications are not acceptable, work shall not commence until an acceptable installer is found.

PART 2 PRODUCTS

2.01 DETECTABLE WARNING TILES

- A. Detectable warning tiles to be manufactured by a PennDOT Bulletin 15 approved manufacturer.
 - 1. Detectable Warning Surfaces shall be compliant with ADA and PennDOT regulations.
 - 2. Detectable Warning Surfaces shall be of the Polymer Composite type composed of epoxy polymers employing aluminum oxide particles in the truncated domes.
 - 4. Detectable warning surface shall be of the embedded cast-in-place type, Brick Red color.
 - 3. Dimensions: Detectable Warning Surfaces shall be held within the following dimensions and tolerances:
 - Width: 24" nominal
 - Face Thickness: 0.1875 +/- 5% max.
 - Warpage of Edge: 0.5% max.
 - Length: as required to be provided across the full width of the ramp at the grade break near the street edge
- B. Color shall be as directed by Engineer.
- C. Detectable warning surface shall be guaranteed in writing for a period of five years from date of final completion. The guarantee must include defective work, breakage, deformation, and

loosening of tiles.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall be performed according to manufacturer's recommendations.
- B. Tile shall be installed in a manner which does not create a tripping hazard.

3.02 CLEANING AND PROTECTION

- A. Protect tiles against damage during construction period to comply with manufacturer's specification.

END OF SECTION

SECTION 32 31 10

CHAIN LINK FENCING

PART 1 - GENERAL

1.01 SUMMARY

- A. The work required under this section consists of furnishing all labor, materials, equipment, services, and related items necessary to complete all the Chain Link Fencing work as indicated on the drawings and described in the specifications. The work includes, but is not limited to Chain Link Fencing.

1.02 RELATED SECTIONS

- A. Section 31 20 10 - Earthwork

1.03 QUALITY ASSURANCE

- A. Provide chain link fences and gates from a single source including necessary erection accessories, fittings, and fastenings.
- B. Perform work in compliance with applicable requirements of governing authorities having jurisdiction.
- C. All material specified herein shall be full weight and first class in every respect. All fittings necessary to produce a complete installation shall be included even though not specifically mentioned.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for metal fencing, fabric, and accessories.
- B. Shop drawings showing layout, fabrication, assembly, color, and erection details in accordance with the supplementary conditions shall be submitted to the Project Consultant for approval.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Dimensions indicated, for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.
- B. Available Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - 1. Allied Tube and Conduit Corp.
 - 2. American Fence Corp.
 - 3. Anchor Fence, Inc.

2.02 STEEL FABRIC

- A. Fabric: 1-1/4" BLACK & 2" BLACK mesh, with both top and bottom selvages to be knuckled. See drawings for call out of type.
1. Furnish one-piece fabric width.
 2. Fabric Finish (See Drawings for type)
 - a. 6 gauge Galvanized for all surfaces including cut ends, ASTM A 392, Class II, with not less than 2.0 oz. zinc per sq. ft. of surface.
 - b. 6 gauge Aluminum-coated for all surfaces including cut ends, ASTM A491-63T. Weight of coating shall be determined in accordance with current ASTM Specification A 428.
 - c. PVC-coated over galvanized wire: ASTM F 668, Class 2b, 7 mil (0.18 mm) thermally fused polyvinyl chloride in Black and Blue color. ASTM A 641, galvanized steel core wire, tensile strength 75,000 psi (571 MPa), with 9 gauge core wire.
 3. All fabric shall have a tensile strength of 80,000 psi minimum, unless otherwise indicated on the drawings.
 4. Certification of fabric is required.

2.03 FRAMING AND ACCESSORIES

- A. Steel Framework, General (See Drawings for Type):
1. Galvanized steel, ASTM A 120 or A 123, with not less than 1-8 oz. zinc per sq. ft. of surface.
 - a. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.
 2. Materials for aluminum-coated steel chain link fence shall conform to the requirements specified in the AASHTO. Designation M181-60, with the following amendments:
 - a. Aluminum for coating shall conform to the requirements specified therefore in ASTM, Specification A491-63T. Weight of coating shall be determined in accordance with current ASTM, Specification A428.
 3. PVC-Coated finish: In accordance with ASTM F1043, apply supplemental color coating of 10-15 mils (0.254 - 0.38 mm) of thermally fused PVC in Black color to match fabric. In areas where blue fabric is being used, framework will be galvanized steel and not PVC-Coated.
 4. All coatings to be applied inside and out after welding.
- B. Line, End, Corner and Pull Posts: Standard O.D. (as per schedule 40) pipe of nominal diameters shown on Standard Chain Link Fencing Table included at the end of this section.
- C. Top Rail and Bottom Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint.
1. 1 5/8" O.D. pipe, .140" minimum pipe wall thickness; 2.27 lbs. per lin. ft.
- D. Wire Ties: Shall be of nine (9) gauge galvanized steel spaced 1 ft. 2 in. apart on line posts and 2 ft. apart on top, bottom, and middle rails. Each end shall be wrapped around the chain link fabric at least 540 degrees.
- E. Post Tops: Shall be a pressed steel or malleable iron, weather tight, closure cap. Provide one (1) through riveted cap for each tubular post.
- F. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate corner and pull post, except where fabric is integrally woven into post.

- G. Stretcher Bar Bands: Bands shall be 11 gauge spaced not over 14" o.c., to secure stretcher bars to end, corner, pull, and gate posts. Install stretcher bars at vertical edges and at top and bottom edges. Attach stretcher bars to gate frame at not more than 14" o.c.

2.04 PVC COATED ACCESSORIES (Where vinyl-coated fencing specified)

- A. Chain link fence accessories: (ASTM F 626) Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.
- B. Post caps: Formed steel, cast malleable iron, or aluminum alloy weathertight closure cap for tubular posts. For each line post provide tops to permit passage of top rail.
- C. Top rail and brace ends: Pressed steel per ASTM F626, for connection of rail and brace to terminal posts.
- D. Top rail sleeves: 7@ (178 mm) expansion sleeve with spring, allowing for expansion and contraction of top rail.
- E. Wire ties and clips: 10 gauge 0.135@ galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge 0.092@ for rails and braces.
- F. Brace and tension (stretcher bar) bands: Pressed steel. At square post provide tension bar clips.
- G. Tension (stretcher) bars: One piece lengths equal to 2@ (50 mm) less than full height of fabric with a minimum cross-section of 3/16@ x 3/4@ (4.76 mm x 19 mm) or equivalent fiberglass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.
- H. Truss rods & tightener: Steel rods with minimum diameter of 5/16@ (7.9 mm). Capable of withstanding a tension of minimum 2,000 lbs.
- I. Nuts and bolts are galvanized but not vinyl coated.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Coordinate setting of posts with construction activities of other trades.
- B. Line Posts: Posts shall be spaced not more than eight (8) feet on centers in line of fence. They shall be plumb with tops properly aligned, and embedded securely in concrete foundations as shown on drawings.
- C. End, Corner and Pull Posts: Provide terminal post at each termination and change in horizontal or vertical direction of 30 degrees or more. All posts shall be plumb with tops properly aligned, and embedded securely in concrete foundations as shown on drawings.
- D. Post Footings:
 - 1. Drill holes in firm, undisturbed or compact soil. Gate post footings shall have a diameter not less than 12" in diameter. Holes shall have a depth approximately 6" deeper than post bottom. Excavate deeper, as required, for adequate support in soft and loose soils and heavy lateral loads.

2. Place concrete around posts in a continuous pour. Trowel finish tops of footings and slope or dome to direct water away from posts.
- E. Stretcher Bars: Provide one stretcher bar for each corner and end post. Thread tension bar through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.
- F. Top Rails: Run rails continuously through post caps. Provide expansion couplings as recommended by fencing manufacturer.
- G. Bottom Rails: Attach to line or end posts with galvanized steel boulevard clamps.
- H. Fabric:
1. Fabric shall be tied in such a manner as to be flush with the top of the top rails and the bottom of the bottom rails. The bottom rails shall be installed two inches above finish grade. Pull fabric taut and tie to posts, rails, and tension wires. Fabric shall be pulled tight in accordance with standard practice using "come along" or other approved method.
 2. Where fencing encloses court game areas such as tennis or basketball, the fabric shall be installed on the inside, facing the court game area. In all other areas, unless otherwise indicated on the drawings or directed by the Project Consultant, the fabric shall be installed on the outside.
- I. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing:
1. Tie fabric to line posts, with wire ties spaced 14" o.c.
 2. Tie fabric to rails and braces, with wire ties spaced 24".
- J. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- K. Cleaning Up: The contractor shall remove from the vicinity of the completed work all unused material and debris of any nature.
- L. Handling: Care shall be taken when handling and installing fence materials to avoid damage to materials. Any materials damaged shall be rejected from use in the finished installation.

END OF SECTION

SECTION 32 31 19

ORNAMENTAL FENCES AND GATES

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of This Section Includes:

1. Furnish and install ornamental aluminum fencing in accordance with the requirements of this Section and where shown on the Drawings.

1.02 RELATED SECTIONS

A. Related Work Specified Elsewhere:

1. Section 03 30 00: Cast-In-Place Concrete

1.03 SUBMITTALS

A. Manufacturers Literature:

1. Submit manufacturer's descriptive literature for the following items in accordance with Section 01 33 00:
 - Railing (rails & parts)
 - Fittings, splices, reinforcements and accessories
 - Mounting devices and attachments

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements set forth in Section 01 60 00 of these specifications relative to transportation and handling along with storage and protection.

B. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces. Exercise care when off-loading material to prevent damage.

C. Storage on site

1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way which will prevent bending.
2. Store aluminum, components and materials in clean, dry location, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that will permit circulation of air inside the covering.

D. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of materials.

E. In the event of any damage to the material, however slight, Contractor shall notify the Resident Project Representative at once and shall repair or replace the material in a manner satisfactory to Engineer.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. The fencing system shall be Commercial Strength Aluminum Ornamental Fence, with a picket length of 48" as manufactured by Stephens Pipe & Steel, or approved equivalent. The color of the fence shall be Black.

2.02 MATERIALS

- A. Aluminum Extrusions: All posts and rails used in the fence system shall be extruded from HS-35™ aluminum alloy having a minimum yield strength of 35,000 psi, or approved equivalent. All pickets shall have a minimum yield strength of 25,000 psi. 6063-T5 alloy is not acceptable for any components.
- B. Fasteners: All fasteners shall be stainless steel. Square drive screws shall be used to connect the pickets to the horizontal rails. Rail to post connections shall be made using self-drilling hex-head screws.
- C. Accessories: Aluminum sand and die castings shall be used for all scrolls, post caps, finials, and miscellaneous hardware. All castings shall be products of the USA. Only stainless steel fasteners may be used with these accessories.

2.03 FINISH

- A. Pretreatment: A three stage non-chrome pre-treatment shall be applied. The first step shall be a chemical cleaning followed by a water rinse. The final stage shall be a dry-in-place activator which produces a uniform chemical conversion coating for superior adhesion.
- B. Coating: Fence materials shall be coated with FencCoat™, a TGIC polyester power-coat finish system, or approved equivalent. Epoxy powder coatings, baked enamel or acrylic paint finishes shall be not acceptable. The finish shall have a finished thickness of at least 2.0 mils. In addition, the screw heads shall be painted to match the color of the fence.
- C. Tests: The cured finish shall meet the following:
 - 1. Humidity resistance of 3,000 hours using ASTM D2247.
 - 2. Salt spray resistance of 3,000 hours using ASTM B117.
 - 3. Accelerated weathering for 1,000 hours under Method 6152 of Federal Test Method 141 shall show no adhesion loss, with only slight fading, chalking and water staining.
 - 4. Outdoor weathering shall show no adhesion loss, checking or crazing, with only slight fade and chalk when exposed for 3 years in Florida facing south at a 45 degree angle.
 - 5. Minimum hardness of 2H using ASTM D3363.

2.04 INSTALLATION

- A. Horizontal rails shall be 1 $\frac{5}{8}$ " channels formed in a modified "U" shape. Pickets shall pass through holes punched in the top of the rail. The top wall shall be .70" thick and the side walls .100" thick for superior vertical load strength. There shall be 3 horizontal rails in each section.
- B. Pickets shall be fastened to the rails using painted stainless steel screws. Screws shall be used on only one side of the rail, leaving the other side with a clean appearance. Pickets shall be 1" square and have a wall thickness of .062". Welding the pickets to the rails is not permitted.

- C. Posts shall be 2½" square extrusions with pre-punched holes which allow the fence section rails to slide in. Posts shall be spaced 71½" on center and have .075" walls. Gate posts shall be 4" square with .125" walls and used on both sides of a gate. Cast aluminum caps shall be provided with all posts.
- D. Assembled sections shall support a 1500 lb. Vertical load at the midpoint of any horizontal rail.

2.05 WARRANTY

The entire fence system shall have a written Limited Lifetime Warranty against rust and defects in workmanship and materials. In addition, the finish shall be warranted not to crack, chip, peel or blister for the same period.

END OF SECTION

SECTION 32 92 00

FINISH GRADING, SEEDING, AND SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work Of This Section Includes, but is not limited to:
1. Placing topsoil
 2. Soil conditioning
 3. Finish grading
 4. Seeding
 5. Sodding
 6. Maintenance
- B. Restore unpaved surfaces to a condition similar to that prior to excavation as specified and indicated on the Drawings.
- C. The "Seeding Restoration Table" at the end of this section lists specific seeding restoration requirements. Refer to Drawings for seeding restoration requirements at each specific location of Work.
- D. Related Work Specified Elsewhere:
1. Section 01 57 13: Soil Erosion and Sediment Control

1.02 QUALITY ASSURANCE

- A. Testing Agency:
1. The Contractor has the option to use soil testing to justify decreasing lime and fertilizer rates. When soil testing is selected by the Contractor, the soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Engineer.
 - a. Collect soil samples under the direction of the Resident Project Representative.
- B. Reference Standards:
1. Pennsylvania Department of Transportation
Publication 408 Specifications
 2. Pennsylvania Seed Act of 1965, Act 187, as amended.
 3. Agricultural Liming Materials Act of 1978, P.L. 15, No. 9 (3P.S. 132-1), as amended.
 4. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3P.S.68.2), as amended.'
 5. Rules for Testing Seeds of the Association of Official Seed Analysts.

1.03 SUBMITTALS

- A. Certificates:
1. Prior to use or placement of material, submit certifications of material composition of the following for approval:
 - a. Topsoil analysis
 - b. Fertilizer
 - c. Lime
 - d. Seed mixture(s)
 2. If soil tests are performed to justify decreased liming and fertilizer rates, submit certified soil

sample analyses, including laboratory's recommend soil supplement formulation.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Seed:

1. Deliver seed fully tagged and in separate packages according to species or seed mix. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

B. Sod:

1. Mow sod in the field to a height of not more than 2-1/2" within 5 days prior to lifting.
2. Cut sod to a depth equal to the growth of the fibrous roots, but in no case less than 1-1/2", exclusive of grass and thatch. Do not cut sod when the ground temperature is below 32 degrees Fahrenheit.
3. Deliver sod to the project site within 24 hours after being cut and place sod within 36 hours after being cut. Do not deliver small, irregular, or broken pieces of sod.
4. During wet weather, allow sod to dry sufficiently to prevent tearing during handling and placing. During dry weather, moisten sod to ensure its vitality and to prevent dropping of the soil during handling. Sod which dries out will be rejected.

C. Other Requirements:

1. Section 01 60 00, also addresses Storage and Protection of Materials and Equipment.

PART 2 - PRODUCTS

2.01 TOPSOIL

- A. Having a pH of between 6.0 and 7.0; containing not less than 2% nor more than 10% organic matter as determined by AASHTO T194.
- B. Fertile friable loam, sand loam, or clay loam which will hold a ball when squeezed with the hand, but which will crumble shortly after being released.
- C. Free of clods, grass, roots, or other debris harmful to plant growth.
- D. Free of pests, pest larvae, and matter toxic to plants.

2.02 FERTILIZER

A. Basic Dry Formulation Fertilizer:

1. Analysis 0-20-20 and as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.

B. Starter Fertilizer:

1. Analysis 10-5-5 or 12-6-6 and as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Law.

2.03 LIME

- A. Raw ground limestone conforming to Section 804.2(a), Publication 408 Specifications.

2.04 SEED

- A. Fresh, clean, dated material from the last available crop and within the date period specified, with a date of test not more than 9 months prior to the date of sowing. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance. All seeds will be subject to analysis and testing.

2.05 SEED MIXTURES

- A. See "Seeding Restoration Table" at end of this Section.

2.06 INOCULANT

- A. Inoculate leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species.
- B. Do not use inoculant later than the date indicated by the manufacturer.
- C. Protect inoculated seed from prolonged exposure to sunlight prior to sowing.
- D. Reinoculate seed not sown within 24 hours following initial inoculation.

2.07 MULCHING MATERIALS

- A. Mulches for seeded areas shall be one, or a combination of, the following:

- 1. Hay:

- a. Cured to less than 20% moisture content by weight.
- b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
- c. Timothy hay or mixed clover and timothy hay.

- 2. Straw:

- a. Cured to less than 20% moisture content by weight.
- b. Contain no stems of tobacco, soybeans, or other coarse or woody material.
- c. Wheat or oat straw.

- 3. Wood Cellulose:

- a. No growth or germination inhibiting substances.
- b. Green, air dried. Packages not exceeding 100 pounds.
- c. Requirements:
 - Moisture content: $12\% \pm 3\%$
 - Organic Matter: $98.6\% \pm 0.2\%$ on the oven dry basis.
 - Ash Content: $1.4\% \pm 0.2\%$
 - Minimum Water-Holding Capacity: 1,000%

- 4. Mushroom Manure:

- a. Organic origin, free of foreign material larger than 2" and substances toxic to plant growth.
- b. Organic Matter: 20% minimum
- c. Water-Holding Capacity: 120% minimum
- d. pH: 6.0

2.08 SOD

- A. At least three year old, well-rooted Kentucky Bluegrass (*Poa pratensis*) sod containing a growth of not more than 10% of other grasses and clovers.
- B. Free from noxious weeds such as bermuda grass, wild mustard, crab grass, and kindred grasses.

3. Incorporate as part of tillage operation.

D. Liming and Fertilizer rates may be decreased if lesser rates are indicated by soil tests provided by the Contractor.

3.05 FINISH GRADING

A. Remove unsuitable material larger than 2" in any dimension.

B. Uniformly grade surface to the required contours without the formation of water pockets.

C. Rework areas which puddle by the addition of topsoil and fertilizer. Re-rake.

D. Distribute starter fertilizer at the following rates:

10-5-5: 10 pounds per 1,000 square feet.

12-6-6: 10 pounds per 1,000 square feet.

E. Incorporate starter fertilizer into the upper 1" of soil.

3.06 SEEDING

A. See Drawings for seeding restoration at each specific location of Work; otherwise, use Formula B for sunny areas and Formula D for shady areas.

B. Uniformly sow specified seed mix at the rate noted in the Seeding Restoration Table by use of approved hydraulic seeder, power-drawn drill, power-operated seeder, or hand-operated seeder or by hand. Do not seed when winds are over 15 mph.

C. Upon completion of sowing, cover seed to an average depth of 1/4" by hand re-raking or approved mechanical methods.

3.07 MULCHING

A. Mulch within 48 hours of seeding.

B. Place hay and straw mulch in a continuous blanket at a minimum rate of 135 pounds per 1,000 square feet.

1. Anchor hay or straw mulch by use of twine, stakes, wire staples, paper, or plastic nets.

2. Emulsified asphalt may be used for anchorage provided it is applied uniformly at a rate not less than 31 gallons per 1,000 square yards.

3. Apply approved chemical mulch binders at the manufacturer's recommended rate.

C. Chemical mulch binders or a light covering of topsoil may be used for anchorage when the size of the area precludes the use of mechanical equipment.

D. Apply wood cellulose fiber hydraulically at a rate of 35 pounds per 1,000 square feet.

1. Incorporate as an integral part of the slurry after seed and soil supplements are thoroughly mixed.

E. Spread mushroom manure uniformly to a minimum depth of 1/2" or to the depth indicated on the Drawings.

F. When mulch is applied to grass areas by blowing equipment, the use of cutters in the equipment will be permitted to the extent that a minimum of 95% of the mulch is 6" or more in length. For cut mulches applied by the blowing method, achieve a loose depth in place of not less than 2".

G. When mulching by the asphalt mix method, apply the mulch by blowing. Spray the asphalt binder material into the mulch as it leaves the blower. Apply the binder to the mulch in the proportion of 1.5 to 2.0 gallons per 45 pounds of mulch.

1. Protect structures, pavements, curbs, and walls to prevent asphalt staining.
2. Erect warning signs and barricades at intervals of 50 feet or less along the perimeter of the mulched area.
3. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.

3.08 SODDING

- A. Prior to sod placement, complete soil preparation or topsoiling.
- B. Apply lime and fertilizer as specified. Work into the soil a minimum of 2".
- C. Do not place sod when the temperature is lower than 32 degrees Fahrenheit.
- D. Place sod by hand with tight joints and no overlap. Transverse joints shall be broken or staggered.
- E. Place sod so that the top of the sod is flush with the surrounding grade.
- F. Use of tools which damage the sod or dumping of sod from vehicles will not be permitted.
- G. Water sod to the saturation point immediately after placement.
- H. After watering, tamp with an approved tamper to close all joints and insure close contact between sod and sod bed. After tamping, the sod shall present a smooth, even surface free from bumps and depressions. If so directed, use a light roller, weighing not more than 65 pounds per foot of roller width to complete firming and smoothing the sod.
- I. When placing sod in ditches, place the strip with the long dimension at right angles to the flow of water. At any point where water will start flowing over a sodded area, the upper edge of the sod strips shall be turned into the soil below the adjacent area and a layer of compacted earth placed over this juncture to conduct the water over the edge of the sod.
- J. In ditches and on slope areas, stake each strip of sod securely with at least 1 wood stake for each 2 square feet of sod. Stakes shall be 1/2" by 1" with a length of 8" to 12". Drive stakes flush with the top of the sod, with the long face parallel to the slope contour.

3.09 MAINTENANCE

- A. Maintenance includes watering, weeding, cleanup, edging and repair of depressions, washouts or gullies.
- B. Those areas which do not show a prompt catch of grass within 14 days of seeding or sodding shall be reseeded or resodded until complete grass catch occurs.

NOTE: SEEDING RESTORATION TABLE IS ATTACHED AT END OF THIS SECTION.

END OF SECTION

SEEDING RESTORATION TABLE per PennDOT Pub. 408, Section 804

FORMULA AND SPECIES	% BY WEIGHT	MINIMUM %		MAX % WEED SEED	SEEDING RATE: LBS PER 1000 SY
		PURITY	GERMINATION		
<u>Formula B – Residential Mix</u>					<u>Total 42.0</u>
* Perennial Ryegrass Mixture (<i>Lolium perenne</i>) A combination of improved, certified varieties with no one variety exceeding 50% of the total ryegrass component	20	97	90	0.10	8.5
* Creeping Red Fescue or Chewings Fescue	30	97	85	0.10	12.5
* Kentucky Bluegrass Mixture (<i>Poa pratensis</i>) A combination of improved, certified varieties with no one variety exceeding 50% of the total bluegrass component	50	97	80	0.15	21.0
<u>Formula T – Temporary seed</u>					
* Oats (<i>Avena sativa</i>) Spring	100	97	85	0.10	6.0
* Cereal Rye (<i>Secale cereale</i>) Fall	100	97	85	0.10	6.0
<u>Formula L – Clear Zone Mix</u>					<u>Total 48.0</u>
* Hard Fescue Mixture (<i>Festuca longifolia</i>) A combination of improved, certified varieties with no one variety exceeding 50% of the total hard fescue component	55	97	85	0.10	26.4
* Creeping Red Fescue (<i>Festuca rubra</i>)	35	97	85	0.10	16.8
* Annual Ryegrass (<i>Lolium multiflorum</i>)	10	95	90	0.10	4.8
<u>Formula C – Conservation Mix (slopes)</u>					<u>Total 12.0</u>
* Oats (<i>Avena sativa</i>) Spring nursery crop	50	95	90	0.10	6.0
* Cereal Rye (<i>Secale cereale</i>) Fall nursery crop	50	95	90	0.10	6.0
Permanent Seed:					
* Little Bluestem (<i>Schizachyrium scoparium</i>)	10	80	70	0.20	1.2
* Showy Tick-trefoil (<i>Desmodium canadense</i>)	7.5	-	-	-	0.9
* Partridge Pea (<i>Chamaecrista fasciculata, syn. Cassia fasciculata</i>)	13.33	-	-	-	1.6
* Smooth Blue Aster (<i>Symphyotrichum laeva</i>)	0.5	-	-	-	0.06
* Black-eyed Susan (<i>Rudbeckia hirta</i>)	3.67	80	60	0.20	0.44
* Purple Top (<i>Tridens flavus</i>)	2	-	-	-	0.24
* Big Bluestem (<i>Andropogon gerardii</i>)	10	-	-	-	1.2
* Canada Wildrye (<i>Elymus canadensis</i>)	3	85	70	0.20	0.36

SECTION 32 93 00

LANDSCAPING

PART 1 - GENERAL

1.01 SECTION INCLUDES:

- A. Preparation of soil, placement of plants, ground cover, seed, sod, and fertilizer.

1.02 RELATED SECTIONS:

- A. Related Work Specified Elsewhere:

1. Section 01 57 13: Soil Erosion and Sediment Control
2. Section 31 11 00: Clearing and Grubbing
3. Section 31 20 00: Earthwork
4. Section 31 23 33: Excavation, Backfill and Compaction

1.03 QUALITY CONTROL

- A. Nursery: Company specializing in growing and cultivating the plant material specified in this Section.
- B. Sod Producer: Company specializing in sod production and certified by the State of Pennsylvania.
- C. Maintenance Services: Performed by Contractor or his agent (e.g., landscape subcontractor) unless otherwise specified.
- D. Reference Standards:
1. Pennsylvania Department of Transportation, Publication 408 Specifications
 2. Pennsylvania Soil Conditioner and Plant Growth Substance Law, Act of December 1, 1977, P.L. 258, No. 86 (3P.S.68.2), as amended.

1.04 WARRANTY

- A. Plant Material: Provide 18 month guarantee for plant material.

Plants replaced under the terms of the guarantee shall be of same size and species as originally specified, planted in the next growing season, with a new warranty commencing on date of replacement.

- B. Seeded or Sodded Areas: Reseed and/or replace sod as required until grass is well established and exhibits a vigorous growing condition provided Owner provides reasonable maintenance following completion and acceptance of the Work.

1.05 MAINTENANCE SERVICE

- A. Contractor shall be responsible for the maintenance of seeded areas, sodded areas, and plant material until completion and acceptance of the Work by Owner.

PART 2 - PRODUCTS

2.01 GRASS

A. Seed Mixture:

1. Permanent: Utilize Formula B as set forth in the "Seeding Restoration Table" at the end of this Section.
2. Permanent on Steep Slopes: Utilize low maintenance mix consisting of the following seed mixture applied on locations in accordance with the Drawings at a rate of 36-45 lbs per 1000 square yards.

<u>Species</u>	<u>% of Weight</u>
Nordic Hard Fescue	40
Azure Blue Fescue	30
Salem Creeping Red Fescue	30

3. Wetlands: Utilize the following seed mixture on disturbed wetlands areas applied at a rate of 30 lbs per 1000 square yards.

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

4. Temporary Stabilization: Utilize Formula T as set forth in the "Seeding Restoration Table" at the end of this Section.

- B. Sod: ASPA/Pennsylvania certified, nursery grown cultivated grass sod; with strong fibrous root system. Sod mixture shall be specified as being hardy for the region of installation.

2.02 TREES, PLANTS, AND GROUND COVER

- A. Landscape Plant Material and Ground Cover: Plant material specified on plant list indicated on Drawings shall be symmetrical in growth, true to species, variety and size, nursery grown in climatic conditions similar to region of installation and be free of any pests or disease.
- B. Quality and size of plants, spread of roots and size of balls shall be in accordance with ANSI Z80 (revised 1980), "American Standard for Nursery Stock", as published by the American Association of Nurserymen, Inc.

2.03 SOIL AND SOIL ENHANCEMENT MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, free of subsoil, clay or impurities, plants, weeds and roots or other foreign materials.
- B. Fertilizer:
 1. Basic Fertilizer: Analysis 10-20-20 as defined by the Pennsylvania Soil Conditioner and Plant Growth Substance Act.
- C. Lime: Raw ground limestone conforming to Section 804.2(a), Publication 408 Specifications.

2.04 ORGANIC SOIL AMENDMENT MATERIALS

- A. Compost: A mixture of partially decomposed organic materials (chipped, shredded, or ground vegetation or waste or recycled wood products), mushroom soil/spent mushroom soil substrate (SMS), composted animal manure, or exceptional quality (Class A) composted biosolids.
- B. Compost shall be processed or completed to reduce weed seeds, pathogens, and deleterious material, and shall not contain paint, petroleum products, herbicides, fungicides, or other chemical residues that would be harmful to plant or animal life. Other deleterious material, plastic, glass, metal, or rocks shall not exceed 0.1 percent by weight or volume.
- C. Compost produced from biosolids (sewage/wastewater sludge) shall be "Class A Grade" (exceptional quality) and meet US EPA's 40 CFR Part 503 regulations.
- D. Compost shall meet the following analysis:
 - 1. Organic Matter Content: On dry weight basis, 40 to 75 percent.
 - 2. Nitrogen Content: 1 to 2.5 percent.
 - 3. Phosphorus Content: 1 to 2 percent.
 - 4. Potassium Content: 0.5 to 1.5 percent.
 - 5. Carbon – Nitrogen Ratio: 12 to 25:1
 - 6. Moisture Content: 40 to 60 percent.
 - 7. Moisture Absorption: 100 percent (Dry Weight Basis) Minimum.
 - 8. pH: 6.0 to 8.0.
 - 9. Bulk Density: 800 to 1,000 lbs. per cubic yard.
 - 10. Soluble Salt Content: 5 dS (mmhos/cm) or less.
 - 11. Trace Elements: Meet US EPA 40 CFR Part 503 requirements.
 - 12. Particle Size: Must pass 1 inch sieve or smaller.
 - 13. Stability Rating: Stable.

2.05 PLANTING SOIL MIXTURE

- Groundcover, Perennial, & Ornamental Grass Planting Holes/Beds: Install planting soil as described in Part 3.
 - 2 Parts topsoil as specified.
 - 1 Part selected organic soil amendment.

2.06 ACCESSORIES

- A. Wood Pegs: Softwood, sufficient size and length to ensure anchorage of sod on slope.
- B. Mesh: Interwoven plastic.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
 - 1. Contractor shall be responsible for planting at correct grades and alignment.
 - 2. Contractor shall report any soil or drainage conditions considered detrimental to the

growth of the plant material.

- B. Scarify subsoil to a depth of 3 inches.

3.02 PLACING TOPSOIL & TILLAGE

- A. Spread topsoil to a minimum depth of 6 inches to obtain the required grade elevation.
- B. Apply lime at a rate of 275 pounds per 1,000 square feet or as required by a soils test at various locations on the site.
- C. Apply basic fertilizer in according with manufacturer's instructions at an application rate of 23 pounds per 1,000 square feet.
- D. Thoroughly loosen soil and incorporate lime and basic fertilizer to a minimum depth of 4 inches by discing, harrowing or other approved method.

3.03 FINISH GRADING

- A. Hand rake topsoil and remove all unsuitable materials including rocks and debris.
- B. Uniformly grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.04 SEEDING

- A. Apply seed within the following time periods unless otherwise directed by Engineer.

- Formula B, D, and L - March 15 to June 1
 August 1 to October 15
- Formula E - March 15 to October 15
- Formula W and - April 1 to June 15
 Wetland Seed Mixture August 16 to September 15
- Steep Slope Seed -March 15 to May 15
 Mixture September 1 to October 15

Formula E (Annual ryegrass) to be utilized for temporary stabilization of areas disturbed by construction may be applied anytime.

- B. Seeding Rates:

1. Permanent: Apply seed or hydroseed with a seed slurry evenly in two intersecting directions at the rate noted in the Seeding Restoration Table unless an alternate seeding rate appropriate for site conditions is approved by Engineer.
2. Temporary Stabilization: Apply seed or hydroseed with a seed slurry at the rate noted in the Seeding Restoration Table.

- C. Immediately following permanent or temporary seeding, apply agricultural mulch at a minimum rate of 3 tons/acre (135 lbs. per 1000 sq. ft.). Steep slopes to be seeded with a low maintenance mix shall be hydroseeded or provided with erosion control mat or netting.

- D. Apply water with a fine spray immediately after each area has been mulched.

3.05 LAYING SOD

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod within 24 hours after harvesting with tight staggered joints.
- C. On slopes 1:2 and steeper, place mesh over top soil, lay sod perpendicular to slope and secure every row with wooden pegs.
- D. Water sodded areas immediately after placement.

3.06 PLANTING

- A. Insofar as it is practicable, plant materials shall be planted on the day of delivery. In the event this is not possible, Contractor shall protect stock not planted. Plants shall not remain unplanted for longer than a three (3) day period after delivery.
- B. Set plants in pits or beds, partly filled with prepared backfill soil mixture.
- C. All plants shall be planted in topsoil that is thoroughly watered and tamped as backfilling progresses. Nothing but suitable topsoil, free of dry sod, stiff clay, litter, etc., shall be used for planting.
- D. Planting operations shall be performed during periods within the planting season when weather and soil conditions are suitable and in accordance with accepted local practice.
- E. Set all plants plumb and straight. Set at such a level that after settlement, a normal or natural relationship to the crown of the plant with the ground surface will be established. Locate plant in the center of the planting pit.
- F. Each tree and shrub shall be pruned in accordance with standard horticultural practice to preserve natural character of the plant. Pruning shall be done with clean, sharp tools.
- G. Contractor shall verify location of all utilities prior to placement of landscape material. Contractor shall not place landscaping material on top of utility piping.

3.07 MAINTENANCE OF NEWLY SEEDED AND SODDED AREAS

- A. Maintenance of grass areas shall consist of watering, mowing, weeding, re-seeding and/or re-sodding, edging and repair of depressions, washouts or gullies as necessary to obtain an stabilized lawn area. Maintenance shall continue until Owner's Representative accepts the project.
- B. In the absence of rainfall, during the first week of seed or sod installation, watering shall be performed daily by the Contractor or as often as deemed necessary by the Owner's Representative. Water must be in sufficient quantities to maintain moist soil to a depth of 4 inches. The total shall be equal to the equivalent of at least 1 inch of water per week. Watering shall continue until the stabilized lawn area is accepted. For seeded areas, bare spots, which persist after three weeks of favorable growing weather, shall be re-cultivated, re-seeded, raked and rolled. Re-seeding of bare spots shall be done as many times as necessary until an acceptable stabilized lawn area is established. For sodded areas, bare spots shall be re-sodded until deemed acceptable. If the turf stand is not accepted by the following seeding and sod season, the Contractor shall re-seed or sod and fertilize, as necessary, the unaccepted areas at no additional charge to the Owner.
 - 1. If lawn area provides between 40% and 90% ground coverage, overseed and fertilize using half of the rates originally applied.

2. If lawn area provides less than 40% coverage, reestablish stand following original rates and procedures.
- C. Flooded, washed-out, rilled or otherwise damaged or defective areas of seeding, sod, mulch, grade, swales or berms shall be reconstructed and all grades re-established in accordance with the grade plans or other specifications or when, in the judgment of the Owner's Representative, such defects or damages are the result of poor workmanship, or failure to meet the requirements of the specifications.
 - D. All mowing shall be the Contractor's responsibility until final acceptance of the project. No mowing shall remove more than one-third of the grass blade length. Heavy mowing, resulting in grass piles shall be "double mowed" or the Contractor shall remove piles. Height of the grass shall be maintained between two and a half and three inches, unless otherwise specified.
 - E. Following are some examples of delays in final acceptance of a project:
 1. Improper Grades:
 - a. Low or high spots on flat or fairly level areas.
 - b. Improper drainage such as, swales, low areas, rip-rapped outlets and paved areas.
 - c. Washed out or rilled areas.
 - d. Exposed debris.
 2. Turf Grass Conditions:
 - a. Poor or thin stand; improper application of sod, dead grass or sod; use of seed mixtures or sod, other than approved in specifications.
 - b. Improper fertilizer application - Uneven spreading, insufficient amounts, and failure to re-fertilize during extended acceptance.
 - c. Persistent weeds established in turf areas.
 - F. Seeded areas shall be maintained by the Contractor until fully established and accepted by the Owner. Fully established grass areas shall meet the specification for 'stabilized lawn area' as noted on the Drawings.

3.08 SCHEDULE - SEED FORMULA

- A. See Section 2.01 and Drawings for seeding restoration requirements at each specific location of Work; otherwise use Formula B for sunny areas and Formula D for shady areas.

3.09 SCHEDULE - SOD

- A. See Drawings for areas where sod is to be utilized.

3.10 SCHEDULE - PLANT LIST

- A. See Schedule on Drawings listing type of various plant life, if applicable to be planted at locations shown on Drawings.
- B. All landscaping not indicated "to be removed" on the Drawings that is damaged or destroyed shall be replaced "in-kind" by Contractor.

NOTE: SEEDING RESTORATION TABLE IS ATTACHED AT END OF THIS SECTION.

END OF SECTION

SEEDING RESTORATION TABLE per PennDOT Pub. 408, Section 804

FORMULA AND SPECIES	% BY WEIGHT	MINIMUM %		MAX % WEED SEED	SEEDING RATE: LBS PER 1000 SY
		PURITY	GERMINATION		
<u>Formula B – Residential Mix</u>					<u>Total 42.0</u>
* Perennial Ryegrass Mixture (<i>Lolium perenne</i>) A combination of improved, certified varieties with no one variety exceeding 50% of the total ryegrass component	20	97	90	0.10	8.5
* Creeping Red Fescue or Chewings Fescue	30	97	85	0.10	12.5
* Kentucky Bluegrass Mixture (<i>Poa pratensis</i>) A combination of improved, certified varieties with no one variety exceeding 50% of the total bluegrass component	50	97	80	0.15	21.0
<u>Formula T – Temporary seed</u>					
* Oats (<i>Avena sativa</i>) Spring	100	97	85	0.10	6.0
* Cereal Rye (<i>Secale cereale</i>) Fall	100	97	85	0.10	6.0
<u>Formula L – Clear Zone Mix</u>					<u>Total 48.0</u>
* Hard Fescue Mixture (<i>Festuca longifolia</i>) A combination of improved, certified varieties with no one variety exceeding 50% of the total hard fescue component	55	97	85	0.10	26.4
* Creeping Red Fescue (<i>Festuca rubra</i>)	35	97	85	0.10	16.8
* Annual Ryegrass (<i>Lolium multiflorum</i>)	10	95	90	0.10	4.8
<u>Formula C – Conservation Mix (slopes)</u>					<u>Total 12.0</u>
* Oats (<i>Avena sativa</i>) Spring nursery crop	50	95	90	0.10	6.0
* Cereal Rye (<i>Secale cereale</i>) Fall nursery crop	50	95	90	0.10	6.0
Permanent Seed:					
* Little Bluestem (<i>Schizachyrium scoparium</i>)	10	80	70	0.20	1.2
* Showy Tick-trefoil (<i>Desmodium canadense</i>)	7.5	-	-	-	0.9
* Partridge Pea (<i>Chamaecrista fasciculata, syn. Cassia fasciculata</i>)	13.33	-	-	-	1.6
* Smooth Blue Aster (<i>Symphyotrichum laeva</i>)	0.5	-	-	-	0.06
* Black-eyed Susan (<i>Rudbeckia hirta</i>)	3.67	80	60	0.20	0.44
* Purple Top (<i>Tridens flavus</i>)	2	-	-	-	0.24
* Big Bluestem (<i>Andropogon gerardii</i>)	10	-	-	-	1.2
* Canada Wildrye (<i>Elymus canadensis</i>)	3	85	70	0.20	0.36

SECTION 32 93 02

EXTERIOR PLANTING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK:

- A. The planting of trees, shrubs, ground covers, perennials, and ornamental grasses, with planting soil, topsoil, soil amendments, fertilizer, mulch, planting accessories and maintenance.

1.02 RELATED SECTIONS

- A. Applicable Sections of Division 01.
- B. Section 02220: Excavation, Backfill and Compaction.
- C. Section 02930: Finish Grading, Seeding, and Sodding.

1.03 DEFINITIONS

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Ground Ivy, Perennial Sorrel, and Brome Grass.
- B. Plants: Living trees, plants, and ground cover specified in this Section.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit instructions for continuing Borough maintenance under provisions of Section 01 70 00.
- B. Include cutting and trimming methods; types, application frequency and recommended coverage of fertilizer, mulching frequency, etc.

1.05 QUALITY ASSURANCE

- A. Nursery: Company specializing in growing and cultivating the plants specified in this Section with minimum six (6) years experience.
- B. Installer: Company specializing in installing and planting the plants specified in this Section with minimum six (6) years experience.
- C. Plant Materials: Free of disease or hazardous insects.

1.06 REGULATORY REQUIREMENTS

- A. Comply with Local, State or Federal Codes.
- B. Comply with regulatory agencies for fertilizer and herbicide composition.

C. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. American National Standards Institute (ANSI):
 - a. Z60.1 - American Standards for Nursery Stock
 - b. A300 – Standards for Tree Care Operations
2. United States Department of Agriculture (USDA)
 - a. Plant Hardiness Zone Map

1.07 HARVESTING, DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Section 01 60 00.
- B. Store and protect products under provisions of Section 01 60 00.
- C. For balled and burlapped and bare root plant material dig plants in a manner to retain as many fibrous roots as possible. Spray trunks, twigs and foliage at the nursery with anti-desiccant in accordance with manufacturer's written recommendation.
- D. Ball and burlap all plants, unless otherwise indicated, with firm natural ball of soil of sufficient breadth and depth to include roots. Minimum acceptable ball size shall be in accordance to sizes set forth in ANSI Z60.1 – American Standard For Nursery Stock for type and size indicated. Burlap and rope entire earth ball. Plants with mushy, badly cracked or frozen earth balls shall not be acceptable.
- E. Container grown stock shall be grown in specified container long enough for root system to have developed sufficiently to hold soil together.
- F. Prevent injury to plant material when digging, moving, transporting, and unloading.
- G. Handle all balled and burlapped plants from root ball only.
- H. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- I. During transport protect plants from wind by wrapping with plastic or tarpaulins.
- J. Vehicles shall be adequately ventilated to prevent overheating of plants.
- K. Protect plants until planted. Protection includes, but is not limited to:
 1. Protecting plant stems and trunks from damage and/or injury.
 2. During harvesting, transport, and planting processes the plant stem and trunks shall be wrapped with a pervious protective cover. The protective cover shall be removed once the plant is installed and complete. Plants with injured stems will not be accepted.
 3. Protecting plant branches from damage and/or injury.
 4. Protecting plants from injury due to wind burn.
 5. Protecting plants from drying out, plants and root balls shall be kept moist.

- L. Deliver plant materials immediately prior to placement. Keep plant ball moist. Notify Design Professional at least three (3) working days in advance of start of Work.

The Landscape Architect reserves the right to reject plant materials not meeting the above requirements.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Do not install plants during freezing weather or when the ground is frozen.
- B. Do not install plants during excessively wet conditions.
- C. Do not install plants when wind velocity exceeds 30 mph.
- D. Plants shall not be placed on any day in which temperatures are forecast to exceed 90 degrees unless the LANDSCAPE ARCHITECT approves otherwise.

1.09 SEQUENCING AND SCHEDULING

- A. Coordinate and schedule work with other contractors and with the municipality.
- B. Comply with planting periods as specified in this specification.
- C. Notify ENGINEER and LANDSCAPE ARCHITECT at least three (3) business days in advance of start of Work.

1.10 WARRANTY

- A. Provide a warranty on work of this Section for eighteen (18) months. Commence warranty on date when work is accepted by OWNER.
- B. Warranty: Include coverage of plants from death or unhealthy conditions.
- C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.11 MAINTENANCE SERVICE

- A. Maintenance Services: Performed by installer.
- B. Maintain plant life immediately after placement until Work is accepted by OWNER.
- C. Maintenance to include:
 - 1. Cultivation and weeding plant beds and tree pits.
 - 2. Application of herbicides for weed control in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
 - 3. Application of pesticides in accordance with manufacturer's instructions.
 - 4. Remedy damage from use of pesticides.
 - 5. Irrigating sufficient to saturate root system.

6. Trimming and pruning, including removal of clippings and dead or broken branches, and treatment of pruned areas or other wounds.
7. Disease control.
8. Maintaining guys, stakes, wire, hoses, turnbuckles, and/or strapping. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.

PART 2 - PRODUCTS

2.01 NURSERIES

- A. Nursery shall be a member of American Association of Nurserymen and Pennsylvania Landscape and Nurserymen's Association (or other such State organization).

2.02 TREES, PLANTS, & GROUND COVERS

- A. Trees, Plants, and Ground Covers: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.03 TOPSOIL

- A. Topsoil to be imported to the project site shall be a sandy loam topsoil (as defined in USDA Soil Texture Classification) and be fertile, friable, well-drained, pH range of 6.0 to 6.5, free of subsoil, toxic substances harmful to plant growth, without clay lumps, stones, roots or debris.
- B. The imported topsoil shall have a mechanical analysis as follows:
 - Sand: 35 percent to 40 percent.
 - Clay: 15 percent to 20 percent.
 - Organic Matter: 2.5 percent.
 - Silt: Balance.

2.04 ORGANIC SOIL AMENDMENT MATERIALS

- A. Compost: A mixture of partially decomposed organic materials (chipped, shredded, or ground vegetation or waste or recycled wood products), mushroom soil/spent mushroom soil substrate (SMS), composted animal manure, or exceptional quality (Class A) composted bio-solids.
- B. Compost shall be processed or completed to reduce weed seeds, pathogens, and deleterious material, and shall not contain paint, petroleum products, herbicides, fungicides, or other chemical residues that would be harmful to plant or animal life. Other deleterious material, plastic, glass, metal, or rocks shall not exceed 0.1 percent by weight or volume.
- C. Compost produced from bio-solids (sewage/waste water sludge) shall be "Class A Grade" (exceptional quality) and meet US EPA's 40 CFR Part 503 regulations.
- D. Compost shall meet the following analysis:
 1. Organic Matter Content: On dry weight basis, 40 to 75 percent.

2. Nitrogen Content: 1 to 2.5 percent.
3. Phosphorus Content: 1 to 2 percent.
4. Potassium Content: 0.5 to 1.5 percent.
5. Carbon – Nitrogen Ratio: 12 to 25:1
6. Moisture Content Range: 40 to 60 percent.
7. Moisture Absorbtion: 100 percent (Dry Weight Basis) Minimum.
8. pH Range: 6.0 to 8.0.
9. Bulk Density Range: 800 to 1,000 lbs. per cubic yard.
10. Soluble Salt Content: 5 dS (mmhos/cm) or less.
11. Trace Elements: Meet US EPA 40 CFR Part 503 requirements.
12. Particle Size: Must pass 1 inch sieve or smaller.
13. Stability Rating: Stable.

2.05 PLANTING SOIL MIXTURE

- A. Tree Pits: Thoroughly mix planting soil mixture prior to installation in planting hole/tree pit.
- B. Planting mix will consist of the following:
 - 3 Parts topsoil as specified.
 - 1 Part selected organic soil amendment.
- C. Shrub Planting Holes/Beds: Thoroughly mix planting soil mixture prior to installation in planting hole/tree pit. Planting mix will consist of the following:
 - 3 Parts topsoil as specified.
 - 1 Part selected organic soil amendment.
- D. Groundcover, Perennial, & Ornamental Grass Planting Holes/Beds: Install planting soil as described in Part 3.
 - 2 Parts topsoil as specified.
 - 1 Part selected organic soil amendment.

2.06 WATER

- A. Water shall be clean, fresh, potable, and free of substances or matter which could inhibit vigorous growth of plants.

2.07 SOIL FERTILITY MATERIALS

- A. Fertilizer (Trees & Shrubs): "Agriform", one (1) year duration controlled-released planting tablets manufactured by The Scotts Company, LLC, Marysville, OH, (800)

492-8255 . Planting tablets shall be 20-10-5 formulation in 21 gram size. Apply fertilizer tablets in the following rates:

1. For trees: 2 tablets for each caliper inch.
 2. For shrubs: 1 tablet for each 12 inches of plant height or spread.
- B. Mycorrhizal Treatment for Trees & Shrubs: "Tree Saver" 3-Ounce packet manufactured by Plant Health Care, Inc, 440 William Pitt Way, Pittsburgh, PA 15238; Phone: (412) 826-5488; Web: www.planthealthcare.com. Install per manufacturer's instructions. Apply at the following rates:
1. For single stem trees: 1 Packet per inch of tree caliper, minimum of 1 packet.
 2. For multi-stem trees: 1 Packet per each 12 inches of rootball diameter, minimum of 1 packet.
 3. For shrubs: 1/3 Packet for each gallon of container size or for each 12 inches of plant height or spread.
- C. Mycorrhizal Treatment (Perennials, Groundcovers, & Ornamental Grasses): "Flower Saver" manufactured by Plant Health Care, Inc, 440 William Pitt Way, Pittsburgh, PA 15238; Phone: (412) 826-5488; Web: www.planthealthcare.com. Install per manufacturer's instructions. Apply at the following rates:
1. 6 Pounds per 100 square feet of planting bed.

2.08 HERBICIDE & PESTICIDE

- A. Herbicide: As may be required with approval of Landscape Architect.
- B. Pesticide: As may be required with approval of Landscape Architect.

2.09 MULCH MATERIALS

- A. Mulching Material: Double ground hardwood bark, brown in color, and free of growth or germination inhibiting ingredients.

2.10 GUYING & STAKING MATERIALS

- A. Stakes: Cedar, 2-inch square with pointed end.
- B. Guy Wire: 10 gauge aluminum wire, single strand.
- C. Guy Cable: 1/4 inch five-strand galvanized flexible steel cable.
- D. Turnbuckle: 1/4 inch by 5 1/4 inches zinc plated.
- E. Hose: Two-ply green or black neoprene hose, 3/4 inch diameter and minimum 6 inches long.
- F. Synthetic tree guy strapping: ArborTie® strapping as manufactured by Deep Root Partners, L.P. – 530 Washington Street, San Francisco, CA 94111; Phone: (800) 458-7668; Web: www.deeproot.com.

1. Material: Flat, woven polypropylene
2. Size: ¾ Inch wide
3. Color: White

2.11 VERIFICATION

- A. Provide certification of inspection by the Landscape Architect for confirming approval of plants supplied.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that Project Site is ready for planting prior to delivery of materials
- B. Beginning of installation means acceptance of existing conditions.

3.02 PLANTING PERIODS

- A. Planting shall be performed within the following periods:
 1. From March 15 to June 15.
 2. From September 1 to November 15.
- B. Only with the approval of the LANDSCAPE ARCHITECT can planting occur for the period of after November 15 to March 15.
- C. Planting between June 16 to August 31 is not permitted.

3.03 PREPARATION FOR PLANTING AREAS

- A. Contractor shall locate plants by staking with stakes and flags as indicated on the Drawings for approval by the LANDSCAPE ARCHITECT.
- B. For mass groundcover, perennial, or ornamental grass plantings excavate planting areas to depths as indicated and install planting soil in six inch maximum lifts. Once soil depth is achieved incorporate specified fertilizer/Mycorrhizal treatment into the soil mixture and roto-till entire planting bed to a depth of 12 inches. Planting mix shall be installed during dry weather and on dry unfrozen subgrade.
- C. Grade planting to eliminate rough, low, or soft areas, and to ensure positive drainage.

3.05 PLANTING

- A. Excavate circular plant pits with scarified vertical sides, except for plants specifically indicated to be planted in beds, to depths as indicated on the drawings. Provide planting pits at least twice the diameter of the root system or container. Depth of pit shall accommodate the entire root system. Scarify the bottom and sides of the pit to a depth of four inches. If groundwater is encountered upon excavation of planting holes, the Contractor shall promptly notify the LANDSCAPE ARCHITECT.
- B. If plants are containerized, the containers shall be removed from the plants immediate prior to planting and in a manner that prevents damage to the root system.

Containers may require vertical cuts down the full depth of the container to accommodate removal. All circling roots shall be loosened to ensure natural directional growth after planting.

- C. Set plant material in the planting pit to proper grade and alignment. Set plant upright, plumb, and faced to give the best appearance or relationship to each other or adjacent structure. Set crown of plant material at the finish grade. No filling will be permitted around trunks or stems or above grafts on grafted trees.
- D. Once plant material is set correctly in planting pit begin to backfill with specified planting mixture. Do not use frozen or muddy mixtures for backfilling. When planting hole depth is ½ full with planting soil, water soil in and lightly firm to remove voids and/or air pockets. After planting soil is watered and firmed for balled and burlapped plants remove burlap, rope/twine, and/or wire baskets from top 1/3 of rootball and tuck into planting hole. If burlap has been chemically treated (green color) or rope materials are plastic or not natural material remove from the planting pit.
- F. Install fertilizer tablets and Mycorrhizal treatment packets as specified on firmed soil in planting pit. Tablets and packets shall be evenly distributed throughout the pit.
- G. Continue backfilling planting hole to final grades as shown on the plans. Once backfilling is complete thoroughly water in planting soil and lightly firm to remove voids and/or air pockets.
- G. Containerized shrubs shall follow same procedure as described above.
- H. Containerized groundcover, perennials, and/or ornamental grasses shall be planted in a roto-tilled bed in holes same size as rootball. Once plant is placed lightly firm soil around rootball to ensure firmly placed in hole.
- I. Space ground cover plants using triangular spacing in accordance with indicated dimensions. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants. Plant to within eighteen inches (18") of the trunks of trees and shrubs within planting bed and to within twelve inches (12") of edge of bed.

3.06 MULCHING

- A. Mulch tree and shrub planting pits and shrub beds with required mulch two inches (2") deep immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.
- B. Mulch groundcover, perennial, and ornamental grass beds with required mulch two inches (2") deep immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.

3.07 STAKING/GUYING

- A. Stake all deciduous and coniferous trees immediately after planting.

3.08 PRUNING

- A. Prune all trees only to remove broken or damaged branches, or for aesthetic purposes as directed by the LANDSCAPE ARCHITECT. Branches will be pruned at the branch collar. Neither stubs nor flush cuts will be acceptable.

3.09 CLEANING

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from planting operations.

3.10 MAINTENANCE

- A. Begin specified maintenance until work is accepted by OWNER.

3.11 FINAL INSPECTION

- A. Inspection to determine completion and acceptance of planted areas will be made by the LANDSCAPE ARCHITECT, upon Contractor's request. Provide notification at least ten (10) business days before requested inspection date. Inspection comments will be submitted to contractor in writing.
- B. Planted areas will be accepted provided all requirements, including the maintenance period have been complied with and plant materials are alive and in a healthy, vigorous condition.
- D. Upon acceptance the OWNER will assume plant maintenance and the plant material warrantee period begins.
- E. An additional inspection will be made near the end of the warrantee period to determine if plant materials need to be replaced. Plants shall be in a healthy, vigorous growing state and free of disease and insects.

END OF SECTION

SECTION 33 41 00

STORM DRAIN PIPE

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work Of This Section Includes:

1. Storm sewer pipelines

1.02 RELATED SECTIONS

A. Related Work Specified Elsewhere:

1. Section 01 57 13: Soil Erosion & Sediment Control
2. Section 31 23 16.26 Rock Removal
3. Section 31 23 33: Excavation, Backfill & Compaction
4. Section 32 12 23: Restoration of Paved Surfaces
5. Section 32 93 00: Landscaping
6. Section 33 44 14: Storm Inlets, Catch Basins, Endwalls, End Sections
7. Section 33 49 13: Storm Manholes

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):

M36 Specification for Corrugated Steel Pipe, Metallic - Coated, for Sewers and Drains.

M294 Specification for Corrugated Polyethylene Pipe, 12-to 24-inch Diameter.
2. American Society for Testing and Materials (ASTM):

A760 Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.

C14 Specification for Concrete Sewer, Storm Drain and Culvert Pipe.

C76 Specification for Reinforced Concrete Culvert Storm Drain, and Sewer Pipe.

C507 Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.

3. Pennsylvania Department of Transportation: Publication 408 Specifications

1.04 SUBMITTALS

A. Manufacturer's Literature:

1. Submit manufacturer's descriptive literature for the following items in accordance with Section 01 33 00:

- Pipe
 - Pipe fittings
 - Joints
2. Submit manufacturer's instructions and recommendations for the following items in accordance with Section 01 33 00
- Assembly of joints

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. During loading, transporting and unloading, exercise care to prevent damage to materials.
- B. Do not drop pipe or fittings.
- C. Other Requirements:
1. Section 01 60 00 also addresses transportation and handling along with storage and protection of materials and equipment.

PART 2 - PRODUCTS

2.01 CORRUGATED GALVANIZED STEEL PIPE

- A. Pipe, End Sections and Coupling Bands:
1. Section 601.2, Publication 408 Specifications.
 2. AASHTO M36, Type I or ASTM A760, Type 1.
 3. Metal sheet thickness and corrugation size as noted below unless otherwise indicated on Drawings.

<u>Pipe Diameter</u>	<u>Wall Thickness</u>	<u>Corrugation Size</u>
12 in.	0.064 in. (16 gauge)	2 2/3 in. x 1/2 in. helical
15 in.	0.064 in. (16 gauge)	2 2/3 in. x 1/2 in. helical
18 in.	0.079 in. (14 gauge)	2 2/3 in. x 1/2 in. helical

2.02 NON-REINFORCED CONCRETE PIPE

- A. Pipe:
1. ASTM C14, Minimum Class 3 unless otherwise indicated on Drawings.
- B. Joints:
1. Bell and spigot, or
 2. Tongue and groove

2.03 REINFORCED CONCRETE PIPE

- A. Pipe and Fittings:

1. ASTM C76, Minimum Class III unless otherwise indicated on Drawings.
- B. Joints:
1. Bell and spigot, or
 2. Tongue and groove
- 2.04 ELLIPTICAL REINFORCED CONCRETE PIPE
- A. Pipe:
1. ASTM C507, Minimum Class HE-A or VE-II unless otherwise indicated on Drawings.
- B. Joints:
1. Bell and spigot, or
 2. Tongue and groove
- 2.05 SMOOTH LINED CORRUGATED POLYETHYLENE PIPE
- A. Pipe
1. Section 601.2(a)6.d.&.e., Publication 408 Specifications
 2. AASHTO M294, Type C (Corrugated) and Type S (Smooth-lined)
- B. Joints
1. Hancor Titeline Watertight Joints or approved equal

PART 3 - EXECUTION

3.01 PREPARATION

- A. Perform trench excavation to the line and grade shown on the Drawings and as specified in Section 31 23 33.
- B. Provide pipe bedding as specified in Section 31 23 33 for each type of pipe used. Place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be laid to the required tolerances.

3.02 LAYING PIPE IN TRENCHES

- A. Give ample notice to the Resident Project Representative in advance of pipe laying operations.
- B. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
- C. Lay pipe proceeding upgrade with the bell or groove pointing upstream.
- D. Lay pipe to a true uniform line with the barrel of the pipe resting solidly in bedding material

throughout its length. Excavate recesses in bedding material to accommodate joints, fittings, and appurtenances.

- E. Lay each section of pipe to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.
- F. Clean and inspect each pipe and fitting before joining. Align pipe with previously laid sections.
- G. Assemble joints in accordance with the pipe manufacturer's instructions. Pipe joints shall consist of a preformed rubber gasket or be mortared except for interlocking style pipe and pipe joined with bands.
 - 1. For mortared joints, mortar the lower half of the joint before placing the succeeding pipe section to bring the inner surface of the abutting pipe flush. Before placing mortar, wet the pipe with as much water as it will readily absorb. Fill the outside of bell- and-spigot pipe joints with mortar, flush with the bell end. Fill tongue-and-groove pipe joints flush with the pipe's outside surface. On the inside of the pipe, fill the lower half of the joint flush with mortar, wipe clean, and finish smoothly. For pipes of 24-inch diameter and larger, fill the joints for the entire inside periphery in the same manner. Fill voids for lift holes with mortar after pipe is placed.
- H. Check each pipe installed as to line and grade in place. Correct deviation from line and grade immediately. A deviation from the designed grade as shown on the Drawings, or deflection of pipe joints, will be cause for rejection.
- I. Place and compact sufficient backfill to hold each section of pipe firmly in place as the pipe is laid.

3.03 BACKFILLING TRENCHES

- A. Backfill pipeline trenches only after examination of pipe laying by the Resident Project Representative.
 - 1. If joints are mortared, backfilling may proceed immediately only if the operation will avoid joint damage, maintain pipe in proper alignment and grade, and provide satisfactory curing conditions for mortar.
- B. Backfill and compact trenches as specified in Section 31 23 33.

END OF SECTION

SECTION 33 44 14

STORM INLETS, CATCH BASINS, ENDWALLS, END SECTIONS

PART 1 - GENERAL

1.01. SECTION DESCRIPTION

A. The Work of This Section Includes, but is not limited to:

1. Storm drainage curb inlets
2. Storm drainage catch basins
3. Storm drainage pipe endwalls
4. Pipe culvert end sections

1.02 RELATED SECTIONS

A. Related Work Specified Elsewhere:

1. Section 01 57 13: Soil Erosion and Sediment Control
2. Section 31 23 33: Excavation, Backfill & Compaction
3. Section 32 92 00: Finish Grading, Seeding, and Sodding

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. American Society for Testing and Materials (ASTM):

- A36 Specification for Structural Steel
- A47 Specification for Malleable Iron Castings
- A536 Specification for Ductile Iron Castings
- C32 Specification for Sewer and Manhole Brick
- C270 Specification for Mortar for Unit Masonry

2. Pennsylvania Department of Transportation

- Publication 408 Specifications
- Publication #72 Standards for Roadway Construction

B. Acceptable Manufacturer:

1. Precast structures, and frames and covers shall be provided by a firm regularly engaged in the manufacture of such products of the types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
2. Precast structures shall be provided by one of the following manufacturers or approved equal.
 - Monarch Precast Concrete Corporation
 - Modern Concrete Septic Tank Company
 - Atlantic Concrete Products
 - Oldcastle Precast Company
3. Frames and grates shall be provided by one of the following manufacturers or approved equal.
 - Neenah Foundry Company
 - E.A. Quirin Machine Shop, Inc.
 - East Jordan Iron Works, Inc.

1.04 SUBMITTALS

A. Shop Drawings:

1. Submit detailed shop drawings of inlet units, end walls, and end sections including reinforcing steel details.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Precast Concrete Units:

1. After fabrication and curing, transport the units to the job site. Protect until required for installation.
2. Handle to avoid damage to surfaces, edges and corners and to avoid creation of stresses within the units.

B. Other Requirements:

1. Section 01 60 00 also addresses transportation and handling along with storage and protection of materials and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate Subbase:

1. PADOT Number 2A, Type C, Section 703.2, Publication 408 Specifications.

B. Brick: ASTM C32, grade SS, solid

C. Masonry Mortar: ASTM C270, Type S

D. Malleable Iron Castings: ASTM A47, Grade 35018. Domestic

E. Ductile Iron Castings: ASTM A536, Grade 60-40-18. Domestic

F. Structural Grade Carbon Steel: ASTM A36

G. Concrete: Section 03 30 53

2.02 FABRICATIONS

A. Precast Cement Concrete Units:

1. Comply with the requirements of Section 713.2(d), Publication 408 Specifications

B. Inlets and Catch Basins:

1. Comply with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC-34) for precast units.

C. End Walls:

1. Comply with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC-31) for precast units.

D. Pipe Culvert End Sections:

1. Comply with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC-33).

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Perform excavation in conjunction with storm pipe installation, Section 33 41 00 and as specified in Section 31 23 33.
- B. Locate inlets, catch basins, endwalls and end section indicated on the Drawings.

3.02 CONSTRUCTION

- A. Construct inlets and catch basins of either precast sections or of cast-in-place construction in compliance with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC-34).
 1. Place precast units on a 12" coarse aggregate subbase placed in 4" layers compacted to 95% of dry weight density.
 2. Construct cast-in-place units on undisturbed earth.
 3. Shape bottom of inlet boxes to channel flow of water to the outlet pipe and to prevent water from standing in box.
 4. Unless units are cast-in-place, use precast concrete sections or brick to adjust to grade. Mortar in place.
- B. Construct endwalls of either precast units or cast-in-place construction in compliance with the type, design and dimensions shown on the Drawings and in accordance with Publication #72 (RC-31).
 1. Cast-in-place endwalls shall be monolithically cast reinforced concrete units.
- C. Do not permit pipes to project more than 2" into inlets. Do not expose end of pipe through faces of endwalls.
- D. Where indicated on the Drawings, provide pipe culvert end sections in compliance with the design and dimensions shown on the Drawings and in accordance with Publication #72 (RC-33).
- E. Where indicated, construct energy dissipator in accordance with Section 31 37 16.

3.03 BACKFILLING

- A. Backfill structures only after examination by the Resident Project Representative.
- B. Perform backfilling and compaction as specified in Section 31 23 33.

END OF SECTION

SECTION 33 49 13

STORM MANHOLES

PART 1 - GENERAL

1.01 SECTION DESCRIPTION

A. The Work of this section includes:

1. Precast Concrete Manholes
2. Concrete Manhole Bases
3. Manhole Steps
4. Manhole Covers and Frames

1.02 RELATED SECTIONS:

A. Related Work Specified Elsewhere:

1. Section 01 57 13: Soil Erosion and Sediment Control
2. Section 03 30 53: Concrete Work for Utilities
3. Section 31 23 16.26: Rock Removal
4. Section 31 23 33: Excavation, Backfill & Compaction
5. Section 32 12 23: Restoration of Paved Surfaces
6. Section 32 93 00: Landscaping
7. Section 33 41 00: Storm Drain Pipe

1.03 QUALITY ASSURANCE

A. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
Standard Specifications for Highway Bridges
2. American Society for Testing and Materials (ASTM):
A48 Specification for Gray Iron Castings
A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C270 Specifications for Mortar for Unit Masonry
C478 Specifications for Precast Reinforced Concrete Manhole Sections
D4101 Specification for Propylene Plastic Injection and Extrusion Materials
3. Pennsylvania Department of Transportation Publication 408 Specifications

B. Acceptable Manufacturer:

1. The storm manhole structure, and frame and cover shall be provided by a firm regularly engaged in the manufacture of such products of the types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than five (5) years.
2. Storm manhole structures shall be provided by one of the following manufacturers or approved equal.
 - a. Atlantic Concrete Products, Inc.
 - b. Monarch Precast Concrete Corporation
 - c. Modern Concrete Septic Tank Company
3. Frames and covers shall be provided by one of the following manufacturers or approved equal.
 - a. Neenah Foundry Company
 - b. E.A. Quirin Machine Shop, Inc.
 - c. East Jordan Iron Works, Inc.
 - d. Syracuse Castings Sales Corporation

1.04 SUBMITTALS

A. Shop Drawings:

1. Submit detail shop drawings of the following items in accordance with Section 01 33 00:
 - Manhole sections and precast bases
 - Manhole frames and covers
 - Manhole steps

PART 2 - PRODUCTS

2.01 BASIC MATERIALS

A. Coarse Aggregate Subbase:

1. PennDOT No. 2A or AASHTO No. 8 in accordance with Table C, Section 703.2, Publication 408 Specifications.

B. Masonry Mortar: ASTM C270, Type S.

C. Concrete: PennDOT Class A, Section 03 30 53

2.02 FABRICATED PRODUCTS

A. Precast Concrete Manhole Sections: ASTM C478

1. 5.5% ± 1% air-entrained cement concrete.
2. Eccentric cone section (Type `A'), or top slab (Type `B'), minimum 24" access opening unless otherwise indicated.

3. Precast riser sections of length to suit.
 4. Precast bases of a design similar to the precast riser sections.
- B. Manhole Steps:
1. Forged aluminum alloy 6061-T6 with drop front and safe tread as manufactured by Alcoa (No. 16829) or approved equal; portion to be embedded in precast manhole wall shall be dipped in heavy bodied bituminous paint or else provided with plastic inserts; or
 2. Steel reinforced copolymer polypropylene with serrated tread and end lugs. The copolymer polypropylene shall conform to ASTM D-4101 (PP200B33454Z02) propylene copolymers and shall completely encase a ½ inch deformed steel reinforcing bar which shall conform to ASTM A-615, Grade 60; manufactured by M.A. Industries, Inc. (Model PS2-PF) or approved equal.
- C. Manhole Frames and Covers:
1. Domestic cast iron castings: ASTM A 48, Class 30 or better; free of bubbles, sand and air holes, and other imperfections.
 2. Heavy duty traffic, AASHTO Highway Loading Class H-20 (16,000# wheel loading).
 3. Frame and cover dimensions shall conform to the dimensions shown on the Drawings.
 4. Contact surfaces machined and matched.
 5. All manhole covers shall have as non-slip pattern and shall be inscripted as shown on the Drawings with raised letters. Letters shall have a height and width of not less than two (2) inches.
 6. All manhole covers shall have two (2) concealed pick holes
 7. Manufactured by Syracuse Casting Sales Corporation.

Standard: Model #12554552 frame with #10396162 cover
Watertight: Model #1030453 frame with #1204 cover
or
Neenah Foundry Company

Standard: Model #R-1788-A
Watertight: Model #R-1916-F

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Perform excavation to the line and grade shown on the Drawings and as specified in Section 31 23 33.
- B. Location and depth of manholes as shown on the Drawings.

3.02 CONSTRUCTION

- A. Construct manholes of precast concrete sections and of the type shown on the Drawings.
- B. Install precast base on a minimum of six (6) inches of coarse aggregate subbase.
- C. Form flow channels in manhole bases as shown on the Drawings. Slope channels uniformly from influent invert to effluent invert. Slope bench towards channel at 1 inch per foot. Construct bends of the largest possible radius. Form channel sides and invert smooth and uniform; free of cracks, holes or protrusions.
- D. Do not permit pipe to project more than 2" into the manhole.
- E. Seal interior joints between precast concrete manhole sections with non-shrink mortar.
- F. Install manhole sections with steps in proper vertical alignment.
- G. Use precast concrete grade manhole rings to achieve elevation shown for frame and cover. Do not adjust elevation more than one (1) foot with precast rings. Provide the exterior of the grade rings with a 1/2" thick coat of mortar.
- H. Install manhole frames and covers.
 - 1. Set top of frames at finished grade elevation or other elevation shown on the Drawings.
 - 2. Anchor manhole covers at four (4) locations as shown on the Drawings.
 - 3. Seal joint between manhole frame and manhole with non-shrink mortar.

3.03 BACKFILLING

- A. Backfill only after examination of the manhole by the Resident Project Representative.
- B. Perform backfilling as specified in Section 31 23 33.

3.04 SITE RESTORATION WORK

- A. Once the manholes and related storm sewer construction has been completed in an area, the following site restoration work shall be completed in accordance with the Drawings and as specified in the noted Sections:
 - 1. Finish Grading Section 32 93 00
 - 2. Topsoil and Seed Section 32 93 00
 - 3. Pavement Restoration Section 32 12 23
- B. Contractor shall stage site restoration work for a large project in accordance with the construction schedule approved by Engineer.

END OF SECTION