

CLINTON STREET PARK 02-2019-127

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SECTION 01 22 00 – UNIT PRICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Measurement.
 - 2. Payment.

1.2 UNIT PRICES

- A. Provide unit prices for items listed, for inclusion in Contract, guaranteed to apply for duration of Project as basis for additions to or deductions from Contract Sum.
- B. Take measurements and compute quantities.
- C. Quantities and measurements indicated are for Contract purposes only. Actual quantities and measurements supplied or placed in the Work will determine payment.
- D. Payment includes full compensation for all required labor, Products, tools, equipment, plant, transportation, services, and incidentals, and for erection, application, or installation of an item of the Work.
- E. Adjustments to Contract Sum will be made by Change Order based on net cumulative change for each item of the Work.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submittal procedures.
 - 2. Proposed Products list.
 - 3. Submittal schedule.
 - 4. Shop Drawings.
 - 5. Product Data.
 - 6. Samples.
 - 7. Quality control submittals.

1.2 SUBMITTAL PROCEDURES

- A. Number each submittal with Project Manual section number and a sequential number within each section. Number resubmittals with original number and an alphabetic suffix.
- B. Identify Project, Contractor, Subcontractor or supplier, pertinent Drawing sheet and detail numbers, and specification Section number, as appropriate.
- C. Submit all submittals listed under “Submittals for Review” simultaneously for each Product or Specification Section.
- D. Where multiple products function as an assembly, group submittals for all related Products into single submittal.
- E. Architect/Engineer will not review incomplete submittals.
- F. Apply Contractor’s stamp, signed or initialed certifying that:
 - 1. Submittal was reviewed.
 - 2. Products, field dimensions, and adjacent construction have been verified.
 - 3. Information has been coordinated with requirements of Work and Contract Documents.
- G. Schedule submittals to expedite the Project, and deliver to Architect. Coordinate submittal of related items.
- H. For each submittal, allow 14 days for Architect’s review, excluding delivery time to and from the Contractor.
- I. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of completed Work.
- J. Revise and resubmit submittals when required; identify all changes made since previous submittal.
- K. Distribute copies of reviewed submittals to concerned parties and to Project Record Documents file. Instruct parties to promptly report any inability to comply with provisions.

1.3 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Notice to Proceed, submit a complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.
- C. Submit electronically in Adobe PDF format.

1.4 SUBMITTAL SCHEDULE

- A. Within 15 days after date of Notice to Proceed, submit a submittal schedule showing all submittals proposed for project, including submittals listed as:
 - 1. Submittals for Review.
 - 2. Quality Control Submittals.
- B. Include for each submittal:
 - 1. Specification section number.
 - 2. Description of submittal.
 - 3. Type of submittal.
 - 4. Anticipated submittal date.
 - 5. For submittals requiring Architect's review, date reviewed submittal will be required from Architect.
- C. Submit submittal schedule electronically in Adobe PDF format.
- D. The City of Paterson shall review the schedule and add or remove items at the sole discretion of the City of Paterson. Resubmit a revised schedule within 7 days of receiving comments from the City of Paterson.

1.5 SHOP DRAWINGS

- A. Present information in clear and thorough manner.
- B. Identify details by reference to sheet and detail numbers or room number shown on Drawings.
- C. Reproductions of details contained in Contract Documents are not acceptable.
- D. Submit electronically in Adobe PDF format. Architect will return one copy electronically in Adobe PDF format to Contractor for printing and distribution.

1.6 PRODUCT DATA

- A. Mark each copy to identify applicable products, models, options, and other data.
- B. Supplement manufacturers' standard data to provide information unique to this Project.
- C. Submit electronically in Adobe PDF format. Architect will return one copy to Contractor in Adobe PDF format for printing and distribution.

1.7 SAMPLES

- A. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
- B. Where so indicated, submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Architect's selection.
- C. Include identification on each sample, with full Project information.
- D. Unless otherwise specified in individual specifications, submit one of each sample.
- E. Architect will notify Contractor of approval or rejection of samples, or of selection of color, texture, or pattern if full range is submitted.

1.8 QUALITY CONTROL SUBMITTALS

- A. Quality control submittals specified in Section 01 4000 are for information and do not require Architect's responsive action except to require resubmission of incomplete or incorrect information.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 02 41 00 – DEMOLITION

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This Section includes specifications for demolition, removal and disposal of selective site items, pavement and related ancillary services, including backfilling of excavations and depressions to restore site to final grade.
- B. Extent of demolition work shall include, but not be limited to:
 - 1. Locating all utilities in the vicinity of the work to be done prior to the commencement of any work.
 - 2. Disconnect, cut, and cap utility services to facilities to be removed, rerouted, or demolished.
 - 3. Removal of existing concrete curbs, concrete wall, concrete pad, fences, block wall, signs, sidewalks, pavements, rubber play surface, benches abandoned inlets and manholes, drain pipes, metal and concrete structures, duct banks and other obstructions to the work.
 - 4. Store all items and materials to be re-used or turned over to the Owner in a manner and location where the materials are protected from damage.

1.02 REFERENCE STANDARDS

- A. American National Standards Institute (ANSI): ANSI A10.6 Safety Requirements for Demolition

1.03 PERMITS

- A. Contractor shall obtain all special permits and licenses and give all notices required for performance and completion of the demolition and removal work, hauling, and disposal of debris.

1.04 SUBMITTALS

- A. Demolition Plan: Provide a demolition plan to the Construction Manager for review, describing the proposed sequence, methods, and equipment for demolition, removal, and disposal of structure(s), including salvage if required.
- B. Permits: Submit copies of demolition, hauling, and debris disposal permits and notices to the Construction Manager for review and record purposes. Include description of proposed haul routes.
- C. Utility Severance Certificates: Provide certificates of severance of utility services to the Construction Manager for review and record purposes.

1.05 SITE CONDITIONS

- A. Protection of Persons and Property:
1. Where directed, install chain link fencing around the work area.
 2. Where directed, erect and maintain temporary bracing, shoring, lights, barricades, signs, and other measures as necessary to protect the public, workers, and adjoining property from damage from demolition work, all in accordance with applicable codes and regulations.
 3. Open depressions and excavations occurring as part of this work shall be barricaded and posted with warning lights when accessible through adjacent property or through public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 4. Protect utilities, pavements, and facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by the demolition operations.
- B. Protection of Utilities:
1. Protect active sewer, water, gas, electric, and other utilities indicated or, when not indicated, found or otherwise made known to the Contractor before or during demolition work. If utility is damaged, immediately notify the Engineer, Construction Manager and the utility owner for corrective action.
 2. Prior to the demolition of any part of the building, involving utilities, arrangements shall be made for the disconnection and termination of all water, sewer, gas, electric, telephone, cable television, traction power and other facilities that are connected within the building, in conformance with the requirements of the owner and municipalities and companies owning or controlling them.
 3. When only a portion of an occupied structure is to be demolished, demolition and related operations shall be conducted in such a manner as not to interrupt the service to the portion of the structure, which is not to be demolished. Where it is necessary to reconnect any facilities to the undemolished portion of the structure, such reconnection shall be made permanent.
 4. The municipalities and companies concerned shall be notified, in writing, when such disconnections, terminations or reconnections are required, and the work shall be performed in accordance with their standard practices and requirements and under their supervision, or arrangements shall be made for the work to be performed with their forces.
- C. Noise and Dust Abatement:
1. Provide continuous noise and dust abatement as required to prevent disturbance and nuisance to the public and workers and to the occupants of adjacent premises and surrounding areas. Dampen areas affected by demolition operations as necessary to prevent dust from rising.

2. When a certain level of noise is unavoidable because of the nature of the work or equipment involved, and such noise is objectionable to the occupants of adjacent premises, make arrangements with the governmental authorities having jurisdiction to perform such work or operate such equipment at the most appropriate time periods of the day Provide abatement measures to the extent feasible and practicable.

D. Unknown Conditions:

1. City of Paterson cannot and does not warrant that the Contract Drawings and related documents represent all surface and subsurface conditions at the site and adjoining areas.
2. Existing utilities and drainage systems below grade are located from existing documents and from surface facilities such as manholes, valve boxes, area drains, and other such surface fixtures. City of Paterson cannot and does not warrant the accuracy and completeness of the Contract Documents. It is the Contractor's responsibility to verify type and location of all existing utilities prior to demolition.
3. If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Engineer in writing, requesting instructions on their disposition. Take immediate steps to ensure the service provided is not interrupted, at no additional cost to the City of Paterson and do not proceed with the work until written instructions are received from the Engineer.
4. Contractor shall remove and dispose of pavement (as indicated on the Drawings) of whatever thickness as required, at no additional cost to the City of Paterson.

PART 2 – PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. Furnish all materials, tools, equipment, devices, appurtenances, facilities, and services as required for performing the demolition and removal work.
- B. Materials used for backfill shall conform to the requirements for backfill of Section 31 20 00 Earth Moving.

PART 3 – EXECUTION

3.01 PRESERVATION OF REFERENCE MARKERS

- A. Record the locations and designation of survey markers and monuments prior to their removal. Provide three reference points for each survey marker and monument removed, established by a licensed land surveyor.
- B. Store removed markers and monuments during demolition work, and replace them upon completion of the work. Re-establish survey markers and monuments in conformance with the recorded reference points. Forward to the Engineer letter verifying reestablishment of survey markers and monuments, signed by a licensed land surveyor.

3.02 DEMOLITION

- A. Perform demolition in accordance with the accepted demolition plan, notes and phasing plans(s). Perform demolition work in accordance with ANSI A10.6.
- B. Perform operational procedures in accordance with the accepted demolition plan and permit requirements.
- C. Demolish concrete and masonry near structures in small sections. Perform demolition with small tools as much as possible.
- D. Remove pavement in accordance with Section 02 41 13.13 Pavement Removal.
- E. Cap and plug pipes and other conduits abandoned due to demolition, with approved type caps and plugs as required by the utility owners.
- F. Backfill depressions caused by excavations, demolition, and removal with materials placed and compacted in accordance with Section 31 20 00 Earth Moving.
 - 1. Additional materials required for backfilling shall be furnished at no cost to the City of Paterson. The quality, nature and source of additional material required for backfilling shall be in accordance with Section 31 20 00 Earth Moving.
 - 2. All operations in connection with backfilling and grading shall be performed and completed in such a manner to ensure proper drainage.
 - 3. Wall foundations against which backfill material is to be placed shall first be cleaned, pointed and waterproofed with two coats of asphalt or tar.
 - 4. The ground surface shall be graded, if necessary, to eliminate water pockets.
- G. Building Demolition
 - 1. Demolish building completely and remove from the site. Use such methods as required to complete the work within the limitation of governing regulations.
 - 2. Proceed with demolition in a systematic manner, from the top of the structure to the ground. Complete demolition work above each floor or tier before disturbing supporting members on lower levels.
 - 3. Demolish concrete and masonry in small sections.
 - 4. Remove structural framing members and lower to ground by means of hoists, derricks, or other suitable methods.
 - 5. Break up and remove concrete slabs on grade at street level.
 - 6. Locate demolition equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.

3.03 DISPOSAL OF DEBRIS

- A. Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction.
- B. Burying of trash and debris on the site will not be permitted. Burning of trash and debris at the site will not be permitted.
- C. Remove trash and debris from the site at frequent intervals so that its presence will not delay the progress of the work, nor it be an annoyance to the occupants.
- D. Removed materials, trash, and debris shall become the property of the Contractor and shall be removed from the Owner's property and disposed of in a legal manner. Location of disposal site and length of haul shall be the Contractor's responsibility.

3.04 CLEANUP

- A. Provide a clean and orderly site. Place equipment not in use outside or on the edge of the project area so as not to interfere with other operations. Fill excavations as soon as possible after removals.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENTS AND PAYMENT

- A. No specific measurement and payment will be made for the work described in this Section. The cost shall be included in the unit prices bid for Site Clearing as indicated on the bid price form.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reinforcing bars, wire fabric, and accessories for cast-in-place concrete.
- B. Related Sections:
 - 1. Section 03 30 00, Cast-In-Place Concrete.

1.2 REFERENCES

- A. American Concrete Institute (ACI) 301 - Specifications for Structural Concrete for Buildings.
- B. ASTM International (ASTM):
 - 1. A185/A185M - Standard Specification for Welded Steel Wire Reinforcement, Plain, for Concrete.
 - 2. A615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 3. A767 - Standard Specification for Zinc-Coated (Galvanized) Bars for Concrete Reinforcement.
 - 4. D3963 - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Reinforcing Steel.
- C. American Welding Society (AWS) D1.4 - Structural Welding Code - Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute (CRSI):
 - 1. Manual of Practice.
 - 2. Publication 63 - Recommended Practice for Placing Reinforcing Bars.
 - 3. Publication 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings:
 - a. Include bar sizes, spacings, laps, locations, and quantities of reinforcing bars, wire fabric, and accessories.
 - b. Provide bending and cutting schedules.
 - c. Show complete layout plan for each layer of reinforcing.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcing to project site in bundles marked with tags indicating bar size, length, and mark.
- B. Store reinforcing above ground in dry, well drained area; protect from corrosion.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars:
 - 1. ASTM A615/A615M, deformed billet steel, Grade 60.
 - 2. Finish: Plain.
- B. Welded Wire Fabric:
 - 1. ASTM A185/A185M. Furnish in flat sheets.
 - 2. Finish: Plain.

2.2 ACCESSORIES

- A. Spacers, Chairs, Bolsters, and Bar Supports:
 - 1. Sized and shaped for strength and support of reinforcement during concrete placement.
 - 2. Galvanized or plastic coated steel for surfaces exposed to weather.
- B. Tie Wire: Annealed steel, minimum 16 gage.

2.3 FABRICATION

- A. Fabricate in accordance with ACI 301 and CRSI Manual.
- B. Bend bars cold; do not heat or bend by makeshift methods. Discard damaged bars.
- C. Welding: AWS D1.4.
- D. Fabrication Tolerances:
 - 1. Sheared length: Plus or minus 1 inch.
 - 2. Bends in stirrups and ties: Plus or minus 1/2 inch.
 - 3. All other bends: Plus or minus 1 inch.

PART 3 EXECUTION

3.1 PREPARATION

- A. Before placing in work, thoroughly clean reinforcing of loose rust, mill scale, dirt, oil, and other materials that could reduce bonding.
- B. Inspect reinforcing left protruding for future bonding or following delay in work, and clean if necessary.

3.2 INSTALLATION

- A. Install reinforcing in accordance with ACI 301, and CRSI Manual and Publications 63 and 65.
- B. Accurately position reinforcing; securely tie at intersections.
- C. Welding: AWS D1.4.
- D. Install wire fabric reinforcing in longest practical lengths. Offset end laps in adjacent widths to prevent continuous lap.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cast-in-place concrete for footings, foundations and slabs on grade.
 - 2. Playground equipment footings.
 - 3. Fence post footings.
 - 4. Metal railing footings.
 - 5. Concrete steps.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 03 20 00 Concrete Reinforcing
 - 3. Section 32 16 00 Curbs, Gutters, and Sidewalks

1.2 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 301 - Structural Concrete for Buildings.
 - 2. 305R - Hot Weather Concreting.
 - 3. 306R - Cold Weather Concreting.
 - 4. 308 - Standard Practice for Curing Concrete.
 - 5. 318 - Building Code Requirements for Structural Concrete.
- B. ASTM International (ASTM):
 - 1. C31 - Standard Test Method for Method of Making and Curing Concrete Test Specimens in the Field.
 - 2. C33 - Standard Specification for Concrete Aggregates.
 - 3. C39 - Standard Test Method for Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. C94 - Standard Specification for Ready-Mixed Concrete.
 - 5. C143 - Standard Test Method for Slump of Portland Cement Concrete.
 - 6. C150 - Standard Specification for Portland Cement.
 - 7. C171 - Standard Specification for Sheet Materials for Curing Concrete.
 - 8. C172 - Standard Test Method for Method of Sampling Freshly Mixed Concrete.
 - 9. C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 10. C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 11. C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 12. C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
 - 13. C494 - Standard Specification for Chemical Admixtures for Concrete.
 - 14. C618 - Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
 - 15. C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
 - 16. D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Concrete Mix Designs: Include:
 - a. Proportions of cement, fine and coarse aggregates, [fibrous reinforcing,] and water.
 - b. Combined aggregate gradation.
 - c. Aggregate specific gravities and gradations.
 - d. Water/cement ratio, design strength, slump, and air content.
 - e. Type of cement and aggregates.
 - f. Air dry density and split cylinder ratio for lightweight concrete.
 - g. Type and proportion of admixtures.
 - h. Special requirements for pumping.
 - i. Range of ambient temperature and humidity for which design is valid.
 - j. Special characteristics of mix requiring precautions in mixing, placing, or finishing techniques to achieve finished product.

1.4 QUALITY ASSURANCE

- A. Concrete Mix Design: In accordance with ACI 301, Method 1 or 2.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Mix and deliver concrete to project ready mixed in accordance with ASTM C94.
- B. Schedule delivery so that pours will not be interrupted for over 15 minutes.
- C. Place concrete on site within 90 minutes after proportioning materials at batch plant.

1.6 PROJECT CONDITIONS

- A. Cold Weather Placement - Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. Comply with ACI 306R and following requirements:
 - 1. Do not pour concrete when ambient air temperature is below or expected to fall below 40 degrees F, unless approved by the Engineer.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- B. Hot Weather Placement - Place concrete in accordance with ACI 305R and following requirements:
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Use chilled mixing water or chopped ice if water equivalent of ice is calculated in total amount of mixing water.
 - 2. If required, cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature.
 - 3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
 - 4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers listed below or approved equal- Concrete Chemicals
 - 1. Burke by Edoco. (www.burkebyedeco.com)
 - 2. Conspec Marketing and Manufacturing. (www.conspecmkt.com)
 - 3. Dayton/Richmond. (www.daytonrichmond.com)
 - 4. BASF Admixtures, Inc. (www.masterbuilders.com)
 - 5. W. R. Meadows, Inc. (www.wrmeadows.com)
 - 6. Nox-Crete Products Group. (www.nox-crete.com)

2.2 MATERIALS

- A. Portland Cement: ASTM C150, Type I or III, gray color.
- B. Aggregates:
 - 1. Fine: ASTM C33, clean, hard, durable, uncoated natural sand, free from silt, loam, and clay.
 - 2. Coarse: ASTM C33, clean, hard, durable, uncoated crushed stone, maximum size No. 467, Table No. 2.
- C. Fly Ash: ASTM C618, maximum 2 percent loss on ignition.

2.3 ACCESSORIES

- A. Water: Clean and potable.
- B. Admixtures:
 - 1. Water reducing or water reducing/set retarding: ASTM C494, Type A or D.
 - 2. Air entraining: ASTM C260.
- C. Expansion Joint Filler: ASTM D1752, non asphaltic type.
- D. Non-Shrink Grout: Premixed, consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; minimum 7,000 psi compressive strength at 28 days.
- E. Bonding Agent: Two component modified epoxy resin.
- F. Curing Compound: ASTM C309, [solvent] [water] based type.
- G. Curing Paper: ASTM C171, waterproof paper or polyethylene film.

2.4 MIXES

- A. Proportions: In accordance with ACI 301 to provide 4,000 PSI compressive strength at 28 days, unless indicated otherwise in the Plans..
- B. Design concrete to yield characteristics scheduled at end of Section or as indicated on Drawings.
- C. Air Entrained Concrete: Provide air entraining admixture to produce 4 to 6 percent air by volume of concrete.
- D. Use accelerating admixture in cold weather only when approved by Architect. Use of admixtures will not reduce cold weather placement requirements.
- E. Fly Ash Content: Minimum 15 percent by weight of cementitious material in mix.

PART 3 EXECUTION

3.1 PREPARATION

- A. Notify Engineer and Testing Laboratory minimum 24 hours prior to placing concrete.
- B. Accurately position anchor bolts, sleeves, conduit, inserts, and accessories. Do not cut reinforcing steel to facilitate installation of inserts or accessories.
- C. Remove water and debris from forms and excavations.
- D. Close openings left in forms for cleaning and inspection.
- E. Prepare previously placed [and existing] concrete surfaces by cleaning with steel wire brush and applying bonding agent in accordance with manufacturer's instructions.
- F. Where new concrete is doweled to existing, drill holes in existing concrete, insert steel dowels, and pack holes solid with non shrink grout.

3.2 PLACEMENT OF CONCRETE

- A. Place concrete in accordance with ACI 301 and ACI 318.
- B. Ensure reinforcement, inserts, and embedded parts are not disturbed during concrete placement.
- C. Deposit concrete as nearly as possible in its final position to minimize handling and flowing.
- D. Place concrete continuously between predetermined expansion, control, and construction joints.
- E. Do not place partially hardened, contaminated, or retempered concrete.
- F. Do not allow concrete to free fall over 8 feet; provide tremies, chutes, or other means of conveyance.
- G. Consolidate concrete with mechanical vibrating equipment. Hand compact in corners and angles of forms.
- H. Screed slabs level, to flatness tolerance of 1/4 inch in 10 feet.

3.3 PLACEMENT OF GROUT

- A. Remove loose and foreign matter from concrete; lightly roughen bonding surface.
- B. Just prior to grouting, thoroughly wet concrete surfaces; remove excess water.
- C. Mix grout in accordance with manufacturer's instructions. Do not retemper.
- D. Place grout continuously, by most practical means; avoid entrapped air. Do not vibrate grout.

3.4 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.
- C. Provide artificial heat to maintain temperature of concrete above minimum specified temperature for duration of curing period.
- D. Keep forms sufficiently wet to prevent cracking of concrete or loosening of form joints.

3.5 CURING

- A. Cure concrete in accordance with ACI 308:
 - 1. Horizontal surfaces:
 - a. Surfaces to receive additional toppings or setting beds: Use curing paper method.
 - b. Other surfaces: Use either curing paper or curing compound method.
 - 2. Vertical surfaces: Use either wet curing or curing compound method.
- B. Curing Compound Method:
 - 1. Spray compound on surfaces in two coats, applying second at right angle to first, at minimum rate recommended by manufacturer.
 - 2. Restrict traffic on surfaces during curing.
- C. Curing Paper Method:
 - 1. Spread curing paper over surfaces, lapping ends and sides minimum 4 inches; maintain in place by use of weights.
 - 2. Remove paper after curing.
- D. Wet Curing Method: Spray water over surfaces and maintain wet for 7 days.

3.6 CLEANING

- A. Remove efflorescence, stains, oil, grease, and foreign materials from exposed surfaces.

3.7 CONCRETE SCHEDULE

Minimum 28 Day Compressive Strength	Slump	Comments	Uses
4000 psi	4 to 6 inches		Piers &Footings
4000 psi	3 to 5 inches	Air entrained	Paving
4000 psi	3 to 5 inches	Air-entrained	Slabs on grade

END OF SECTION

SECTION 03 60 00 - GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. CONTRACTOR shall furnish all labor, tools, and equipment for the placement of grout in the holes and other locations as shown on the DRAWINGS and specified herein.
2. This section includes basic mixing, application, and curing methods for grout.

B. RELATED SECTIONS

1. Section 03 30 00, Cast-In-Place Concrete.
2. Section 32 16 00, Curbs, Gutters, and Sidewalks

1.2 REFERENCES

A. ASTM International (ASTM):

1. C78, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
2. CI 09/CI 09M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
3. C469, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
4. C666JC666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
5. C882, Standard Test Method for Bond Strength of Epoxy-Resin System used with Concrete by Slant Shear.
6. C1012, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to Sulfate Solution.
7. C1202, Standard Test Method for Electrical indication of Concrete's Ability to Resist Chloride Ion Penetration.

1.3 SUBMITTALS

A. Provide product data on the following:

1. Grout.
2. Bonding agent.
3. Coring compound.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Cement based mortar shall be delivered and stored in manufacturer's packaging until it is ready to be mixed and placed. Mortar bags shall be stored off the ground and protected from water and all other substances that may penetrate packaging.

1.5. PROJECT CONDITIONS

- A. Cold Weather Placement - Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures. Comply with ACI 306R and following requirements:
 - 1. Do not pour grout when ambient air temperature is below or expected to fall below 40 degrees F, unless approved by the Engineer.
 - 2. Do not place grout on frozen subgrade or on subgrade containing frozen materials.
 - 3. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

PART 2 PRODUCTS

2.1. MATERIALS

- A. Mortar for Tie Holes: EMACO R320 or approved equal
- B. Bonding Adhesives: Concrevice Liquid LPL or Concrevice Standard Liquid or approved equal
- C. Water: Only clean potable water shall be used.
- D. Coring Compound: MB 429, Masterkure 100W, Masterkure 200W or approved equal
- E. (Exposed) Reinforcing Steel Coating: EMACO P22 or approved equal
- F. Evaporation Reducer: Confilm Evaporation Reducer.

PART 3 EXECUTION

3.1 GENERAL

- A. CONTRACTOR shall have a printed set of manufacturer's recommendations for product use onsite for review during preparation, mixing, and application of grout.
- B. These grouts contain admixtures that increase grout strength and workability. The strength and performance of the grout is dependent on proper surface preparation, grout mixing and coring. CONTRACTOR shall be required to use a calibrated measuring device to add clean potable water to the grout mix. Water added to a grout mix without a calibrated device is cause for grout rejection, removal and replacement.
- C. Curing is critical to prevent shrinkage cracks that can develop with grouts containing some admixtures. Curing shall begin immediately after placement.
- D. All mixing, surface preparation, handling, placing, consolidation, and other means of execution for pre-packaged mortars shall be done according to the instructions and recommendations of the manufacturer and this SPECIFICATION. In the event that a conflict occurs between this SPECIFICATION and manufacturer's instructions, the manufacturer's instructions shall prevail in all cases.

3.2 INSTALLATION

- A. Preparation:
 - a. Thoroughly clean the roughened surface and any exposed reinforcement of rust, dirt, loose chips, and dust. Maintain substrate in a saturated, surface-dry condition.
 - b. Where applicable, coat exposed reinforcing steel with EMACO P22 reinforcing

steel bar protection coating prior to patching.

- B. Mixing: Comply with mortar manufacturer's recommendations for water quantity. Mechanically mix with a slow speed drill (four hundred to six hundred [400 to 600] rpm) and Jiffler-type paddle. Pour approximately ninety percent (90%) of the mix water into the mixing container; then add the bagged material while continuing to mix. Add remaining water as needed. Mix time shall not exceed five (5) minutes.
- C. Application:
- a. Apply bonding adhesive such as Concrevice Liquid LPL or Concrevice Standard Liquid.
 - b. Place and finish with trowel or screed. In hot, windy, or dry conditions, where rapid surface evaporation may occur, apply evaporation reducer.
- D. Curing: Apply MasterkuIo 200 W curing compound in accordance with label instructions.

3.3 FIELD QUALITY CONTROL

A. Field Tests:

1. When OWNER is to perform grout testing, CONTRACTOR shall assist OWNER or the concrete testing consultant as requested during the performance of quality control testing.
2. When prescribed in the DRAWINGS or by these SPECIFICATIONS, length change test specimens will be taken during construction from the first placement of each type of mortar, and at intervals thereafter as selected by ENGINEER to ensure continued compliance with these SPECIFICATIONS. Unless otherwise specified in the DRAWINGS or SPECIFICATIONS the testing will be performed by OWNER or testing representative.
3. When required, length change tests and fabrication of specimens for cement based mortar shall be performed as specified in ASTM C1012 at intervals during construction as selected by ENGINEER. A set of three (3) specimens will be made for testing at seven (7) and twenty eight (28) days.
4. All mortar, already placed, that fails to meet the requirements of this SPECIFICATION, shall be subject to removal and replacement at the cost of CONTRACTOR.
5. Unless otherwise specified in the DRAWINGS or SPECIFICATIONS, the cost of all laboratory tests on grout shall be borne by OWNER, but CONTRACTOR shall assist ENGINEER in obtaining specimens for testing. However, CONTRACTOR shall be charged for the cost of any additional tests and investigation of WORK performed which does not meet the SPECIFICATIONS.

END OF SECTION

SECTION 11 68 13 – PLAYGROUND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Play Equipment
 - a. Final play equipment selections and colors shall be selected by the landscape architect prior to construction.

1.2 SUBMITTALS

A. Submittals for Review:

1. Product Data: Provide product data on equipment showing materials, colors, finishes, operating characteristics, and installation methods.
2. Provide shop drawings indicating proposed footings and method of mounting.

1.3 QUALITY ASSURANCE

- A. Provide copy of manufacturer's warranty with product data submittal.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Playground equipment and play structures shall be the make and model as indicated in the Drawings or an approved equal.
- B. All equipment shall be inspected for damage and or defect at the time of delivery by a representative from Paterson Habitat for Humanity. Damage components shall be replaced prior to installation.
- C. The contractor is responsible for storing and protecting equipment from the time of delivery until final acceptance.
- D. Components or equipment damaged prior to final inspection and acceptance shall be replaced at no cost to Paterson Habitat for Humanity.

PART 3 EXECUTION.

3.1 INSTALLATION

- A. Install all equipment and components in accordance with manufacturer's instructions and approved Shop Drawings at the locations indicated in the Drawings.
- B. The exact location of all playground equipment shall be approved by the landscape architect prior to installation.

1. Location and layout of all playground equipment shall be included in the prices bid for the various items. The Contractor shall be provided with an electronic Autocad format drawing of the equipment locations to assist in layout.
- C. Set components level, plumb, aligned, and rigid.
- D. The Contractor shall be fully responsible for coordinating the construction of footings and playground installation with the construction and location of base courses, drainage, utilities and slope stabilization, so as to protect all work already in place and avoid conflicts. Notify the Architect immediately if a conflict in location arises.
- E. All equipment must be installed by certified play equipment installer and checked by certified playground inspector prior to project completion.

3.2 ADJUSTING

- A. Lubricate operable parts.
- B. Adjust operable components for proper operation.

PART 4 MEASUREMENT AND PAYMENT

- 4.1 All play equipment unit cost on the bid form includes materials only.
- 4.2 All cost for installation of playground equipment, including footings, hardware, tools, materials and labor, shall be included under the play equipment installation item on the bid form.

END OF SECTION

SECTION 22 11 00 – WATER DISTRIBUTION

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes water-distribution piping and specialties outside the building for the following:
 - 1. Water supply to drinking fountains, misters and other exterior equipment requiring domestic water service.
- B. Contractor furnished products as required by the approving Authority to construct and test a complete working water service system as indicated on the plans.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Water Piping Installation
 - 2. Piping specialties.
 - 3. Valves and accessories.
 - 4. Fittings.
- B. Shop Drawings: For the following:
 - 1. Water main piping, fittings and accessories.
 - 2. Valves
 - 3. Testing Procedures
- C. Coordination Drawings: For piping and specialties including relation to other services in same area. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- D. Field Quality-Control Test Reports: From Contractor.
- E. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 include the following:
 - 1. Connections
 - 2. Valves.
- F. Record Drawings: At project closeout, submit record as-built drawings of installed water piping in accordance with contract requirements and authority having jurisdiction.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.

2. Comply with standards of authorities having jurisdiction for potable water-service piping, including materials, installation, testing, and disinfecting.
 3. Comply with standards of authorities having jurisdiction for fire-suppression water service piping, including materials, hose threads, installation, and testing.
- C. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined 10 NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fixed suppression.
- G. NSF Compliance:
1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, according to the following:
1. Ensure that valves are dry and internally protected against rust and corrosion.
 2. Protect valves against damage to threaded ends and flange faces.
 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, according to the following:
1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.6 PROJECT CONDITIONS

- A Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.

1.7 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 POLYETHYLENE (PE) PIPE AND MATERIALS

- A Pipe Requirements – ADS potable water service tubing shall meet the requirements of ASTM D2737, AWWA C901 and NSF Standards 14 and 61. Pipe dimensions shall meet Copper Tubing Size (CTS) standards.
- B Material Properties – Tubing material shall be high-density polyethylene conforming to the minimum requirements of cell classification 445574E as defined and described in ASTM D3350. The resin shall have a material designation code of PE4710 by the Plastic Pipe Institute.

2.3 COPPER TUBE AND FITTINGS

- A Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.
 - 1. Copper Tube: ASME B16.18, cast-copper-alloy or ASME B 16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
- B Hard Copper Tube: ASTM B 88, Type K water tube, drawn temper.
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

2.4 DUCTILE-IRON PIPE AND FITTINGS

- A Class 52 Ductile Iron Cement Lined (Double thickness) US Pipe Tylon.
 - 1. Joint with Fieldlok Gasket (US Pipe or equal) fittings shall be mechanical joint with retainer glands (Ebba Iron Series I 100 mega lugs). All pipes/fittings to be encased in 8 mil polyethylene encasement-Repacor-8 mil ASTM D1248-89 TYPE 1 Black.

2.5 CORROSION-PROTECTION ENCASUREMENT FOR PIPING

- A Encasement for Underground Metal Piping: PE film, 0.008-inch minimum thickness, tube or sheet.

2.6 GATE VALVES

- A A WWA, Cast-Iron Gate Valves: or as per the approving authority.
 - 1. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA CS09, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Mueller Model No. A-2360-20 (mj) or A-2360-6 (f).
 - a. Minimum Working Pressure: 200 psig.
 - b. End Connections: Mechanical joint.

- c. Interior Coating: Complying with A WWA CSSO.

2.7 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Tapping-Sleeve Assemblies: Comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.
 - 1. Ductile Iron Type - as approved by the Authority having jurisdiction Mueller Model No.
 - a. H-615 (sleeve) for DIP.
 - b. H-GS7 (valve)
 - c. H-619 (sleeve) for A.C. pipe.
 - d. Smith-Blair model 663 stainless steel sleeve \V /304 5.S. nuts and bolts for A.C.
 - e. pipe (16" diameter or larger)
 - B. Valve Boxes: Comply with A\VWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with. Lettering "WATER," bottom section with base of size to fit over valve, and approximately 5-inch diameter barrel. 5 in. shaft, 2 piece Bing HDM & Taylor fig. No. 4908 or Tyler pipe.

2.8 CHECK VALVES

- 1. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.
- 2. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching Curb valve.

2.9 DETECTOR CHECK VALVES

- A. Mueller model A-2130-6 or as approved by the Water Authority.

2.10 DETECTABLE WARNING TAPE

- A. Detectable warning tape, with a minimum 5.0 mil overall thickness and a solid aluminum foil core. Tape meet the APWA approved Color-Code shall have permanent printing to meet or exceed industry standards. Tape width shall be 2" for maximum 12" depth, 3" for 12"-18" depth and 6" tape for maximum 24" depth.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- C. Install piping by tunneling, jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- D. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.
 - 1. Terminate piping with caps, plugs, or flanges as required for piping material on plans.
- E. All pipe shall be laid on a solid, dry foundation. Pipe shall be laid true to the lines and grades shown on the Contract Drawings with the bell ends upstream. Each section of pipe shall rest upon

the pipe bed the full length of its barrel and for a minimum of one-half its diameter with recesses excavated to accommodate bells and joints. Any pipe which has its grade or joints disturbed after laying shall be taken up and re-laid at the Contractor's expense. The Contractor shall close the ends of all unconnected pipe with a waterproof stopper. Bedding shall be in conformance with the standard detail.

- F. All pipes and joints shall be installed in accordance with the manufacturer's requirements. When the requirements contained in this specification exceed the manufacture's specifications, the specifications contained herein shall govern.
- G. Piping and appurtenances shall be cleansed of foreign matter before being lowered into the trench and shall be kept clean during the laying operations by plugging or other approved means. Cutting of pipe shall be done in a neat and workmanlike manner with an approved type of mechanical cutter without damage to the pipe or lining so as to leave a smooth end at right angle to the axis of the pipe.
- H. All gaskets and mating surfaces shall be thoroughly cleaned and lubricated in accordance with the manufacture's specifications. The pipe shall be aligned with the previously installed pipe and, with gasket in place, put together. After pipes are put together, the joint shall be inspected to verify that the gasket is properly positioned and that the joint has been properly made and is tight.

3.2 ANCHORAGE INSTALLATION

- A. Install anchorage for tees, plugs and caps, bends, crosses, valves, and hydrant branches.
- B. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.3 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FM Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- D. Water-Regulating Valves: Install in vault or aboveground between shutoff valves. Install full-size valved bypass.
- E. E. Relief Valves: Install aboveground with shutoff valve on inlet.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve as required by jurisdiction having authority.
- C. Ground equipment according to Division 16 Section "Grounding and Bonding."
- D. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently, if applicable. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. The Contractor shall provide for hydraulic pressure test of the water main before making the final connection into existing pipes as follows or as required by the authority having jurisdiction:
 - 1. Hydraulic pressure testing shall conform to A WW A Standard C-600.
 - 2. A hydrostatic test pressure shall be maintained in the pipeline for minimum period of two (2) hours. At the end of the test period, if the test pressure has remained constant, the pipeline shall have passed the test. If the pipe does not hold pressure, the Contractor shall locate the leak, permanently repair the section of piping where the leak is occurring to the satisfaction of the Authority having jurisdiction, and retest the pipe line as specified above. This process shall be repeated until the pipeline has successfully passed the pressure test.
 - 3. Contractor shall make certain that all air is expelled from a pipeline before it is tested. All caps, plugs, and fittings shall be adequately braced and anchored to withstand the test pressures.
 - 4. Hydrostatic test pressure shall be 150 psi or 1.5 times the working pressure measured at the highest elevation in the pipeline under test, whichever is greater.
 - 5. The leakage test may be performed concurrently with the pressure test. If no pressure drop is seen during pressure test, the leakage test may be waived by the authority having jurisdiction.
 - 6. If leakage is encountered during the hydrostatic test, the Contractor shall begin this leakage test which shall be accomplished by increasing the hydrostatic pressure to a specified value and maintaining of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain the specified leakage test pressure after the air in the pipeline has been expelled.
 - 7. The hydrostatic pressure for the leakage test shall be 150 psi.
- C. Prepare reports of testing activities and submit to Owner and authority having jurisdiction.

3.6 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-serving piping. Locate below finished grade, directly over piping.

WATER SERVICE DISINFECTION

- A. All water pipelines shall be disinfected in conformance with the latest edition of A WWA Standard C-651 for disinfecting water mains prior to being put into service. Hypochlorite and liquid chlorine for use in disinfection shall conform to A WW A Standards B-300 and B-301, respectively.
- B. All pipelines shall be thoroughly flushed before introduction of chlorinating material which shall be done in an approved manner. The amount of chlorine applied shall be such as to provide a dosage of not less than 50 parts per million. The chlorinated water shall be retained in the main for at least 24 hours during which time all hydrants and valves in the section treated shall be operated to be disinfected. The heavily chlorinated water shall then be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system. The Contractor shall then have samples taken by an approved testing laboratory and bacteriological analyses made. Should the initial treatment prove ineffective, disinfection shall be repeated until satisfactory samples must be obtained.
- C. After final flushing and before the water main is placed in service, a sample or samples shall be collected from the end of the line and along the length of the mains .. If corporation stops for

water services are not available or if additional ones are needed to perform bacteriological tests, the Contractor shall install them at no additional cost to the Owner. Upon successful completion of bacteriological tests, the additional corporation stops shall be shut off and abandoned. Samples shall be tested for bacteriological quality in accordance with Standard Methods, and shall show the absence of coliform organisms.

- D. Prepare reports of purging, disinfecting activities and provide bacteria test results and chain of custody documentation to the Owner and authority having jurisdiction.

END OF SECTION

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing site utilities.
7. Cleaning existing inlets.

1.2 MATERIAL OWNERSHIP

- ##### A.
- Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PROJECT CONDITIONS

- ##### A. Traffic:
- Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

- ##### B. Salvable Improvements:
- Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or specified.

- ##### C. Utility Locator Service:
- Notify New Jersey One Call for area where Project is located before site clearing.

- ##### D.
- Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

- ##### E.
- The following practices are prohibited within owner designated protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 Earth Moving.
 - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
- B. New bathroom door shall be of the same material and finish as the existing door. Paint new door as required to match existing. Provide submittal for replacement door.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary soil erosion and sedimentation control measures in accordance with Section 31 25 00 Soil Erosion and Sediment Control.

3.3 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to the Drawings and local requirements.
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by the Engineer.

3.4 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction as shown on plans.
 1. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 2. Use only hand methods for grubbing within owner designated protection zones.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to a minimum depth of 4 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and dispose accordingly. Remove off site in accordance with local, state, and federal regulations.
- B. Separate recyclable materials produced during site clearing from other non-recyclable materials shall be stored or stockpiled without intermixing with other materials and transport them to recycling facilities. This process shall not interfere with other Project work.

3.8 CLEANING EXISTING INLETS

- A. Remove debris and vacuum clean soil and water from existing inlets, where shown on the Plans. Disposal of material in accordance with this Section.
- B. The cost of cleaning existing inlets shall be included in the price bid for "Clearing Site".

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 Site Clearing shall be paid as a Lump Sum. Cleaning of existing inlets shall be included in the price bid for "Site Clearing".

4.2 Removal and disposal of unsuitable material, where directed, shall be paid under the bid item "Site Clearing".

4.3 Removal of dead planting and debris shall be paid under the bid item "Site Clearing".

END OF SECTION

SECTION 31 20 00 – EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Site grading.
 2. Preparing subgrades for slabs, walks, pavements, turf and grasses, and plants.
 3. Subbase course for concrete walks and pavements.
 4. Subbase course and base course for asphalt paving.
 5. Excavating and backfilling for utility trenches

1.2 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill
- E. Drainage Course: Aggregate layer supporting the ground floor slab that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Engineer or his designated representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Engineer or his designated representative. Unauthorized excavation, as well as remedial work directed by the Engineer or his designated representative, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. Yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Excavation of Footings, Trenches, and Pits: track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.

2. Bulk Excavation: track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general purpose bare bucket; measured according to SAE J -732.
 - I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
 - J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
 - K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
 - L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.
- 1.3 REFERENCE STANDARDS
- A. American Society for Testing and Materials (ASTM):
 - ASTM C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
 - ASTM D422 Test Method for Particle Size Analysis of Soils
 - ASTM D448 Classification for Sizes of Aggregates for Road and Bridge Construction
 - ASTM D1557 Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³)
 - ASTM D2487 Classification of Soils for Engineering Purposes
 - ASTM D2940 Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- 1.4 QUALITY ASSURANCE
- A. Pre-excavation Conference: Conduct conference at designated location.
- 1.5 SUBMITTALS
- A. Material Test Reports: From a qualified testing laboratory retained by the Contractor indicating and interpreting test results for compliance of the following with requirements indicated:
 1. Gradation analysis according to ASTM D422 and classifications according to ASTM D2487 of each borrow soil material, dense graded aggregate base course, and gravel base course. Gradation analyses and classification of additional samples of each borrow soil shall be performed at a frequency of one analysis per 5,000 cubic yards of material.
 - B. Samples: For the following:
 1. 30-lb samples, sealed in airtight containers, of each proposed soil material from borrow source.
 - C. Bills of Lading and Affidavit of No Contamination: For all borrow soil, the following documentation that the material supplied is not contaminated shall be submitted and accepted by the Engineer or his designated representative:
 1. Bills of lading documenting the source of the fill, with the name of the person certifying that it is not contaminated and the relationship of the person certifying the fill to the source of the fill;

2. The location where the fill was obtained, including the street, town, lot and block, and state, and a brief history of the site which is the source of the fill;
 3. A statement that to the best of the certifier's knowledge and belief, the fill being provided is not contaminated pursuant to any applicable remediation standard and a description of the steps taken to confirm such.
- D. No borrow soil shall be brought on-site until the materials and their documentation are deemed acceptable by the Engineer or his designated representative.
- E. Documentation of Proper Disposal of Waste Material: For material disposed off-site, documentation from the disposal facility for the delivered material, e.g. waste manifests.

1.6 PROJECT CONDITIONS

- A. Utility Locator Service: Notify New Jersey One Call for area where Project is located before beginning earth moving operations.
- B. Do not commence earth moving operations until plant-protection measures are in place.

PART 2-PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations and where required by the Contract Documents.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.
- D. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- E. Dense Graded Aggregate Base Course (DGA): Conform to New Jersey Department of Transportation Specification for Road and Bridge Construction (2007) section 901.10.
- F. Gravel Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand conforming to AASHTO No. 57 stone mix. Submittal shall be approved before ordering.
- G. Engineered Fill: Naturally or artificially graded mixture of natural sand or sand and gravel mixture imported from an off-site borrow source; 100 percent passing a 1-1/2-inch sieve, not more than 40 percent by weight passing a No. 40 sieve, and not more than 12 percent by weight passing a No. 200 sieve. The portion passing the No. 40 sieve shall be nonplastic.

Bedding Material and Underslab Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel meeting the requirements of ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

- H. 3/8" Crushed Stone: Naturally or artificially graded mixture of natural or crushed gravel or crushed stone, wash free of dust and fines, conforming to AASHTO No. 8 stone mix. Submittal shall be approved before ordering.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3-EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth work operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR WALKS, PAVEMENTS, PLAY FIELD, AND TOT AREAS

- A. Excavate surfaces under walks, pavements, playfield and tot areas to indicated lines, cross sections, elevations, and subgrades.

3.4 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit.
 - 1. Clearance: Minimum 4 inches each side of pipe or conduit.
- B. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
- D. Excavate trenches as shown on Contract Drawings to allow for bedding course.
- E. Trenches in Tree- and Plant-Protection Zones:
 - 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots accordingly.

3.6 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required

3.7 SUBGRADE INSPECTION

- A. Proof-roll subgrade below the pavement sections with a minimum of four passes of a vibratory roller or plate compactor weighing at least 200 pounds and imparting a dynamic force of a least 2-1/2 tons prior to the placement of fabric, stone, concrete structures or any other material. Do not proof-roll wet or saturated subgrades.
- B. Excavate soft or unstable areas to a depth of three feet below ground surface and backfill with Engineered Fill.
- C. All proofrolling to be performed under the observation of the Engineer or his designated representative.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Engineer, without additional compensation.

3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by the Engineer.
- B. Fill unauthorized excavations under other construction, pipe, or conduit as directed by the Engineer.

3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding material on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

- C. Trenches under Footings: Backfill trenches excavated under footings with Satisfactory Soils.
- D. Trenches under Roadways: Provide bedding materials as shown on Contract Drawings. After installing and testing, backfill in accordance with Contract Drawings.
- E. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under landscaped areas, use Satisfactory Soils.
 - 2. Under playfield, tot area, and pavements, use Engineered Fill.
 - 3. Under steps and sidewalks, use Engineered Fill.
 - 4. Under building slabs, use Satisfactory Soils.

3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:
 - 1. Under, steps, and pavements, compact each layer of backfill or fill soil material to a minimum of 95 percent of maximum dry density.
 - 2. Under walkways, play field, and tot play areas, compact each layer of backfill or fill soil material to a minimum 92 percent of maximum dry density.
 - 3. Under landscaped areas, compact each layer of backfill or fill soil material to a minimum of 85 percent of maximum dry density.
 - 4. For utility trenches, compact each layer of backfill to minimum 92 percent of maximum dry density

3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Play field, tot areas and landscaped areas: Plus or minus 1 inch.
 - 2. Walks and Pavements: Plus or minus 1/2 inch.

3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course under pavements and walks as follows:
 - 1. Shape subbase course to required crown elevations and cross-slope grades.
 - 2. Place subbase course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 3. Compact subbase course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight ASTM D1557.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: The contractor is responsible to engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing and approval determinations as the soils engineer. The contractor is to cooperate with the soils consultant in all respects and shall provide samples of each type of fill material used so that various tests may be performed to ascertain compliance with the specifications.
- B. Allow testing agency to inspect and test sub grades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect/Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained with no additional compensation from the owner.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil and waste materials, including Satisfactory Soils, Unsatisfactory Soils, trash, and debris, and dispose in accordance with all pertinent laws and regulations.
- B. Contractor is responsible for all expenses associated with the sampling and testing of soil for waste characterization purposes in accordance with the requirements of the approved disposal facility.

PART 4-MEASUREMENT AND PAYMENT

- 4.1 The cost of earth moving, cuts and fills as required to meet the lines, grades and subgrades prescribed in the Drawings shall be paid under the lump sum price bid for “Earthwork”. All costs for importing required fill material or exporting excess soil material, except material falling under “unsuitable material”, shall also be included in the price bid for “Earthwork”.
- 4.2 Removal of unsuitable material, which is deemed not suitable for fill or use elsewhere on the site, shall be made at the direction of the City of Paterson.
- 4.3 The price bid for Gravel Base shall include the cost of underlying filter fabric.

END OF SECTION

SECTION 31 23 00 - EXCAVATION AND FILL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating for structures and site components.
 - 2. Filling.
 - 3. Trenching.
 - 4. Backfilling.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - 3. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - 4. D2487 - Standard Classification of Soils for Engineering Purposes.
 - 5. D2922 - Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. D4254 - Standard Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.
 - 7. D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 SYSTEM DESCRIPTION

- A. Limits of Work: Do not extend earthwork beyond areas of excavation or construction shown on Drawings or reasonably necessary for performance of Work.
- B. Contractor is responsible for design of temporary earth retention systems.

1.4 SUBMITTALS

- A. Statement describing the method of dewatering and disposing of water.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Sand: Natural river or bank sand, washed, free from silt, clay, loam, friable or soluble materials, and organic matter:
- B. Common Fill: In general, soil materials shall be free of debris, roots, wood, scrap material, vegetative matter, refuse, soft unsound particles, frozen, deleterious or objectionable materials. Maximum particle size shall be 3 inches.

1. General site fill material shall be friable soil without clods of clay and shall conform to the general requirements for soil materials.
2. General site fill shall possess the characteristics required for compaction to the values of soil density herein specified for the location of intended use.
3. General site fill shall be classified as SW, SP or SM by ASTM D2487.
4. General site fill shall have a dry maximum density of not less than 105 pounds per cubic foot per ASTM D1557.
5. General site fill may be re-used site soils provided it meets the above conditions.

2.2 SOURCE QUALITY CONTROL

- A. Testing and Inspection Services: Test Engineered Fill prior to placement:
1. Liquid limit, plastic limit, and plasticity index: Test to ASTM D4318.
 2. Moisture/density relationship: Test to ASTM D698.
 3. Provide soil description; determine compliance with gradation and quality requirements.

PART 3 EXECUTION

3.1 EXCAVATING

- A. Excavate to grades and subgrades indicated. Make excavations large enough to permit placing and inspection of work.
- B. Stockpile excavated materials that are suitable for reuse separately from subgrade material.
- C. Remove and dispose of excavated material that is unsuitable or not required for backfilling. Remove underground obstructions.
- D. Brace sides of excavations where necessary; maintain until permanent construction is in place. Remove temporary shoring and bracing as backfill is placed.
- E. Excavation for Structures:
1. Form bottoms of excavations reasonably level.
 2. Maintain moisture level in excavations as near their natural level as possible.
- F. Keep excavations free of water.

3.2 FILLING

- A. Prior to placing fill on existing subsoils:
1. Proof roll to detect soft and weak zones. Remove soft and spongy soils down to firm subsoil.
 2. Replace undercut areas with Fill placed in maximum 12 inch deep loose, even, horizontal lifts. Compact each lift to 90 percent of ASTM D698 standard Proctor maximum dry density.
- B. Fill low areas outside of structures and under paving with Common Fill to achieve required grades and elevations.
1. Place fill in maximum 12 inch deep loose, even, horizontal lifts.
 2. Compact each lift to 90 percent of ASTM D698 standard Proctor maximum dry density.

- C. Fill under structures with Dense Graded Aggregate.
 - 1. Place fill in maximum 6 inch deep loose, even, horizontal lifts.
 - 2. Compact each lift to 95 percent of ASTM D698 standard Proctor maximum dry density at optimum moisture level.
- D. Do not fill over porous, wet, frozen, or soft subgrades.
- E. Bench fill into slopes.
- F. When moisture must be added to aid in compaction, uniformly apply water to surface, but do not flood. Free water shall not appear on surface during or after compaction operations.
- G. Scarify soil too wet for proper compaction and allow to dry. Replace and recompact.
- H. Uniformly grade areas to smooth surface at required grades and elevations. Adjust contours to eliminate water ponding and provide positive drainage. Make grade changes gradually. Blend slopes into level grades.
- I. Tolerances: Within plus or minus 1 inch of required subgrade elevation.

3.3 TRENCHING

- A. Cut trenches sufficiently wide to allow for installation of utilities and for inspection of work.
- B. Hand trim excavations; remove loose matter.
- C. Remove rocks and obstructions.
- D. Correct over-excavation by use of lean concrete or pipe bedding material.
- E. Keep trenches free of water.

3.4 BACKFILLING

- A. Backfill in six (6) inch lifts in accordance with subsection 3.2 above.

3.5 CLEANING

- A. Remove surplus materials and those not suitable for reuse from site.

3.6 PROTECTION

- A. Protect graded areas from traffic and erosion; keep free of trash and debris.

END OF SECTION

SECTION 31 23 19 - DEWATERING

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. This Section includes construction dewatering.
- B. Related Sections include the following:
 - 1. Section 31 20300 "Excavation and Fill" for excavating, backfilling, and site grading.

1.3 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, provide, test, operate, monitor, and maintain a dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.
 - 1. Work includes removing dewatering system when no longer needed.
 - 2. Contractor to maintain dewatering operations to ensure erosion is controlled, stability of excavations and constructed slopes is maintained, and flooding of excavation and damage to structure are prevented.
 - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 4. Accomplish dewatering without damaging existing buildings and site improvements adjacent to excavation.

1.4 SUBMITTALS

- A. Shop Drawings: For dewatering system, where applicable show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.
 - 1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Photographs or videotape, sufficiency detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations
- C. Record drawings at Project closeout identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.
- D. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform dewatering who has specialized in installing dewatering systems similar to those required for this Project and with a record of successful in-service performance.

- B. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities sending facilities occupied by the Owner or others unless permitted in writing by the Owner and/or Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. The contractor shall make test borings and/or conduct other exploratory operations as required to design the dewatering system, if necessary.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities must have permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

3.2 DEWATERING

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
- B. Before excavation below ground-water level, place system into operation to lower water to specified levels and then operate it continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level a minimum of 24 inches (600 nun) below surface of excavation.

- E. Dispose of water removed from excavations in a manner to avoid endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner to avoid inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on a continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 nun) below overlying construction.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION

SECTION 31 25 00 – SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

The work covered by this section consists of the installation and maintenance of all erosion and siltation control devices, wash down areas, or seeding and sodding applications necessary to effectively prevent storm water pollution of adjoining or downstream areas that may occur as a direct or indirect result of the construction of this project. The contractor is responsible for installing and maintaining all soil erosion and sediment control measures as shown on the Drawings. These measures include silt fence, inlet filters, tree protection and stabilized construction entrance.

PART 2 – PRODUCTS

- 2.1 All materials shall be as noted and detailed on the Soil Erosion and Sediment Control plans certified by the local Soil Conservation District.

PART 3 – EXECUTION

3.1 GENERAL

- A. It is the responsibility of the Contractor to utilize whatever techniques are necessary to address erosion problems as they occur during construction.
- B. Siltation control and sediment trapping devices shall be installed prior to site clearing, grading or utility construction operations. All devices should be positioned so as to effectively remove silt from storm water before it leaves the site. Of particular concern, are gravel or stone blankets placed at construction traffic exits and entrances. These controls should be closely monitored to see that they trap sediment before it reaches the existing street and drainage system.
- C. Construction activities should be phased to expose a minimum of graded area at one time. Earth exposed by the construction process shall be re-vegetated every two weeks until vegetation is established. Re-vegetation shall require seeding, hydromulching or sodding. Fresh growth of vegetation shall eliminate the need for additional re-vegetation but does not constitute stabilization.
- D. Should a construction process remove any portion of the perimeter controls, the controls should be replaced in accordance with the local regulations. Prior to the completion of the project, all bare areas shall be re-vegetated with a cellulose fiber hydromulch seeding process or sodded.
- E. Siltation control devices placed at storm drain inlets and culverts shall be removed by the Contractor once the site has been stabilized.

3.2 MAINTENANCE AND INSPECTION

- A. The contractor shall familiarize himself with the local erosion control requirements. The site superintendent, or his representative, shall make a visual inspection of all structural and/or natural controls and newly stabilized areas as shown on the Drawings, especially after a rainfall to ensure that all controls are maintained and properly functioning. Any damaged controls shall be repaired prior to the end of the work day, including re-seeding and mulching or re-sodding if necessary. All inspections shall be documented with a written report. Reports shall include the effectiveness of erosion control measures, construction activities conducted since the last report and their location.
- C. The Contractor shall be responsible for any and all materials, improvements, and maintenance activities necessary to keep dust, silt, and mud from leaving the work zone, including being tracked by vehicles traveling throughout the zone.
- D. Should, in the opinion of the Owner, the Contractor fail to prevent the escape of dust or contain silt and mud within the project, after due notification by the City of Paterson Representative, Owner forces will be used to clean up those affected areas, and the cost of same will be deducted from the contract.
- E. Prior to Substantial Completion, the Contractor shall verify that no dust, silt, or mud exists within the work zone in deposits deeper than two inches (2") as a result of the contractor's containment procedures. Should the Contractor claim final completion without removing such deposits, they will be removed by Owner forces and the cost of which shall be deducted from the contract.

PART 4-MEASUREMENT AND PAYMENT

4.1 Soil Erosion and Sediment Control will be paid as a Lump Sum item, which shall include implementation of all measures in accordance with the Drawings or as directed. The cost for maintaining, cleaning, servicing, repairing or replacing such devices or items shall be included in the lump sum price bid for Soil Erosion & Sediment Control. No addition compensation will be made for replacing items damaged during construction.

4.2 The cost for dust control measures shall be included in the price bid for the item "Earthwork".

END OF SECTION

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot-mix asphalt patching.
2. Hot-mix asphalt paving.
3. Hot-mix asphalt paving overlay.
4. Hot-mix asphalt sidewalk.
5. Pavement-marking paint.

B. Related Sections:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Material Certificates: For each paving material, from manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the NJDOT.

B. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of NJDOT for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

C. Pre-installation Conference: Conduct conference at Project site.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Tack Coat: Minimum surface temperature of 60 deg F .
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- B. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
- C. Mineral Filler: ASTM D 242 or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22.
- B. Tack Coat: ASTM D 977 or AASHTO M 140 emulsified asphalt, or ASTM D 2397 or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint or Match Existing Conditions.
 - 1. Color: As indicated on Project Drawings.
- C. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint or Match Existing Conditions.
 - 1. Color: As indicated on Project Drawings.
- D. Wheel Stops: Solid, integrally colored, 96 percent recycled HDPE or commingled postconsumer and postindustrial recycled plastic; UV stabilized; 4 inches high by 6 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.

2.4 MIXES

- 1. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by NJDOT.
- 2. HMA sidewalk shall consist of a base course of 25M64 and a surface course of 9.5M64.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

- C. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 1. Spread mix at minimum temperature of 250 deg F.
 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 1. Clean contact surfaces and apply tack coat to joints.
 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."

3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to 185 deg F.
 2. Compact HMA sidewalk with rollers weighing at least 1/2 ton.

- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.8 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with the owner and Landscape Architect.
- B. Allow paving to age for 15 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.
- B. Replace and compact hot-mix asphalt where core tests were taken.

- C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 HMA courses for asphalt shall be measured and paid by the square yard for the thicknesses of each respective HMA course as detailed in the Drawings.
- 4.2 Payment of dense graded aggregate base course underlying asphalt shall be included under the bid item “Asphalt Paving”.
- 4.3 Payment of asphalt restraint shall be included under the bid item “Asphalt Paving”.
- 4.4 Paint work on top of asphalt paving shall be considered as volunteer work from the community and not be included in the payment for “Asphalt Paving”.

END OF SECTION

SECTION 32 15 40 – DECOMPOSED GRANITE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the decomposed granite paving as shown on the drawings and/or specified herein.

1.3 SUBMITTALS

- A. Submit manufacturer's product data and installation instructions.
- B. Submit 1 – 1/4 lb. bag sample of paving system material for review.
- C. Submit material certificates for base course and fill materials.

1.4 INSTALLATION MOCKUP

- A. Prior to installation of decomposed granite paving, construct at the site, a 5'x5' mockup following detail drawings and materials for approval by Landscape Architect.
 - 1. The mockup area may remain as part of the installed work at the end of the project if protected from further compaction, contamination or other disturbance.

1.5 QUALITY ASSURANCE

- A. Contractor shall provide the following information to assist in confirmation of the Contractor's ability to complete work of this Section:
 - 1. Client references from the last 3 years.
- B. Installer Qualifications: Installations of work specified in this section shall be by firm(s) which can exhibit proof of a minimum of five (5) years' prior successful experience with installations of equivalent type and similar scope of this Project.
 - 1. Foreman: Installation firm for work of this Section of this Project shall have on staff a supervising Foreman assigned full time to this Project, from time of mock-up installations, who shall have at least 10 years' total installation experience and with at least 5 years' experience in installations of equivalent or more extensive type and scope to this Project. Submit detailed resume of past experience with dates, duration and scope identification, Project Name and location, and work function of previous projects worked on.
 - 2. Use numbers of skilled workmen equal to work requirement or occasion. The skilled workmen shall be thoroughly trained and experienced in the necessary crafts and shall be completely familiar with specific requirements and methods needed for performance of the work of this Section.
- C. Installation: Performed only by skilled work people with satisfactory record of performance on landscaping or paving projects of comparable size and quality.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect paving system materials from damage during delivery and store under tarp when time from delivery to installation exceeds one week.

1.7 PROJECT CONDITIONS

- A. Review installation procedures and coordinate the porous paving work with other work affected.
- B. All hard surface paving adjacent to decomposed granite paving areas, including concrete walks and asphalt paving, must be completed prior to installation of decomposed granite paving.
- C. Cold Weather
 - 1. Do not use frozen materials or materials mixed or coated with ice or frost.
 - 2. Do not build on frozen work or wet, saturated or muddy subgrade.
- D. Protect partially completed paving against damage from other construction traffic when work is in progress.
- E. Protect adjacent work from damage during decomposed granite paving installation.

1.8 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the installer agreeing to repair or replace components of stabilized surfacing that fail in materials or workmanship within the specified warranty period. Stabilizer Solutions, Inc. does not warrant imitation "Stabilizer" purchased from a non-approved Stabilizer Solutions, Inc. licensee. Failures include, but are not limited to, the following:
 - 1. Premature wear and tear provided the material is maintained in accordance with manufacturer's written maintenance instructions.
 - 2. Failure of system to meet performance requirements.
- C. Maintenance Period: Contractor shall provide warranty for performance of product. Contractor shall warrant installation of product for the time of one year from completion.
- D. Contractor shall provide, for a period of sixty days, unconditional maintenance and repairs as required.

1.9 ATTIC STOCK

- A. Furnish Owner with the following excess materials for use in future decomposed granite aggregate surfacing repair: 40 to 50 lb. bags of the aggregate paving blended with proper amount of Stabilizer.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Base Course: As recommended.
- B. Filter Fabric: Geotextile fabric
- C. Decomposed Granite Paving Fill: Decomposed Granite as supplied by Green Pro Materials Engineered Sands and Soil or approved equal. Color Salt & Pepper.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions where decomposed granite paving is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.
- B. Examine subgrade and base course installed conditions. Do not start paving installation until unsatisfactory conditions are corrected. Check for poor drainage, improperly compacted trenches, debris, and improper gradients.
- C. Place decomposed granite paving only at locations indicated on the drawings.

3.2 PREPARATION

- A. Blend 12 to 16-lbs (call manufacturer for exact blend) of stabilizer per 1-ton of decomposed granite or crushed 3/8" screenings. It is critical that stabilizer be thoroughly and uniformly mixed throughout decomposed granite or crushed 1/4" aggregate screenings. Bucket blending is not acceptable. Blending with a rake and or shovel is not acceptable. Blend material dry as water will make the material hard.

3.1 PLACEMENT

- A. After pre-blending, place the decomposed aggregate or 3/8" or 1/4" crushed aggregate screenings on prepared sub-grade. Level to desired grade and cross section.
- B. Depth of pathways – As per drawings.
- C. Place base course material over prepared subbase to grades shown on plans, in lifts not to exceed 6", compacting each lift separately to 95% Modified Proctor.
- D. Leave minimum 3" for decomposed granite paving fill to final grade.

3.2 INSTALLATION

- A. Water heavily for full-depth moisture penetration of the stabilized pathway profile. Water activates stabilizer. To achieve saturation of stabilized pathway profile, 25 to 45-gallons of water per 1-ton must be applied. During water application randomly test for depth using a probing device, which reaches full depth.
- B. Place decomposed granite paving to depths as indicated on drawings.
- C. Compact material.

- D. Upon thorough moisture penetration, compact aggregate screenings to 85% relative compaction by equipment such as; a 2 to 4-ton double drum roller or a 1,000-lb. single drum roller. The roller size will depend on the depth of the pathway. DO NOT use a vibratory plate compactor or vibration function on roller as vibration separates large aggregate particles. Do not begin compaction for 6 hours after placement and up to 48 hours.
- E. If surface aggregate dries significantly quicker than subsurface material, lightly mist surface before compaction.
- F. Take care in compacting decomposed granite or crushed 3/8" or 1/4" minus aggregate screenings when adjacent to planting and irrigation systems. Hand tamping with 8" or 10" hand tamp recommended.
- G. Water surface area with a light spray following compaction. Do not disturb paving surface spray actions.

3.3 INSPECTION

- A. Finished surface of pathway shall be smooth, uniform and solid. There shall be no evidence of chipping or cracking. Cured and compacted pathway shall be firm throughout profile with no spongy areas. Loose material will not be present on the surface after installation, but may appear after use and according to environmental conditions. Pathway should remain stable underneath the loose granite on top. It is a "natural" looking pathway, yet stable throughout. Any significant irregularities in path surface shall be repaired to the uniformity of entire installation.

3.4 MAINTENANCE

- A. Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed. Any plowing program required during winter months shall involve the use of a rubber baffle on the plow blade or wheels on the plow that lifts the blade 1/4" off the paving surface.
- B. During the first year, a minor amount of loose aggregate will appear on the paving surface (1/16" to 1/4"). If this material exceeds a 1/4", redistribute the material over the entire surface. Water thoroughly to the depth of 1". Compact with power roller of no less than 1000 lbs. This process should be repeated as needed.
- C. If cracking occurs, simply sweep fines into the cracks, water thoroughly and hand tamp with an 8" – 10" hand tamp plate.

3.5 REPAIRS

- A. Excavate damaged area to the depth of the stabilized aggregate and square off sidewalls.
- B. If area is dry, moisten damaged portion lightly.
- C. Pre-bend the dry required amount of stabilizer powder with the proper amount of aggregate in a concrete mixer.
- D. Add water to the pre-blended aggregate and stabilizer. Thoroughly moisten mix with 25 to 45 gallons per 1-ton of pre-blended material or to approximately 10% moisture content.
- E. Apply moistened pre-blended aggregate to excavated area to finish grade.

- F. Compact with an 8" to 10" hand tamp or 250 to 300 pound roller. Keep traffic off areas for 12 to 48 hours after repair has been completed.

3.6 CLEANING

- A. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 Payment of dense graded aggregate base course underlying decomposed granite shall be included under the bid item “Decomposed Granite”.
- 4.2 Payment of metal edging shall be included under the bid item “Decomposed Granite”.

END OF SECTION

SECTION 32 16 00– CURBS, GUTTERS, AND SIDEWALKS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This Section includes specifications for Portland cement, concrete curb and gutter, and concrete sidewalk.
- B. The complete WORK shall conform to the thicknesses and typical cross-sections shown on the DRAWINGS. The completed WORK shall conform to the lines and grades shown on the DRAWINGS or to those established by ENGINEER at the job site.

1.02 RELATED SECTIONS

- A. The following is a list of SPECIFICATIONS which may be related to this section:
 - 1. Section 31 23 00, Excavation and Fill.
 - 2. Section 3123 19, Dewatering.
 - 3. Section 31 23 33, Trenching and Backfilling.

1.03 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M6, Standard Specification for Fine Aggregate for Hydraulics Cement Concrete.
 - b. M80, Standard Specification for Coarse Aggregate for Hydraulics Cement Concrete.
 - c. M148, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - d. MI54, Standard Specification for Air-Entraining Admixtures for Concrete.
 - e. MI71, Standard Specification for Sheet Materials for Curing Concrete.
 - f. MI82, Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.
 - g. MI94M1M194, Standard Specification for Chemical Admixtures for Concrete.
 - h. T22, Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens.
 - i. T23, Standard Method of Test for Making and Curing Concrete Test Specimens in the Field.
 - j. T26, Standard Method of Test for Quality of Water to Be Used in Concrete.
 - k. T27, Sieve Analysis of Fine and Coarse Aggregates
 - 1. T96, Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

- m. T11, Standard Method of Test for Clay Lumps and Friable Particles in Aggregate.
 - n. T119M/T119, Standard Method of Test for Slump of Hydraulic Cement Concrete.
 - o. T121Mffl21, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - p. T141, Standard Method of Test for Sampling Freshly Mixed Concrete.
 - q. T152, Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - r. T176, Standard Method of Test for Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.
 - s. T199, Standard Method of Test for Air Content of Freshly Mixed Concrete by the Chace Indicator.
2. ASTM International (ASTM):
- a. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - b. C920, Standard Specification for Elastomeric Joint Sealants.
3. Colorado Department of Transportation (CD01):
- a. Section 703.01, Fine Aggregate for Concrete.
 - b. CP30, Sampling of Aggregates.
 - c. CP31A, Sieve Analysis of Fine and Coarse Aggregates.
 - d. CP60, Determining Surface Moisture in Fine and Coarse Aggregates.

1.04 SUBMITTALS

- A. CONTRACTOR shall cooperate with ENGINEER in obtaining and providing samples of all specified materials.
- B. CONTRACTOR shall submit certified laboratory test certificates for all items required in this section.
- C. Contractor shall submit mix design for concrete in writing to ENGINEER for approval prior to placement of concrete.
- D. CONTRACTOR shall submit batch tickets for each load of concrete. Tickets shall show weight of all materials and additives used in each batch.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete Conformance:

- 1. Concrete shall conform to the following requirements:

Concrete Requirements	
28- Day Field Compressive Strength	3,500 psi
Cement/ Fly Ash	600 lbs./ cu. Yd.

Max. Water/ Cement Ratio	0.53
Air Content % Ratio	5-8
Maximum Slump	4"
Fine Aggregate (max % of total Aggregate)	50%

2. This material shall consist of a mixture of coarse and fine aggregates, Portland cement, water and other materials or admixtures as required. The type of cement shall be Type I, or I/II unless sulfate conditions dictate otherwise. If sulfate conditions exist, Type V cement shall be used.

B. Concrete Aggregates: The grading and composition requirements for coarse and fine aggregates for concrete shall conform to the following tables:

Coarse Aggregates for Portland Cement Concrete	
Sieve Size or Test Procedure	% Passing or Test Requirement
1 inch	100
¾ inch	90-100
3/8 inch	20-55
No.4	0-10
No.8	0-5
% Wear	45, Max
Clay Lumps * Friable Particle's, %	2.0, Max
Coal & Lignites, %	0.5, Max
Sodium Sulfate Soundness %	12, Max

Fine Aggregates for Portland Cement Concrete	
Sieve Size or Test Procedure	% Passing or Test Requirement
¾ inch	100
No.4	95-100
No.16	45-80
No.50	10-30
No.100	2-10
No.200	3, Max
Friable Particles, %	80, Min
Coal & Lignite, %	2.50-3.50
Deleterious Material (AASHTO T112), %	3, Max
Sand Equivalent (AASHTO T176), %	80, Min
Fineness Modules	2.50-3.50
Sodium Sulfate Soundness, %	20.0, Max

C. Coarse Aggregate for Concrete: Coarse aggregates shall conform to the requirements of AASHTO M80, except that the percentage of wear shall not exceed forty-five (45) when tested in accordance with AASHTO 1'96. Coarse aggregate shall conform to the grading in above table.

D. Fine Aggregate for Concrete: Fine aggregates shall meet Colorado Department of

Transportation, Section 703.01 requirements and gradation as shown above. Fine aggregate for concrete shall conform to the requirements of AASHTO M6. The amount of deleterious substances removable by elutriation shall not exceed three percent (3%) by dry weight of fine aggregate when tested in accordance with AASHTO T11, unless otherwise specified. The minimum Sand Equivalent, as tested in accordance with AASHTO T176 shall be eighty (80), unless otherwise specified. The Fineness Modules shall not be less than two and five-tenths (2.50) nor greater than three and five-tenths (3.50), unless otherwise approved.

- E. Fly Ash and Water: Upon approval based on a satisfactory trial mix, CONTRACTOR shall have the option of substituting approved fly ash for Portland cement, up to a maximum of twenty percent (20%) by weight. The total weight of cement and fly ash shall not be less than the specified mix design.
1. Fly ash for concrete shall conform to the requirements of ASTM C618, Class C or Class F. All chemical requirements of ASTM C618 Table I-A shall apply with the exception of footnote A.
 - a. Class C fly ash will not be permitted where sulfate resistant cement is required.
 - b. CONTRACTOR shall submit certified laboratory test results for the fly ash. Test results that do not meet the physical and chemical requirements may result in the suspension of the use of fly ash until the corrections necessary have been taken to ensure that the material meets the SPECIFICATIONS.
 2. Water used in mixing or curing shall be clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substance injurious to the finished product. Water shall be tested in accordance with, and shall meet the suggested requirements of AASHTO T26. Water known to be of potable quality may be used without test. Where the source of water is relatively shallow, the intake shall be enclosed so as to exclude silt, mud, grass, or other foreign materials.
- F. Concrete Curing Materials and Admixtures:
1. Curing Materials: Curing materials shall conform to the following requirements as specified:
 - a. Burlap Cloth made from Jute or Kenaf: AASHTO M182.
 - b. Liquid Membrane-Forming Compounds Curing Concrete: AASHTO M148.
 - c. Sheet Materials for Curing Concrete: AASHTO M171.
 - d. Straw shall not be used for curing unless approved by ENGINEER.
 2. Air-Entraining Admixture: Air-entraining admixtures shall conform to the requirements of AASHTO M154. Admixtures which have been frozen will be rejected. No chloride containing additives shall be permitted
 3. Chemical Admixtures: Chemical admixtures for concrete shall conform to the requirements of AASHTO M194M/M194. Admixtures which have been frozen will be rejected.
 4. Joint Fillers: The joint fillers shall meet the requirements of ASTM C920.

G. Base Course Material:

1. Where required in the Drawings, base course material shall consist of dense graded aggregate base course as specified in Section 31 20 00.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

- A. The subgrade shall be excavated or filled to the required grades and lines. All soft, yielding, or otherwise unsuitable material shall be removed and replaced with suitable material with ENGINEER's approval. Filled sections shall be compacted and compaction shall extend a minimum of six (6) inches outside the form lines.
- B. The moisture content of the subgrade shall be brought within +/- two percent (2%) of optimum moisture content and compacted to ninety-five percent (95%) of the maximum standard Proctor density (ASTM D698) for subgrade materials classified as A-4 through A-7 or ninety five percent (95%) of modified proctor density for materials classified as A-1 through A-3.
- C. Base course shall be installed to the limits and thickness indicated in the Drawings. Base course shall be compacted to ninety-five percent (95%) of the maximum standard Proctor density.

3.02 CONCRETE PLACEMENT

A. General:

1. Concrete transported in truck mixers or truck agitators shall be delivered to the site of the WORK and completely discharged within a period of ninety (90) minutes after the cement comes in contact with the mixing water or with the combined aggregates containing free moisture in excess of two percent (2%) by weight.
 2. The concrete shall be placed either by an approved slip form/extrusion machine, By the formed method, or by a combination of these method.
 3. The subgrade shall be conditioned to provide a uniformly moist surface when concrete is placed.
 4. Special care shall be taken where pouring curb ramps to ensure that the grades and slopes are all ADA compliant. The contractor shall install Detectable Warning Surface onto the concrete sidewalk at the location detailed on the Plans..
- B. Machine Placement: The slip form/extrusion machine shall be so designed to place, spread, consolidate, screed, and finish the concrete in one (1) complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogenous concrete section. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete: section being placed. It shall be operated with as nearly a continuous forward movement as possible. All operations of mixing, delivery, and spreading concrete shall be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum..

C. Formed Method:

1. The vertical face of previously sawed and adjacent asphalt pavement may NOT be used as a forming surface. CONTRACTOR shall use forms on front and back of all curb and gutter, sidewalks and crosspans.
2. The forms shall be of metal or other suitable material that is straight and free from warp, having sufficient strength to resist the pressure of the concrete without displacement and sufficient tightness to prevent the leakage of mortar. Flexible or rigid forms of proper curvature may be used for curves having a radius of one hundred (100) feet or less. Division plates shall be metal. Where directed by ENGINEER, CONTRACTOR shall use a thin metal back form to preserve landscaping, sprinklers, etc. Form shall be straight and rigid and shall be approved by ENGINEER prior to use on PROJECT.
3. The front and back forms shall extend for the full depth of the concrete. All of the forms shall be braced and staked so that they remain in both horizontal and vertical alignment until their removal. No wooden stakes will be allowed. They shall be cleaned and coated with an approved form-release agent before concrete is placed against them. The concrete shall be deposited into the forms without segregation and then it shall be tamped and spaded or mechanically vibrated for thorough consolidation. Low roll or mountable curbs may be formed without the use of a face form by using a straight edge and template to form the curb face. When used, face forms shall be removed as soon as possible to permit finishing. Front and back forms shall be removed without damage to the concrete after it has set.
4. Should the removal of adjacent asphalt pavement be required beyond that shown in the asphalt patch detail to properly correct failed concrete sections, CONTRACTOR shall remove and replace said asphalt pavement to such an extent as to provide a smooth repair. ENGINEER shall be notified prior to commencing any additional asphalt removal.

3.03 FINISHING

- A. The concrete shall be finished smooth by means of troweling and then it shall be given final surface texture using a light broom or burlap drag. Concrete that is adjacent to forms and formed joints shall be edged with a suitable edging tool to the dimensions shown on the DRAWINGS.

3.04 JOINTS

- A. Expansion Joints:
1. Expansion joints shall be constructed at right angles to the curb line at immovable structures and at points of curvature for short radius curves. Filler material for expansion joints shall conform to requirements of the requirements of ASTM C920 and shall be furnished in a single one-half inch (1/2") thick piece for the full depth and width of the joint.
 2. Expansion joint spacing shall be as specified in the Drawings. If the Drawings do not indicate expansion joint spacing, a standard spacing of twenty (20) feet shall be used.

3. Construction joints may be either butt or expansion-type joints. Curbs or combined curbs-and-gutters constructed adjacent to existing concrete shall have the same type of joints as in the existing concrete, with similar spacing; however, contraction joint spacing shall not exceed ten (10) feet.

B. Contraction Joints:

1. Contraction joints shall be placed at the locations and in the patterns shown on the Drawings.
2. Where no joint pattern or spacing is indicated in the Drawings, transverse contraction joints shall be placed in sidewalk at a uniform spacing not to exceed five (5) feet.
3. Joint depth shall average at least one-fourth (1/4) of the cross-section of the concrete.
4. Contraction joints shall be saw cut. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking.

3.05 PROTECTION

- A. CONTRACTOR shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slip-form construction, materials such as wood planks or forms to protect the edges shall also be required. Concrete damaged by rain shall be required to be removed and replaced at CONTRACTOR's expense.
- B. Concrete being placed in cold weather during which the temperature may be expected to drop below forty degrees Fahrenheit (40°F), shall be suitably protected to keep the concrete from freezing until it is at least ten (10) days old. Concrete injured by frost action shall be required to be removed and replaced at CONTRACTOR's expense.
- C. CONTRACTOR shall be responsible for correcting any vandalism or defacement (graffiti) that occurs on the concrete prior to final acceptance.

3.06 CURING

- A. Concrete shall be cured for at least seven (7) days after placement to protect against loss of moisture, rapid temperature change, and mechanical injury prior to any overlay or reconstruction work. Moist burlap, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used as the curing material. Membrane curing shall not be permitted in frost-affected areas when the concrete will be exposed to deicing chemicals within thirty (30) days after completion of the curing period.

3.07 BACKFILLING

- A. The spaces in front and back of curbs shall be refilled with suitable material to the required elevations after the concrete has set sufficiently. The fill material shall be thoroughly tamped in layers.

3.08 TOLERANCE

- A. Forms shall not deviate from true line by more than one-quarter (1/4) inch at any Point.
- B. Mixed concrete shall be not less than fifty degrees Fahrenheit (50 °F), nor more Than eighty degrees Fahrenheit (80°F) at the time of placement in forms, unless otherwise directed.
- C. If air temperature is thirty-five degrees Fahrenheit (35°F) or less at the time of placing, ENGINEER shall require water and/or aggregate heated to not less than seventy degrees Fahrenheit (70°F), or more than one-hundred fifty degrees Fahrenheit (150°F).
- D. Finished joints shall not deviate more than one-quarter (1/4) inch in the horizontal alignment from a straight line.
- E. Any localized humps and or depressions greater than one-quarter (1/4) inch shall require removal and replacement of the WORK in question at CONTRACTORS expense
- F. No ponding of water greater than three-eighths (3/8) inch shall be allowed.
- G. Combination curb, gutter and walk. and/or vertical curb and gutter flow line depth shall not vary from adopted standards by more than +/- one-half (1/2) inch, measured vertically from the top of curb to the gutter invert.
- H. Pedestrian walks shall have a minimum. of two percent (2.0%) and a maximum. of two and one half percent (2.5%) slope toward the roadway.
- I. Heave or settlement of sidewalk, relative to separate curb pour, greater than one-half (1/2) inch shall be cause for corrective action. This provision shall not apply to transverse sidewalk joints.

3.09 QUALITY CONTROL

- A. Testing: Concrete testing and testing laboratory services required shall conform to the following unless otherwise determined by ENGINEER.

Section Type of Test	Project Acceptance Frequency	Point of Sampling Acceptance	Procedures	
			Test Sampling	Project Testing
Sidewalks (concrete Aggregate Gradation)	1/1000 square yards or fraction thereof for each aggregate of concrete placed.	Stock Pile, Belt or Bin	CDOT CP30	CDOT CP31A
Curbing (concrete Aggregate)	1/2000 lineal feet or fraction thereof for each size aggregate		CDOT CP30	CDOT CP31A

Gradation)	of concrete placed			
Moisture Content (Fine Aggregate)	1 per day and as often as needed for quality control.		CDOT CP30	CDOT CP31A

Section Type of Test	Project Acceptance Frequency	Point of Sampling Acceptance	Procedures	
			Test Sampling	Project Testing
Moisture Content (Coarse Aggregate)	1 per day min, where moisture content is greater than + 0.5% from SSD condition	Stockpile, Belt or Bin	CDOT CP30	CDOT CP60
Slump	1 set of tests for every 1000 square yards or fraction thereof of concrete placed per a day	The slump, air content, unit weight and compressive strength tests shall be carried out on the first truck of concrete for the daily placement and thereafter in conformance with this table by sampling from the mixer discharge or pumper truck discharge hose	AASHTO T141	AASHTO T119M/T119
Air Content	1 set of tests for every 1000 square yards or fraction thereof concrete placed per a day		AASHTO T141 T199	AASHTO T152
Yield and Cement	4 tests for every 2000 lineal feet or fraction thereof of concrete placed per a day		AASHTO T141	AASHTO T121M/T121
Compressive (Sidewalks)	1 set (4) of cylinders per 1000 square yards or fraction thereof of concrete placed per day		AASHTO T141 T23	AASHTO T22
Compressive (Curbing)	1 set (4) of cylinders per 2000 square yards or fraction thereof of concrete placed per day		AASHTO T141 T23	AASHTO T22

B. Repair:

1. Prior to backfilling and after forms are removed, honeycombed, defective or damaged areas of concrete shall be replaced within seven (7) days after the forms are removed.
2. At the time of final acceptance inspection, the repair of all cracks shall be completed.

- a. Cracks that are less than one-eighth (1/8) inch wide, exhibit no horizontal or vertical shifting, and do not meet the conditions in b, c, and d, below may, at the discretion of the OWNER, be sealed by routing approximately three-quarter (3/4) inch to one (1) inch deep by one-quarter (1/4) inch wide and filling with Sikaflex 1-A or equivalent.
- b. Any crack that extends through a joint shall require removal and replacement of the entire cracked area.
- c. Any longitudinal cracked section of concrete shall require complete removal and replacement of that section between joints.
- d. Repair action for hairline cracks as determined in 1, above, may be waived at the discretion of OWNER. For the purpose of this section, a hairline crack is one that is reasonably immeasurable and without separation as determined by ENGINEER.

3.10 CLEAN-UP

- A. Remove excess concrete, dust and debris from saw cutting immediately after saw cutting operations.
- B. Do not place any tools or equipment on newly poured concrete until cured for at least 72 hours.
- C. The surface of the concrete shall be thoroughly cleaned upon completion of the WORK and prior to the substantial completion walk through, and the site left in a neat and orderly condition

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENTS AND PAYMENT

- A. The unit price bid for Concrete Sidewalk shall include the cost of underlying base course indicated in the Drawings.
- B. The item Detectable Warning Surface Installation shall include all work and materials to anchor the warning surface material onto the concrete sidewalk in accordance with manufacturer's specifications.

END OF SECTION

SECTION 32 17 26 – TACTILE WARNING SURFACING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section includes Specifications for furnishing and installing Cast In Place Replaceable Tactile Warning Surface Tiles (REP) with an in-line truncated dome pattern, embedded in all curb ramps and walking surfaces at the locations and to the dimensions shown on the Drawings, in accordance with the Contract Documents and as directed by the Engineer.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specifications, apply to this Section.
- B. Americans with Disabilities Act (ADA) Title 49 CFR Transportation, Part 37.9 Standards for Accessible Transportation Facilities, Appendix A, Section 4.29.2 Detectable Warnings on Walking Surfaces. FHA Memo (5-06-02) titled Truncated Domes. Federal Register Volume 71, No. 209, 49 CFR art 37 (10-30-06), ADA Standards for Transportation Facilities (11-29-06, DOT): Sections 406, 705, and 810. ADA Standards for Accessible Design – 2010 (9/05/11, DOJ), ADAAG: Sections 705 and 810. Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way (7/23/11, Access Board), PROWAG: Sections R208, R304, R305, R308, and R309.
- C. American Society for Testing and Materials (ASTM) Test Methods B117, C501, C1028, D543, D570, D638, D695, D790, G151, G155, and E84.
- D. American Association of State Highway and Transportation Officials (AASHTO): Test Method AASHTO-H20.
- E. California Code of Regulations (CCR 2007) Title 24 Part 1 Articles 2, 3 and 4, and Part 2 Section 205 definition of “Detectable Warning”, Section 1127B.5 for “Curb Ramps”, and Section 1133B.8.5 for “Detectable Warnings at Hazardous Vehicle Areas”. California Department of Transportation Detectable Warning Surface Authorized Material List. Division of the State Architect IR 11B-3 (1/26/05) and IR 11B-4 (1/01/11). IR 11B-4 (1/01/11) removed the requirement for a “staggered” pattern and now calls for the “square grid” (in-line) pattern.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer’s literature describing products, installation procedures and maintenance instructions.
- B. Samples for Verification Purposes: Submit two (2) Tactile Warning Surface samples minimum 8” x 8” of the kind proposed for use. Samples shall be properly labeled and shall contain the following information: Name of Project, Submitted by, Date of Submittal, Manufacturer’s Name, and Catalog Number.

- C. Shop Drawings: Submit Standard Manufacturer Shop Drawings showing all pertinent characteristics of the composite Cast In Place Replaceable Tactile Warning Surface Tile (REP), including profile, sound on cane contact amplification feature and installation methods.
- D. Material Test Reports: Submit current test reports from qualified, accredited independent testing laboratory in accordance with ASTM guidelines and indicating that materials proposed for use are in compliance with specification requirements and meet the properties indicated. All test reports submitted shall be representative of the Cast In Place Replaceable Tactile Warning Surface Tile (REP) delivered to the Project.
- E. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of Tactile Warning Surface Tile and accessory.

1.4 QUALITY ASSURANCE

- A. Provide composite Cast In Place Replaceable Tactile Warning Surface Tiles (REP) as produced by a single manufacturer with a minimum of five years experience in manufacturing Cast In Place Replaceable Tactile Warning Surface Tiles (REP).
- B. Installer's Qualifications: Engage an experienced installer certified in writing by the Tactile Warning Surface manufacturer, who has successfully completed Tactile Warning Surface installations similar in material, design, and extent to that indicated for the Contract.
- C. Cast In Place Replaceable Tactile Warning Surface Tiles (REP) must be compliant with ADAAG, PROWAG, and CA Title 24 requirements. Division of the State Architect IR 11B-3 (1/26/05) and IR 11B-4 (1/01/11). IR 11B-4 (1/01/11) removed the requirement for a "staggered" pattern and now calls for the "square grid" (in-line) pattern.
- D. Cast In Place Replaceable Tactile Warning Surface Tiles (REP) shall meet or exceed the following test criteria using the most current test methods:
 - 1. Compressive Strength: 28,900 psi minimum, when tested in accordance with ASTM D695.
 - 2. Flexural Strength: 29,300 psi minimum, when tested in accordance with ASTM D790.
 - 3. Water Absorption: Not to exceed 0.10%, when tested in accordance with ASTM-D570.
 - 4. Slip Resistance: 1.05 minimum wet and 1.18 dry static coefficient of friction when tested in accordance with ASTM C1028.
 - 5. Flame Spread: 25 maximum, when tested in accordance with ASTM E84.
 - 6. Salt and Spray Performance of Tactile Warning Surface: No deterioration or other defects after 200 hours of exposure, when tested in accordance with ASTM-B117.
 - 7. Chemical Stain Resistance: No reaction to 1% hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, and antifreeze, when tested in accordance with ASTM D543.
 - 8. Abrasion Resistance: 500 minimum, when tested in accordance with ASTM C501.
 - 9. Accelerated Weathering of Tactile Warning Surface when tested by ASTM-G155 or ASTM G151 shall exhibit the following result: $\Delta E < 5.0$ at 2,000 hours minimum exposure.

10. Tensile Strength: 11,000 psi minimum, when tested in accordance with ASTM D638.
11. AASHTO-H20 Load Bearing Test: No Damage at 16,000# loading.
12. Freeze/Thaw/Heat: No deterioration when tested in accordance with ASTM C 1026.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Cast In Place Replaceable Tactile Warning Surface Tiles (REP) shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings.
- B. Storage Facility
 1. Store REP Tiles in an area that is within an acceptable temperature range (40-90 degrees). In particular, protect sealants from freezing.
 2. Maintain Storage Facility in a clean dry condition to prevent contamination or damage to REP Tiles and incidentals.

1.6 GUARANTEE

- A. REP Tiles shall be guaranteed in writing for a period of five (5) years from date of Contract's final completion. The guarantee includes manufacturing defects, breakage, and deformation.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Composition: REP Tiles or approved equal shall be manufactured using a matte finish exterior grade homogeneous (uniform color throughout thickness of product) glass and carbon reinforced polyester based Sheet Molding Compound (SMC) composite material. Truncated domes must contain fiberglass reinforcement within the truncated dome for superior structural integrity and impact resistance. A matte finish will be required on the Tactile Warning Surface for superior slip resistance performance superior to that offered by a gloss finish. Use of Tactile Warning Surface Products employing coatings or featuring layers of material with differing composition, performance, or color properties is expressly prohibited under this Section.
- B. Color: Color shall be homogeneous throughout REP Tile.
 1. Brick Red per Federal Standard 595B Table IV, Color No. 22144.
- C. Domes: Square grid pattern of raised truncated domes of 0.2" nominal height, base diameter of 0.9" and top diameter of 0.45". The Federal Code of Regulations permits a truncated dome spacing range of 1.6"-2.4". For superior wheelchair, walker and shopping cart mobility, the preferred truncated dome spacing shall have a center-to-center (horizontally and vertically) spacing of 2.35", measured between the most adjacent domes on square grid.
- D. Configuration: REP Tile sizes shall be as indicated on the Contract Drawings. The REP Tiles shall feature a minimum of eight (8) embedded corrosion resistant 1" x 1" x 1" corrosion resistant concrete inserts with 1" x 1" x 1" heavy duty steel bolts and washers. Bolts must be covered with a structural water tight cap. Bolts must be located BETWEEN the

truncated domes (in the field) for maximum protection of the Bolt integrity. Bolts are NOT to be located in the truncated dome.

1. The field area shall consist of a non-slip textured surface with a minimum static coefficient of friction of 0.80, wet and dry.
2. At a minimum, REP Tile thickness shall measure 1/2" nominal exclusive of the perimeter minimum 3/8" thick (nominal) by 1" wide flange. The body of the Tactile Warning Surface Tile must consist of a SOLID body for maximum strength and to eliminate the possibility of air entrapment and cracking.

E. Radius REP Tile:

1. Radius REP Tile measures 24"x 33.25" and features reverse score lines on each 24" dimension for a 10', 15', and 20' radius condition. The Radius REP Tile out of the box measures 11' - 6" radius.
2. Truncated domes feature proper dome alignment for a radius application. Radius REP Tile shall be cut to the appropriate configuration using the reverse score lines as a guide.

F. Truncated Dome Surface of REP Tile shall be protected with factory installed plastic sheeting for cleanliness during the installation process. Basic Installation Guidelines shall be printed on the plastic sheeting in both English and Spanish for customer convenience.

G. Dimensions: REP Tiles shall be held within the following dimensions and tolerances:

Specifiers Note: Edit section below by selecting desired length and width. Delete non-relevant dimensions.

1. Length and Width:

Rectangular REP Tile:

2.35" Dome Spacing: [24"x36"] [24"x48"] [24"x60"] [36"x48"] [36"x60"]

Radius REP Tile:

1.6" - 2.4" Dome Spacing [24"x33.25"]

H. Cleaning materials used on site shall have code acceptable low VOC solvent content and low flammability.

I. The Specifications of the concrete, sealants and related materials shall be in accordance with the Contract Documents and the guidelines set by their respective manufacturers.

2.2 MANUFACTURERS

A. Available manufacturers, subject to compliance with these Specifications include, but are not limited to, the following:

1. ADA Solutions Inc. of Chelmsford, MA (Phone: 800-372-0519, Fax: 978-262-9125, Web Site: www.adatale.com , E: info@adatale.com), or approved equal.
2. Requests for Approved Equal Status must be submitted and approved by the Owner during the Bid Phase of the Project.

2.3 EQUIPMENT

- A. Contractor shall provide all tools, equipment and services required for satisfactory installation per manufacturer's instruction as Incidental Work. Equipment, which may be required include typical mason's tools, a 2-foot long level with electronic slope readout, (2) 25-pound weights, and a rubber mallet with a piece of wood for tamping down the Tactile Warning Unit(s).

PART 3 – EXECUTION

3.1 PREPARATION

- A. During all concrete pouring and REP Tile Installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.
- B. The physical characteristics of the concrete shall be consistent with the Contract Specifications while maintaining a slump range of 4 - 7 to permit solid placement of the REP Tile. An overly wet mix will cause the REP Tile to float. Under these conditions suitable weights such as 2 concrete blocks or sandbags (25 pounds) shall be placed on each REP Tile.
- C. The concrete shall be poured and finished, true and smooth to the required dimensions and slope prior to REP Tile placement.

3.2 INSTALLATION

- A. Contractor will not be allowed to install Tactile Warning Surface Tiles until all submittals have been reviewed and approved by the Engineer.
- B. REP Tile shall be installed per manufacturer's instructions.
- C. To the maximum extent possible, the REP Tiles shall be oriented such that the rows of in-line truncated domes are parallel with the direction of the ramp. When multiple REP Tiles regardless of size are used, the truncated domes shall be aligned between the tactile warning surface tiles and throughout the entire tactile warning surface installation.
- D. In accordance with the Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Rights of Way (7/23/11, Access Board): Sections 304 + 305), Tactile Warning Surface Tile shall be located relative to the curb line as shown within Sections 304+305 of the Guidelines.
- E. The REP Tiles shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets, and the field level of the Tactile Warning Surface Tile is flush to the adjacent concrete surface or as the Drawings indicate to permit proper water drainage and eliminate tripping hazards between adjacent finishes.
- F. On Continuous Runs: The Installer shall leave a 1/8" nominal gap between successive Tactile Warning Surface Tiles. As part of the concrete finishing operation, the Installer shall apply "•••" edge treatment around the perimeter of the Tactile Warning Surface Tiles to facilitate future replacement of the Tactile Warning Surface Tile. A Urethane Sealant such as Sikaflex 1a or BASF NP1 shall be applied to the edge treatment for a watertight Tactile Warning Surface Tile installation.

- G. The manufacturer recommends that a maximum of 30 feet be installed in any single pour. Please call (800) 372-0519 for further details.

3.3 CLEANING AND PROTECTING

- A. Protect REP Tiles against damage during construction period to comply with REP Tiles manufacturer's Specifications.
- B. During and after the REP Tile installation and the concrete curing stage, it is imperative that there are no walking, leaning or external forces placed on the REP Tile to rock the REP Tile, causing a void between the underside of the REP Tile and the concrete substrate.
- C. Remove Protective Plastic Sheeting from REP Tile within 24 hours of installation of the REP Tile. Particularly under hot weather conditions (80 degrees or higher), plastic sheeting will adhere strongly (resulting in difficult removal of same) to Tactile Warning Surface Tile when not removed quickly.
- D. If requested by the Project Manager, clean REP Tiles not more than four (4) days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean REP Tile by method specified by Tactile Warning Surface Products manufacturer.

END OF SECTION

SECTION 32 18 16.20 – PLAYGROUND MULCH

PART 1 - GENERAL

1.1 WORK INCLUDED

This work includes furnishing and installing the Playground Mulch to the thicknesses shown in the Drawings. The surfacing manufacturer/installer shall be responsible for all labor, materials, tools, and equipment to perform all work and services for the installation of the surface.

1.2 DESCRIPTION OF SYSTEM & GENERAL CONDITIONS

Certified Playground Mulch is engineered wood fiber that has been tested and approved for use as a playground safety surface under and around playground equipment, and is in compliance with federal guidelines for impact resistance and wheelchair accessibility. Certified Playground Mulch shall comply with all requirements set forth in the Americans with Disabilities Act (ADA) and the American Standard Testing Methods (ASTM) and Consumer Products Safety Commission (CPSC) for manufactured Safety Surfaces as detailed below.

1.3 QUALITY ASSURANCE

A. Test Results

1. Impact Attenuation - ASTM F 1292: Surfacing within playground equipment use zones shall meet or exceed the performance requirements of CPSC, ASTM F 1292 and/or CSA Z614-98 that a surface yield both a peak deceleration of no more than 200 g's and a Head Injury Criteria (HIC) value of no more than 1,000 for a head-first fall from the highest accessible portion of play equipment being installed as shown on drawings. Manufactured Safety Surface: For surfaces manufactured for the purpose of playground safety surface, the impact attenuation performance shall be documented by a certificate of compliance provided by third party at owner or contractor's expense
2. Accessibility of Surface Systems - ASTM F1951: All playground surfacing products must pass testing to ensure wheelchair access under and around playground equipment as required by the American Disabilities Act.
3. IPEMA Certification Required: "In the Interest of playground safety, the International Play Equipment Manufacturers Association (IPEMA) provides a Third Party Certification Service whereby a designated independent laboratory, TUV SUD America Inc., (TUV), validates a surfacing manufacturer's certification of conformance to ASTM F1292, Standard Specification for Impact Attenuation Under and Around Playground Equipment, and for an engineered wood fiber manufacturer its certification of conformance, also to ASTM F2075, Standard Specification for Engineered Wood Fiber for use as a Playground Safety Surface Under and Around Playground Equipment, and Section 4.4, for testing Sieve Analysis and Section 4.6, for testing the presence of Tramp Metal. A list of current validated products, their thickness and critical height may be viewed at www.ipema.org."

B. Installer Qualifications - All materials under this section shall be installed by the Manufacturer or its Certified Installers. The playground surfacing installation shall not be performed by anyone other than the product Manufacturer or its Certified Installers.

C. Contractor Pre-Qualifications

1. A list of ten (10) surfacing projects completed with a similar product. List shall include names of project representatives and respective telephone numbers. At least five (5) of these projects must be at least five (5) years old. This list shall also contain projects which require the same level of difficulty, size of project, type of project, e.g. color transitions and special graphics.
2. All bidders must also submit Material Safety Data sheets (MSDS) and Product Data Sheets

on all materials.

3. Insurance Requirements - All bidders must carry minimum insurance of:
 - a) \$1,000,000 General Liability Per Occurrence
 - b) \$2,000,000 General Aggregate
 - c) \$2,000,000 Products Completed Operations
 - d) \$5,000,000 Excess Liability
 - e) \$1,000,000 Workers Comp. & Employers Liability
 - f) \$1,000,000 Automobile Liability (any Auto)

1.4 SUBMITTALS

- A. Manufacturer's descriptive data and installation instructions.
- B. Manufacturer's details showing depths of wear surface and sub-base materials, anchoring systems and edge details.
- C. A list of all materials and components to be installed, including Manufacturer's name, storage requirements, and precautions, and shall state chemical composition and test results to which material has been subjected in compliance with these specifications.
- D. Test results to substantiate that the product meets or exceeds all ASTM & ADA requirements for each standard listed in Section 1.03 Quality Assurance. Test must be performed and certified by an independent laboratory.
- E. Copy of IPEMA Certification.
- F. Documentation of Contractor Pre-Qualification as stated in Section 1.03 Quality Assurance.
- G. Documentation of Insurance Requirements as stated in Section 1.03 Quality Assurance.
- H. Statement signed by the Manufacturer of the synthetic safety surfacing attesting that all materials under this section shall be installed by the Manufacturer or its Certified Installers.
- I. A listing of at least ten (10) installations where products similar to those proposed for use have been installed and have been in successful service for a minimum period of three (3) years. This list shall include Owner or purchaser, address of installation, date of installation, contact person, and phone number.
- J. Upon request, a sample specimen of safety surface proposed for this project.
- K. Upon request, a list of all organizations and affiliations of the company offering the product(s). One original hard copy of the submittal package will be supplied with additional copies on individual CD's. Upon request only hard copies shall be supplied.

1.5 DELIVERY, STORAGE and HANDLING:

Materials and equipment shall be delivered and/or stored in accordance with the manufacturer's recommendations.

1.6 PROJECT SITE CONDITIONS:

- A. Playground mulch shall be installed after the playground equipment is installed unless otherwise noted.
- B. Playground mulch shall be installed after the adjacent asphalt pavement is installed unless otherwise noted.

1.7 WARRANTY:

Surfacing shall maintain required impact attenuation characteristics and be guaranteed against defects in workmanship and material for a period of no less than one (1) year or as specified and agreed upon per contract.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Playground mulch must be certified to meet ASTM standards, provided by Dan Como & Sons, Inc. or approved equal.

PART 3 - EXECUTION

3.1 SUB-BASE REQUIRMENTS

- A. Owner or owner's representative shall provide sub-surface in accordance with manufacturer's recommendation for the project location and application.

3.2 PREPARATION

- A. Scheduling - Playground Mulch shall be installed after other sub-contractors are complete; the area is free from pedestrian traffic; and under the conditions as outlined in Subsection 1.6 Project Site Conditions.
- B. Cleaning - The entire subsurface shall be clean, dry and free from any foreign and loose material.

3.3 INSTALLATION

- A. The perimeter of the playground mulch shall be outlined with asphalt restraint as shown in the drawings.
- B. Install landscape fabric under the playground mulch.
- C. Add the mulch to the playground area to rake it into place. Install the material so that the depth is at least 12" or greater.
- D. Maintain the depth of the mulch, do not allow the mulch to go below the required safety depth.
- E. Keep the top of the mulch minimum of one inch and maximum of three inches below the adjacent pavement level.

3.4 CLEAN UP

- A. Manufacturer's installers shall properly dispose of all material and packing waste before leaving the job site.
- B. Owner or contractor shall be responsible for supplying a dumpster at job site for all waste associated with installation of the safety surface.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 Playground Mulch shall be measured and paid by the Cubic Yard for the thickness indicated.

END OF SECTION

SECTION 32 31 13 - CHAIN LINK FENCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes permanent and temporary chain-link fences.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:
 - 1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet for galvanized or color coated steel.
 - 2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
 - a. Wind Loads: 90 mph.
 - b. Exposure Category: B, C, and D.
 - c. Fence Height: As indicated on the Drawings.
 - d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated and gate latches.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each polymer-coated product and for each color and texture specified, in 6-inch lengths for components and on full-sized units for accessories.
- D. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Product Certificates: For each type of chain-link fence and gate, from manufacturer.
- F. Product Test Reports: For framing strength according to ASTM F 1043.
- G. Operation and maintenance data.
- H. Sample of special warranty.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer or installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
1. Fabric Height: As specified on the Drawings.
 2. Steel Wire Fabric: 9 gauge wire with a diameter of 0.192 inch.
 - a. Mesh Size: 2-1/8 inches.
 - b. Vinyl-Coated Fabric: ASTM F 668, Class 1 over aluminum or zinc-coated steel wire.
 - 1) Color: Black.
 3. Selvage: Knuckled at both selvages.
- B. Chain link for temporary uses and tree protection may be aluminum or galvanized steel and shall be 6 feet high.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
1. Fence Height: As specified on the Drawings..
 2. Horizontal Framework Members: Top and bottom rails complying with ASTM F 1043.
 3. Brace Rails: Comply with ASTM F 1043.
 4. Metallic Coating for Steel Framing:
 - a. Type A zinc coating.
 - b. Type B zinc with organic overcoat.
 - c. External, Type B zinc with organic overcoat and internal, Type D zinc-pigmented coating.
 - d. Type C, Zn-5-Al-MM alloy coating.
 - e. Coatings: Any coating above.
 5. Polymer coating over metallic coating.

- a. Color: Black.

2.4 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.
 - a. Polymer coating over metallic coating. Color black.
 - 2. Aluminum: Mill finish.

2.7 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine areas and conditions, with installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- D. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
- E. Post Excavation: Auger or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

- F. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
 - 3. Mechanically Driven Posts (temporary fence only): Drive into soil to depth of 36 inches. Protect post top to prevent distortion.
- G. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

3.2 TEMPORARY FENCE

- A. Concrete footing is not required for temporary fence.
- B. Where installed on even and solid surfaces, temporary fence may be installed on steel frame bases large enough to provide stable support. Contractor is responsible to assure fence is stable under wind loads and supplement supports as necessary.
- C. Maintain temporary fence as directed during construction, and properly remove fence from after it is no longer required on the Project.

END OF SECTION

SECTION 32 31 19 – DECORATIVE METAL FENCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the ornamental steel fencing as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
 - 1. Welded decorative steel fence system

1.2 RELATED SECTIONS

- A. Cast-in-Place Concrete - Section 03 30 00.

1.3 SYSTEM DESCRIPTION

- A. The manufacturer shall supply a total fence system of Montage Plus® standard picket space, *Welded and Rackable* (ATF – All Terrain Flexibility) Ornamental Steel, Majestic™ design or approved equal. The system shall include all components (i.e., panels, posts, gates and hardware) required.

1.4 QUALITY ASSURANCE

- A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.5 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
 - 3. ASTM D523 - Test Method for Specular Gloss
 - 4. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
 - 5. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
 - 6. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
 - 7. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 - 8. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - 9. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
 - 10. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and installation instructions for metal fencing.

- B. Shop drawings: Submit complete shop drawings showing layout of fence location with dimensions, location of gates and opening size, cleared area, elevation of fence, and details of attachments.

1.7 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect chain link fencing materials, before, during, and after installation to protect the installed work and materials of all other trades.
- B. Replacements: In the event of damage, immediately make all repairs and replacement necessary to the acceptance of the Landscape Architect and at no additional cost to the Owner.

1.8 WARRANTY

- A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.
- B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufactures warranty shall be guaranteed for five (5) years from date of original purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. The fence system shall conform to Montage Plus standard picket space *Welded and Rackable* (ATF – All Terrain Flexibility) Ornamental Steel, Majestic design, flush bottom rail treatment, 3-Rail style, 4” air gap manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma or approved equal.

2.2 MATERIAL

- A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ft² (184 g/m²), Coating Designation G-60.
- B. Material for pickets shall be 3/4” square x 18 Ga. tubing. The rails shall be steel channel, 1.5” x 1.4375” x 14 Ga. Picket holes in the rail shall be spaced 4.675” o.c. Fence posts shall meet the minimum size requirements of Table 1.

2.3 FABRICATION

- A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly (Note: The process produces a virtually seamless, spatter-free good-neighbor appearance, equally attractive from either side of the panel).

C. The manufactured panels and posts shall be subjected to an inline electrode position coating (E-Coat) process consisting of a multi-stage pretreatment/wash, followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2 (Note: The requirements in Table 2 meet or exceed the coating performance criteria of ASTM F2408).

D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Commercial weight fences under ASTM F2408.

E. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

PART 3 - EXECUTION

3.1 PREPARATION

- A. All new installation shall be laid out by the contractor in accordance with the construction plans.

3.2 INSTALLATION

- A. Fence post shall be spaced according to Table 3, plus or minus ¼". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36" (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.3 FENCE INSTALLATION MAINTENANCE

- A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces; 1) Remove all metal shavings from cut area. 2) Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry. 3) Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.4 GATE INSTALLATION

- A. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.5 CLEANING

- A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

Table 1 – Minimum Sizes for Montage Plus Posts		
Fence Posts	Panel Height	
2-1/2" x 16 Ga.	Up to & Including 6' Height	
Gate Leaf	Gate Height	
	Up to & Including 4'	Over 4' Up to & Including 6'
Up to 4'	2-1/2" x 14 Ga.	3" x 12 Ga.
4'1" to 6'	3" x 12 Ga.	3" x 12 Ga.
6'1" to 8'	3" x 12 Ga.	4" x 12 Ga.

Table 2 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Montage Plus – Post Spacing By Bracket Type						
Span	For CLASSIC, GENESIS, MAJESTIC, & WARRIOR 8' Nominal (91.95" Rail)					
Post Size	2-1/2"	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Montage Plus Universal (BB112)	Montage Plus Line Blvd. (BB114)	Montage Plus Flat Mount (BB111)		Montage Plus Swivel (BB113)*	
Post Settings ± 1/4" O.C.	95"	95"	95"	95-1/2"	*95"	*95-1/2"
*Note: When using BB113 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.						

Table 4 – Montage Plus – Wind Loading				
Fence	Nominal	Post	Pickets with 4" Airspace	Pickets with 3" Airspace

Height	Rail Length	Size	Wind Load Capacity Factor	Typical Wind Load Capacity	Wind Load Capacity Factor	Typical Wind Load Capacity
4'	8'	2.5" x 2.5" x 16ga.	66 (PSF)	179 (MPH)	57 (PSF)	166 (MPH)
5'	8'	2.5" x 2.5" x 16ga.	45.5 (PSF)	149 (MPH)	39 (PSF)	137 (MPH)
6'	8'	2.5" x 2.5" x 16ga.	32 (PSF)	125 (MPH)	28 (PSF)	116 (MPH)

PART 4 – MEASUREMENT AND PAYMENT

4.1 Decorative fence shall be measured and paid by the linear feet for the height indicated. Pay item shall include concrete footings.

END OF SECTION

SECTION 32 32 24 - BLOCK RETAINING WALLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Stacked or interlocking concrete block retaining walls.
 - 2. Drainage fill and filter fabric.
- B. Related Sections:
 - 1. Division 01: Administrative, procedural, and temporary work requirements.
 - 2. Section 31 2300 - Excavation and Fill.
 - 3. Section 33 46 00 - Subdrainage

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. C140 - Standard Test Method for Sampling and Testing Concrete Masonry Units.
 - 2. C1372 - Standard Specification for Segmental Retaining Wall Units.
 - 3. D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
 - 4. D4254 - Standard Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.

1.3 SUBMITTALS

- A. Submittals for Review:
 - 1. Shop Drawings:
 - a. Indicate retaining wall system design including wall heights, filter fabric, and drainage provisions.
 - b. Provide product data for concrete adhesive.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store units above ground on wood pallets or blocking.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers/Products:
 - 1. Techo-Bloc (www.techo-bloc.com) or approved equal.
 - 2. Nicolock (www.nicolock.com) or approved equal.

2.2 MATERIALS

- A. Retaining Wall Units:
 - 1. Re-use existing block units on site as much as possible.
 - 2. Do not use any existing block units that are damaged.
 - 3. Store any extra undamaged block units.

- B. Filter Fabric: Polypropylene type, free draining – Mirafi 140N or approved equal..
- C. Geotextile Fabric (where required in the Plans): Type as specified in the Plans.
- D. Backfill: Specified in Section 31 23 00.
- E. Base Course: Gravel, crushed stone, or sand.
- F. Drainage Aggregate: Free-draining, coarse aggregate, graded to ASTM D448, Size No. 57.
- G. Adhesive: Type recommended by retaining wall unit manufacturer.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate to required lines and grades under provisions of Section 31 23 00.
- B. Over-excavate if soft or unsuitable soils are encountered. Backfill and compact under provisions of Section 31 23 00.

3.2 INSTALLATION OF BASE COURSE

- A. Place base course material to minimum 6 inch depth after compaction.
- B. Uniformly compact to minimum 95 percent of ASTM D4254 relative density.
- C. Finish to smooth surface suitable for placement of retaining wall units.

3.3 ERECTION OF RETAINING WALL AND SEAT WALL UNITS

- A. Erect units in accordance with manufacturer's instructions.
- B. Place first course of concrete wall units on prepared base. Check for level and alignment. Ensure that top of units at same elevation and that units are in full contact with base.
- C. Place concrete wall units side by side for full length of wall alignment.
- D. Place minimum 12 inches of drainage fill behind retaining wall units.
- E. Remove excess fill from top of concrete wall units and install next course. Ensure that drainage aggregate and backfill are compacted before installation of next course.
- F. Secure each succeeding course to underlying course with concrete adhesive at each unit.
- G. Install filter fabric in accordance with manufacturer's recommendations.
- H. Apply adhesive to top surface of unit below top cap; place cap unit into position.
- I. Cut units where required to obtain tight fit to adjacent construction.

PART 4 – MEASUREMENT AND PAYMENT

4.1 Retaining Walls shall be measured and paid by the Square Foot of wall face, including buried courses. Cost of cap stones, stone base, drainage fill, pipe and filter fabric shall be included in the square foot cost of the wall.

END OF SECTION

SECTION 32 33 00 – FURNISHINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Bench.
- B. Table and Chairs.
- C. Chess Table and Chairs.
- D. Bike Rack.
- D. Trash Receptacle.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, storage and handling requirements and recommendations, installation methods and available colors, styles, patterns and textures.
- B. Shop Drawings: Submit manufacturer's shop drawings, including plans and elevations, indicating overall dimensions.
- C. Samples: Submit manufacturer's samples of materials, finishes, and colors.
- D. Warranty: Manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer regularly engaged in manufacture of site furnishings for at least five years.
- B. Product Support: Products are supported with complete engineering drawings and design patents.
- C. Manufacturers's welders and machine operators are certified.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original, unopened containers and packaging until installation.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

1.5 WARRANTY

- A. Warranty Information:
 - Products will be free from defects in material and/or workmanship for a period of three years from the date of invoice.
 - The warranty does not apply to damage resulting from accident, alteration, misuse, tampering, negligence, or abuse.
 - The Manufacturer shall, at its option, repair, replace, or refund the purchase price of any items found defective upon inspection by an authorized service representative.
 - Purchasers should be aware that normal use of these high quality products can result in superficial damage affecting the finish. Scratches, nicks, and dents are to be considered normal wear and tear, and are not the responsibility of the manufacturer.

PART 2 PRODUCTS

2.1 BENCH

- A. Victory Stanley or approved equal

- www.victorstanley.com
1. Model: FR-7 Bench, 8 Feet Length
- B. Mounting:
1. Surface mount

2.2 TABLE AND CHAIRS

- A. Landscape Forms or approved equal
www.landscapeforms.com
1. Table Model: Parc Centre 30" Round
 2. Chair Model: Parc Centre Armless Chair
- B. Mounting:
1. Table: Surface mount
 2. Chair: Tied to table

2.3 CHESS TABLE AND CHAIRS

- A. Victory Stanley or approved equal
www.victorstanley.com
1. Table Model: IP-36, 36" Square Table Top
 2. Chair Model: FB-324, 2 Feet Length
- B. Mounting:
1. Surface mount

2.4 BIKE RACK

- A. Dero or approved equal
www.dero.com
1. Model: Arc Bike Rack
- B. Mounting:
1. In-ground mount

2.5 TRASH RECEPTACLE

- A. Victory Stanley or approved equal
www.victorstanley.com
1. Model: Dynasty
 2. Size: 45 Gallon
- B. Mounting:
1. Surface mount

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive elements.
- B. Notify Architect of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install benches, chairs, tables, ping pong table chess table and chairs in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install all elements plumb and level.
- C. Anchor elements as per manufacturer and shown on the plans.

3.3 ADJUSTING

- A. Finish Damage: Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

- B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 CLEANING

- A. Clean all items promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

- A. Protect installed items to ensure that, except for normal weathering, items will be without damage or deterioration at time of Substantial Completion.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 Bench shall be measured by the number of each unit. The price bid shall include all assembly, installation, footing, and all work and materials as detailed on the Drawings.
- 4.2 Table and Chairs shall be measured by the number of each unit. A unit of Table and Chairs shall include one table and four chairs. The price bid shall include all assembly, installation, footing, and all work and materials as detailed on the Drawings.
- 4.3 Chess Table and Chairs shall be measured by the number of each unit. A unit of Chess Table and Chairs shall include one table and two chairs. The price bid shall include all assembly, installation, footing, and all work and materials as detailed on the Drawings.
- 4.4 Bike Rack shall be measured by the number of each unit. The price bid shall include all assembly, installation, footing, and all work and materials as detailed on the Drawings.
- 4.5 Trash Receptacle shall be measured by the number of each unit. The price bid shall include all assembly, installation, footing, and all work and materials as detailed on the Drawings.

END OF SECTION

SECTION 32 91 00 - MODIFIED AND IMPORTED PLANTING SOIL

PART 1 – GENERAL

1.1 SUMMARY

- A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soil and /or the modification of existing site soil for use as Planting Soil, complete as shown on the drawings and as specified herein.
- B. The scope of work in this section includes, but is not limited to, the following:
 - 1. Locate, purchase, deliver and install Imported Planting Soil and soil amendments.
 - 2. Harvest and stockpile existing site soils suitable for Planting Soil.
 - 3. Modify existing stockpiled site soil.
 - a. Modify existing site soil in place for use as Planting Soil.
 - b. Install existing or modified existing soil for use as Planting Soil.
 - 4. Fine grade Planting Soil.
 - 5. Install Compost into Planting Soil.
 - 6. Clean up and disposal of all excess and surplus material.

1.2 CONTRACT DOCUMENTS

- A. Shall consist of specifications, general conditions, and the drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.3 RELATED DOCUMENTS AND REFERENCES

- A. Related Documents:
 - 1. Drawings and general provisions of contract, including general and supplementary conditions and Division I specifications, apply to work of this section.
 - 2. Related Specification Section
 - a. Section – Fescue Grass
 - b. Section – Turfs and Lawns
- B. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the Specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following referenced standards and specifications conflict with each other the more stringent requirement shall prevail.
 - 1. ASTM: American Society of Testing Materials cited section numbers.
 - 2. U.S. Department of Agriculture, Natural Resources Conservation Service, 2003. National Soil Survey Handbook, title 430-VI. Available Online.

3. US Composting Council www.compostingcouncil.org and http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf.
4. *Methods of Soil Analysis*, as published by the Soil Science Society of America (<http://www.soils.org/>).
5. *Up by Roots: healthy soils and trees in the built environment*. 2008. J. Urban. International Society of Arboriculture, Champaign, IL.

1.4 VERIFICATION

- A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Owner's Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner's Representative.

1.5 PERMITS AND REGULATIONS

- A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner's Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.
- B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.
- C. In case of conflict among any referenced standards or codes or among any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner's Representative shall determine which shall govern.

1.6 PROTECTION OF WORK, PROPERTY AND PERSON

- A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to the Contractor's actions.

1.7 CHANGES IN WORK

- A. The Owner's Representative may order changes in the work, and the contract sum adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.
- B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.8 CORRECTION OF WORK

- A. The Contractor shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest possible time that can be coordinated with other work and seasonal weather demands but not more than 180 (one hundred and eighty) days after notification.

1.9 DEFINITIONS

- A. Acceptable drainage: Drainage rate is sufficient for the plants to be grown. Not too fast and not too slow. Typical rates for installed Planting Soil are between 1 - 5 inches per hour. Turf soils are often higher, but drainage rates above 2 - 3 inches per hour will dry out very fast. In natural undisturbed soil a much lower drainage rate, as low as 1/8th inch per hour can still support good plant growth. Wetland plants can grow on top of perched water layers or even within seasonal perched water layers, but could become unstable in high wind events.
- B. Amendment: material added to Topsoil to produce Planting Soil Mix. Amendments are classified as general soil amendments, fertilizers, biological, and pH amendments.
- C. Biological Amendment: Amendments such as Mycorrhizal additives, compost tea or other products intended to change the soil biology.
- D. Compacted soil: Soil where the density of the soil is greater than the threshold for root limiting, and further defined in this specification.
- E. Compost: Well-decomposed stable organic material as defined by the US Composting Council and further defined in this specification.
- F. Drainage: The rate at which soil water moves through the soil transitioning the soil from saturated condition to field capacity. Most often expressed as saturated hydraulic conductivity (Ksat; units are inches per hour).
- G. End of Warranty Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation (if applicable) work run concurrent with each other, and further defined in this specification.
- H. Existing Soil: Mineral soil existing at the locations of proposed planting after the majority of the construction within and around the planting site is completed and just prior to the start of work to prepare the planting area for soil modification and/or planting, and further defined in this specification.
- I. Fertilizer: amendment used for the purpose of adjusting soil nutrient composition and balance.
- J. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes or other suitable devices, and further defined in this specification, and further defined in this specification.
- K. Finished grade: surface or elevation of Planting Soil after final grading and 12 months of settlement of the soil, and further defined in this specification.
- L. Graded soil: Soil where the A horizon has been stripped and relocated or re-spread; cuts and fills deeper than 12 inches, and further defined in this specification.
- M. Installed soil: Planting soil and existing site soil that is spread and or graded to form a planting soil, and further defined in this specification.
- N. Minor disturbance: Minor grading as part of agricultural work that only adjusts the A horizon soil, minor surface compaction in the top 6 inches of the soil, applications of fertilizers, installation of utility pipes smaller than 18 inches in diameter thru the soil zone.
- O. Owner's Representative: The person or entity, appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.
- P. Ped: a clump or clod of soil held together by a combination of clay, organic matter, and fungal hyphae, retaining the original structure of the harvested soil.

- Q. Planting Soil: Topsoil, or Planting Soil Mixes which are imported or existing at the site, or made from components that exist at the site, or are imported to the site; and further defined in this specification.
- R. *Poor drainage: Soil drainage that is slower than that to which the plants can adapt. This is a wide range of metrics, but generally if the soil is turning grey in color it is reasonable preferable to either to plant moisture adaptive plants at smaller sizes that are young in age with shallow root balls or look at options to improve the drainage*
- S. Scarify: Loosening and roughening the surface of soil and sub soil prior to adding additional soil on top, and further defined in this specification.
- T. Soil Fracturing: Deep loosening the soil to the depths specified by using a back hoe, and further defined in this specification.
- U. Soil Horizons: as defined in the USDA National Soil Survey Handbook
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242.
- V. Soil Ripping: Loosening the soil by dragging a ripping shank or chisel thru the soil to the depths and spacing specified, and further defined in this specification.
- W. Soil Tilling: Loosening the surface of the soil to the depths specified with a **rotary tine tilling machine, roto tiller, (or spade tiller)**, and further defined in this specification.
- X. Soil trenching: Cutting narrow trenches thru the soil at the depths and spacing specified to loosen the soil profile, and further defined in this specification.
- Y. Subgrade: surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.
- Z. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation (if applicable) where the Owner's Representative accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project, and further defined in this specification.
- AA. Topsoil: naturally produced and harvested soil from the A horizon or upper layers or the soil as further defined in this specification.
- BB. Undisturbed soil: Soils with the original A horizon intact that have not been graded or compacted. Soils that have been farmed, subjected to fire or logged but not graded, and natural forested land will be considered as undisturbed.

1.10 SUBMITTALS

- A. See the contract General Conditions for policy and procedures related to submittals.
- B. Submit all product submittals eight weeks prior to the start of the soil work.
- C. Product data and certificates: For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with the following:
 - 1. Submit manufacturers or supplier's product data and literature certified analysis for standard products and bulk materials, complying with testing requirements and referenced standards and specific requested testing.
 - a. For each Compost product submit the following analysis by a recognized laboratory:
 - 1.) pH
 - 2.) Salt concentration (electrical conductivity)

- 3.) Moisture content %, wet weight basis
 - 4.) Particle size % passing a selected mesh size, dry weight basis
 - 5.) Stability carbon dioxide evolution rate mg CO₂-C per g OM per day
 - 6.) Solvita maturity test
 - 7.) Physical contaminants (inerts) %, dry weight basis
 - 8.) US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels Chemical Contaminants mg/kg (ppm)
- b. For Coarse Sand product submit the following analysis by a recognized laboratory:
- 1.) pH
 - 2.) Particle size distribution (percent passing the following sieve sizes):
 - 3/8 inch (9.5 mm)
 - No 4 (4.75 mm)
 - No 8 (2.36 mm)
 - No 16(1.18 mm)
 - No 30 (.60 mm)
 - No 50 (.30 mm)
 - No 100 (.15 mm)
 - No 200 (.075 mm)
- D. Samples: Submit samples of each product and material, where required by Part 2 of the specification, to the Landscape Architect for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only.
1. Submit samples a minimum of 2 weeks prior to the anticipated date of the start of soil installation.
 2. Samples of all Topsoil, Coarse Sand, Compost and Planting Soil shall be submitted at the same time as the particle size and physical analysis of that material.
- E. Soil testing for Imported and Existing Topsoil, existing site soil to be modified as Planting Soil and Planting Soil Mixes.
1. Topsoil, existing site soil and Planting Soil Mix testing: Submit soil test analysis report for each sample of Topsoil, existing site soil and Planting Soil from an approved soil-testing laboratory and where indicated in Part 2 of the specification as follows:
 - a. Submit Topsoil, Planting Soil, Compost, and Coarse Sand for testing at least 8 weeks before scheduled installation of Planting Soil Mixes. Submit Planting Soil Mix test no more than 2 weeks after the approval of the Topsoil, Compost and Coarse Sand. Do not submit to the testing laboratory, Planting Soil Mixes, for testing until all Topsoil, Compost and Coarse Sand have been approved.
 - b. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by the Owner's Representative.
 - c. All soil testing will be at the expense of the Contractor.
 2. Provide a particle size analysis (% dry weight) and USDA soil texture analysis. Soil testing of Planting Soil Mixes shall also include USDA gradation (percentage) of gravel, coarse sand, medium sand, and fine sand in addition to silt and clay.
 3. Provide the following other soil properties:
 - a. pH and buffer pH.
 - b. Percent organic content by oven dried weight.
 - c. Nutrient levels by parts per million including: phosphorus, potassium, magnesium, manganese, iron, zinc and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the soil for optimum growth of the plantings

specified.

- d. Soluble salt by electrical conductivity of a 1:2 soil water sample measured in Milliohm per cm.
- e. Cation Exchange Capacity (CEC).

1.11 SOIL INSTALLATION MOCKUP

- A. Prior to installation or modification of Topsoil, site soil, Planting Soil, or Planting Soil Mixes, construct at the site, a mockup of each soil type using the means and methods and equipment proposed by the Contractor to complete the work. Installation of the mockup shall be in the presence of the Owner's Representative. The purpose of the mockup is to test the methods of installation and compaction of the soil and to serve as a benchmark for completed soil compaction and serve to calibrate penetrometer readings to the known proctor density of the mockup. The mockup shall be as follows:
 - 1. Following acceptance of the soil submittals, in areas that can be protected from disturbance and further compaction, install mockups of each soil type and soil modification, 20 foot X 20 foot X the full depth of the deepest installation, using the requirements of these specifications. Compaction methods, including the type of compaction equipment and number of passes required to achieve the required compaction, shall be evaluated and results measured.
 - 2. Compaction in the mockup soil shall be tested using the penetrometer. A minimum of four penetrometer readings from each Planting Soil shall be taken at the specified depths of the soil profile. Record the soil moisture at each penetrometer test site. In the event that the penetrometer readings exceed the specified densities, reconstruct the mockup, adjusting the soil density to achieve the desired results. Where the modification requires ripping, tilling or fracturing soils that are over compacted, start the procedure in a new location so that the process is working on soil that is similar to the density of the expected soil.
 - 3. Submit a report of the final methods of soil installation, the penetrometer and soil moisture readings to the Owner's Representative.
 - 4. The mockup area may remain as part of the installed work at the end of the project if protected from further compaction, contamination or other disturbance.
 - 5. Provide a protective 4 foot high fence on metal posts around each mockup to keep all work and equipment from entering the surface of the mockup area.

1.12 OBSERVATION OF THE WORK

- A. The Owner's Representative may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.
 - 1. The Owner's Representative may utilize the Contractor's penetrometer and moisture meter at any time to check soil compaction and moisture.
- B. The Owner's Representative shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Owner's Representative shall be afforded sufficient time to schedule visit to the site. Failure of the Owner's Representative to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.
 - 1. SOIL MOCKUP REVIEW: At the time of construction of all soil mockups.

2. EXISTING SOIL CONDITIONS REVIEW: Prior to the start of any soil modification that will utilize or modify the existing soil.
 3. EXCAVATION REVIEW: Observe each area of excavation prior to the installation of any Planting Soil.
 4. DRAIN LINE INSTALLATION REVIEW: Upon completion of the installation of drain lines and prior to the installation of any Planting Soil
 5. COMPLETION of SOIL MODIFICATIONS REVIEW: Upon completion of all soil modification and installation of planting soil.
 6. COMPLETION OF FINE GRADING AND SURFACE SOIL MODIFICATIONS REVIEW: Upon completion of all surface soil modifications and fine grading but prior to the installation of shrubs, ground covers, or lawns.
- 1.13 PRE-CONSTRUCTION CONFERENCE
- A. Schedule a pre-construction meeting with the Owner's Representative at least seven (7) days before beginning work to review any questions the Contractor may have regarding the work, administrative procedures during construction and project work schedule.
- 1.14 QUALITY ASSURANCE
- A. Installer Qualifications: The installer shall be a firm having at least 5 years of experience of a scope similar to that required for the work, including the preparation, mixing and installation of soil mixes to support planting. The installer of the work in Section: Planting, shall be the same firm installing the work in this section.
 1. The bidders list for work under this section shall be approved by the Owner's Representative.
 2. Installer Field Supervision: When any Planting Soil work is in progress, installer shall maintain, on site, an experienced full-time supervisor who can communicate in English with the Owner's Representative.
 3. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing soil, shall be trained and proficient in the use of field surveying equipment to establish grades and can communicate in English with the Owner's Representative.
 4. The installer's crew shall be experienced in the installation of Planting Soil, plantings, and irrigation (where applicable) and interpretation of planting plans, soil installation plans, and irrigation plans (where applicable).
 5. Submit references of past projects and employee training certifications that support that the Contractors meet all of the above installer qualifications and applicable licensures.
 - B. Soil testing laboratory qualifications: an independent laboratory, with the experience and capability to conduct the testing indicated and that specializes in USDA agricultural soil testing, Planting Soil Mixes, and the types of tests to be performed. Geotechnical engineering testing labs shall not be used.
 - C. All delivered and installed Planting Soil shall conform to the approved submittals sample color, texture and approved test analysis.
 1. The Owner's Representative may request samples of the delivered or installed soil be tested for analysis to confirm the Planting Soil conforms to the approved material.
 2. All testing shall be performed by the same soil lab that performed the original Planting Soil testing.

3. Testing results shall be within 10% plus or minus of the values measured in the approved Planting Soil Mixes.
 4. Any Planting Soil that fails to meet the above criteria, if requested by the Owner's Representative, shall be removed and new soil installed.
- D. Soil compaction testing: following installation or modification of soil, test soil compaction with a penetrometer.
1. Maintain at the site at all times a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture.
 - a. Penetrometer shall be AgraTronix Soil Compaction Meter distributed by Ben Meadows, www.benmeadows.com or approved equal.
 - b. Moisture meter shall be "general digital soil moisture meter" distributed by Ben Meadows, www.benmeadows.com or approved equal.
 2. Prior to testing the soil with the penetrometer check the soil moisture and penetrometer readings in the mockup soils. Penetrometer readings are impacted by soil moisture and excessively wet or dry soils will read significantly lower or higher than soils at optimum moisture.
 3. The penetrometer readings shall be within 20% plus or minus of the readings in the approved mockup when at similar moisture levels.

1.15 SITE CONDITIONS

- A. It is the responsibility of the Contractor to be aware of all surface and subsurface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.
1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Owner's Representative in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Owner's Representative of such conditions, they shall remain responsible for plant material under the warranty clause of the specifications.
 2. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.

1.16 SOIL COMPACTION – GENERAL REQUIREMENTS

- A. Except where more stringent requirements are defined in this specification. The following parameters shall define the general description of the threshold points of soil compaction in existing, modified or installed soil and subsoil.
- B. The following are threshold levels of compaction as determined by each method.
1. Acceptable Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.
 - a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
 - b. Standard Proctor Method – 75-85%; soil below 75% is unstable and will settle excessively.
 - c. Penetration Resistance Method – about 75-250 psi, below 75 psi soil becomes increasingly unstable and will settle excessively.
 2. Root limiting Compaction: Root growth is limited with fewer, shorter and slower growing roots.
 - a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
 - b. Standard Proctor Method – above approximately 85%.
 - c. Penetration Resistance Method – about 300 psi.

3. Excessive Compaction: Roots not likely to grow but can penetrate soil when soil is above field capacity.
 - a. Bulk Density Method – Varies by soil type see Chart on page 32 in Up By Roots.
 - b. Standard Proctor Method – Above 90%.
 - c. Penetration Resistance Method – Approximately above 400 psi

1.17 DELIVERY, STORAGE, AND HANDLING

- A. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity.
- B. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Cover stockpiles with plastic sheeting or fabric at the end of each workday.
- C. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. Biological additives shall be protected from extreme cold and heat. All products shall be freshly manufactured and dated for the year in which the products are to be used.
- D. Deliver all chemical amendments in original, unopened containers with original labels intact and legible, which state the guaranteed chemical analysis. Store all chemicals in a weather protected enclosure.
- E. Bulk material: Coordinate delivery and storage with Owner's Representative and confine materials to neat piles in areas acceptable to Owner's Representative.

1.18 EXCAVATING AND GRADING AROUND UTILITIES

- A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.
- B. Determine location of underground utilities and perform work in a manner that will avoid damage. Hand excavate as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.
- C. Notification of the *local utility locator service*, is required for all planting areas. The Contractor is responsible for knowing the location and avoiding utilities that are not covered by the *local utility locator service*.

PART 2 – PRODUCTS

2.1 IMPORTED TOPSOIL

- A. Imported Topsoil definition: Fertile, friable soil containing less than 5% total volume of the combination of subsoil, refuse, roots larger than 1 inch diameter, heavy, sticky or stiff clay, stones larger than 2 inches in diameter, noxious seeds, sticks, brush, litter, or any substances deleterious to plant growth. The percent (%) of the above objects shall be controlled by source selection not by screening the soil. Topsoil shall be suitable for the germination of seeds and the support of vegetative growth. Imported Topsoil shall not contain weed seeds in quantities that cause noticeable weed infestations in the final planting beds. Imported Topsoil shall meet the following physical and chemical criteria:
 1. Soil texture: USDA loam, sandy clay loam or sandy loam with clay content between 15 and 25%. And a combined clay/silt content of no more than 55%.
 2. pH value shall be between 5.5 and 7.0.

3. Percent organic matter (OM): 2.0-5.0%, by dry weight.
4. Soluble salt level: Less than 2 mmho/cm.
5. Soil chemistry suitable for growing the plants specified.

Imported Topsoil shall be a harvested soil from fields or development sites. The organic content and particle size distribution shall be the result of natural soil formation. Manufactured soils where Coarse Sand, Composted organic material or chemical additives has been added to the soil to meet the requirements of this specification section shall not be acceptable.

- B. Imported Topsoil for Planting Soil shall NOT have been screened and shall retain soil peds or clods larger than 2 inches in diameter throughout the stockpile after harvesting.
- C. Stockpiled Existing Topsoil at the site meeting the above criteria may be acceptable.
- D. Provide manufacturer's literature and material certification that the product meets the requirements.

2.2 COMPOST

- A. Compost: Blended and ground leaf, wood and other plant based material, composted for a minimum of 9 months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material at levels that are harmful to plants or humans. Source material shall be yard waste trimmings blended with other plant or manure based material designed to produce Compost high in fungal material.
 1. Compost shall be commercially prepared Compost and meet US Compost Council STA/TMECC criteria or as modified in this section for "Compost as a Landscape Backfill Mix Component".
http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf
 2. Compost shall comply with the following parameters:
 - a. pH: 5.5 - 8.0.
 - b. Soil salt (electrical conductivity): maximum 5 dS/m (mmhos/cm).
 - c. Moisture content %, wet weight basis: 30 – 60.
 - d. Particle size, dry weight basis: 98% pass through 3/4 inch screen or smear.
 - e. Stability carbon dioxide evolution rate: mg CO₂-C/ g OM/ day < 2.
 - f. Solvita maturity test: > 6.
 - g. Physical contaminants (inerts), %, dry weight basis: <1%.
 - h. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels.
 - i. Biological contaminants select pathogens fecal coliform bacteria, or salmonella, meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) level requirements.
- B. Provide manufacturer's literature and material certification that the product meets the requirements.

2.3 COARSE SAND

- A. Clean, washed, sand, free of toxic materials
 1. Coarse concrete sand, ASTM C-33 Fine Aggregate, with a Fines Modulus Index of 2.8 and 3.2.
 2. Coarse Sands shall be clean, sharp, natural Coarse Sands free of limestone, shale and slate particles. Manufactured Coarse Sand shall not be permitted.
 3. pH shall be lower than 7.0.
 4. Provide Coarse Sand with the following particle size distribution:

<u>Sieve</u>	<u>Percent passing</u>
3/8 inch (9.5 mm)	100
No 4 (4.75 mm)	95-100
No 8 (2.36 mm)	80-100
No 16 (1.18 mm)	50-85
No 30 (.60 mm)	25-60
No 50 (.30 mm)	10-30
No 100 (.15 mm)	2-10
No 200 (0.75 mm)	2-5

- B. Provide a two gallon sample with manufacturer’s literature and material certification that the product meets the requirements.

2.4 LIME

- A. ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.
 2. Provide lime in form of dolomitic limestone.
- B. Provide manufacturer’s literature and material certification that the product meets the requirements.

2.5 MODIFIED EXISTING SOIL (SOIL SUITABLE FOR PLANTING WITH INDICATED MODIFICATION)

- A. General definition: Surface soil in the areas designated on planting details as Modified Existing Soil has been altered and or graded before or during the construction process but is still considered acceptable for planting and long term health of the plants specified with the proposed modifications. Modifications respond to the soil problems expected or encountered. The Owner’s Representative shall verify that the soil in the designated areas is suitable for modification at the beginning of planting bed preparation work in that area.
1. The Owner’s Representative shall verify that the soil in the designated areas is suitable for the specified modification at the beginning of planting bed preparation work in that area. In the event that the work of this project construction has damaged the existing soil in areas designated for modification to the point where the soil is no longer suitable to support the plants specified with the specified modification, the Owner’s Representative may require further modification of the damaged soil up to an including removal and replacement with soil of equal quality to the soil that would have resulted from the modification. Damage may include further compaction, contamination, grading, creation of hard pan or drainage problem, and loss of the O, and or A horizon.
 2. General requirements for all soil modifications:
 - a. Take soil samples, test for chemical properties, and make appropriate adjustments.
 - b. Unless otherwise instructed, remove all existing plants, root thatch, and non-soil debris from the surface of the soil using equipment that does not add to the compaction in the soil.
 - c. All soil grading, tilling and loosening must be completed at times when the soil moisture is below field capacity. Allow soil to drain for at least two days after any rain event more than 1 inch in 24 hours, or long enough so that the soil does not make the hand muddy when squeezed.
 - d. Provide pre-emergent weed control after the soil work is complete and plants planted but

prior to adding mulch to the surface, if indicated by weed type and degree of threat.

- B. Modified existing soil – soil removed, stockpiled, and spread
 - 1. Description of condition to be modified: Existing soil that is suitable for reuse as Planting Soil but is in the wrong place of elevation, or cannot be adequately protected during construction. Soil is to be harvested, stockpiled and re-spread with or without further modifications as indicated.
 - 2. Modifications:
 - a. Excavate existing soil from the areas and to depths designated on the drawings. Stockpile in zones noted on the drawings or in areas proposed by the Contractor.
 - 1.) Prepare a soil stock pile plan for approval.
 - b. Excavate soil using equipment and methods to preserve the clumps and peds in the soil. Generally this means using the largest piece of equipment that is practical for the project size and scope.
 - c. Protect stock piles from erosion by compacting or tracking the soil surface, covering with breathable fabric or planting with annual grasses as appropriate for the season, location, and length of expected time of storage.
 - d. Re-spread soil as required in Part 3 of this specification.
- C. Modified existing soil – compacted surface soil (Tilling Option)
 - 1. Description of condition to be modified: Surface soil compaction to a maximum of 6 inches deep from traffic or light grading. Original A horizon may be previously removed or graded but lower profile intact with acceptable compaction levels and limited grading. The soil organic matter, pH and chemistry in the A horizon may not be suitable for the proposed plants and may need to be modified as required.
 - 2. Modifications:
 - a. Till top 18 inches or deeper of the soil surface, with a *roto tiller*, *spade tiller*, ripper or agricultural plow. Spread 2 - 3 inches of Compost on the surface of the tilled soil and make any chemical adjustment as recommended by the soil test.
 - b. Till or disk the Compost into the loosened soil. Smooth out grades with a drag rake or drag slip.
- D. Modified existing soil – compacted subsoil
 - 1. Description of condition to be modified: Deep soil compaction the result of previous grading, filling and dynamic or static compaction forces. Original A horizon likely removed or buried. The soil organic matter, pH and chemistry in the A horizon is likely not suitable for the proposed plants and should be modified as required.
 - 2. Soil Ripping:
 - a. Step one: After grading and removing all plants and debris from the surface, using a tracked dozer or similar large grading equipment, loosen the soil by dragging a ripping shank or chisel thru the soil to depths of 24 inches with ripping shanks spaced 18 inches or less apart in two directions. The number of shanks per pull is dependent on the degree of soil compaction and the size of the dozer.
 - b. Step 2: Spread 3-4 inches of Compost over the ripped area and till into the top 6 inches of the soil surface.
 - 3. Following soil ripping the average penetration resistance should be less than 250 psi to the depth of the ripping or fracturing.
 - 4. Do not start planting into ripped or fractured soil until soil has been settled or leave grades

sufficiently high to anticipate settlement of 10 – 15% of ripped soil depth.

- E. Modified existing soil – low organic matter
 - 1. Description of condition to be modified: Low soil organic matter and/or missing A horizon but soil is not compacted except for some minor surface compaction. The soil organic matter, pH and/or chemistry are likely not suitable for the proposed plants and should be modified as required.
 - 2. Modifications:
 - a. Spread 3 - 4 inches of Compost over the surface of the soil and make chemical adjustment as recommended by the soil test.
 - b. Till Compost into the top 6 inches of the soil.
- F. Modified existing soil – soil within the root zone of existing established trees
 - 1. Description of condition to be modified: Surface compaction near or above root limited levels in the upper soil horizon the result of traffic or other mechanical compaction.
 - 2. Modifications:
 - a. Remove the tops of all plants to be removed from the root zone. Remove sod with a walk behind sod cutter. Do not grub out the roots of plants to be removed.
 - b. Use a pneumatic air knife to loosen the top 9 – 12 inches of the soil. Surface roots may move and separate from soil during this process but the bark on roots should not be broken
 - 1.) Pneumatic air knife shall be as manufactured by:
Concept Engineering Group, Inc., Verona, PA (412) 826-8800
or
Supersonic Air Knife, Inc., Allison Park, PA (866) 328 5723
 - c. Make chemical adjustment as recommended by the soil test and add 2 - 3 inches of Compost over the soil.
 - d. Using the pneumatic air knife, mix the Compost into the top 6 – 8 inches of the loosened soil.
 - e. Work in sections such that the entire process - including irrigation - can be completed in one day. Apply approximately one inch of water over the loosened soil at the completion of each day's work. Apply mulch or turf as indicated on the drawings within one week of the completion of work.

PART 3 – EXECUTION

3.1 SITE EXAMINATION

- A. Prior to installation of Planting Soil, examine site to confirm that existing conditions are satisfactory for the work of this section to proceed.
 - 1. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope toward the under drain lines as shown on the drawings.
 - 2. Confirm that surface all areas to be filled with Planting Soil are free of construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches diameter, soil crusting films of silt or clay that reduces or stops drainage from the Planting Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.
 - 3. Confirm that no adverse drainage conditions are present.
 - 4. Confirm that no conditions are present which are detrimental to plant growth.

- 5. Confirm that utility work has been completed per the drawings.
 - 6. Confirm that irrigation work, which is shown to be installed below prepared soil levels, has been completed.
- B. If unsatisfactory conditions are encountered, notify the Owner’s Representative immediately to determine corrective action before proceeding.
- 3.2 COORDINATION WITH PROJECT WORK
- A. The Contractor shall coordinate with all other work that may impact the completion of the work.
 - B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.
 - C. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner’s Representative of any conflicts encountered.
- 3.3 GRADE AND ELEVATION CONTROL
- A. Provide grade and elevation control during installation of Planting Soil. Utilize grade stakes, surveying equipment, and other means and methods to assure that grades and contours conform to the grades indicated on the plans.
- 3.4 SITE PREPARATION
- A. Excavate to the proposed subgrade. Maintain all required angles of repose of the adjacent materials as shown on the drawings or as required by this specification. Do not over excavate compacted subgrades of adjacent pavement or structures. Maintain a supporting 1:1 side slope of compacted subgrade material along the edges of all paving and structures where the bottom of the paving or structure is above the bottom elevation of the excavated planting area.
 - B. Remove all construction debris and material including any construction materials from the subgrade.
 - C. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope approximately parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.
 - D. In areas where Planting Soil is to be spread, confirm subgrade has been scarified.
 - E. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 1/2 inch plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.
 - 1. At the end of each working day, clean up any soil or dirt spilled on any paved surface.
 - 2. Any damage to the paving or site features or work shall be repaired at the Contractor’s expense.
- 3.5 SOIL MOISTURE
- A. Volumetric soil moisture level, in both the Planting Soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilt point and below field capacity for each type of soil texture within the following ranges.

Soil texture	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%

Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

- B. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). If moisture is found to be too low, the planting holes shall be filled with water and allowed to drain before starting any planting operations. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.6 EXISTING SOIL MODIFICATION

- A. Follow the requirements for modifying existing soil as indicated in Part 2 for the different types of soil modifications. The extent of the areas of different soil modification types are indicated on the planting details or as directed by the Owner’s Representative.

3.7 PLANTING SOIL AND PLANTING SOIL MIX INSTALLATION

- A. All equipment utilized to install or grade Planting Soils shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery equipment shall have buckets equipped with 6 inch long teeth to scarify any soil that becomes compacted.
- B. In areas of soil installation above existing subsoil, scarify the subgrade material prior to installing Planting Soil.
 1. Scarify the subsoil of the subgrade to a depth of 3 – 6 inches with the teeth of the back hoe or loader bucket, tiller or other suitable device.
 2. Immediately install the Planting Soil. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.
 3. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Planting Soil.
- C. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts in one row before proceeding to the next. Work out from the furthest part of each bed from the soil delivery point to the edge of the each bed area.
- D. Where possible place large trees first and fill Planting Soil around the root ball.
- E. Installing soil with soil or mulch blowers or soil slingers shall not be permitted due to the over mixing and soil ped breakdown cause by this type of equipment.

3.8 COMPACTION REQUIREMENTS FOR INSTALLED OR MODIFIED PLANTING SOIL

- A. Compact installed Planting Soil to the compaction rates indicated and using the methods approved for the soil mockup. Compact each soil lift as the soil is installed.
- B. Existing soil that is modified by tilling, ripping or fracturing shall have a density to the depth of the modification, after completion of the loosening, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilting point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.

- C. Installed Planting Soil Mix and re-spread existing soil shall have a soil density through the required depth of the installed layers of soil, such that the penetrometer reads approximately 75 to 250 psi at soil moisture approximately the mid-point between wilt point and field capacity. This will be approximately between 75 and 82% of maximum dry density standard proctor.
- D. Planting Soil compaction shall be tested at each lift using a penetrometer calibrated to the mockup soil and its moisture level. The same penetrometer and moisture meter used for the testing of the mockup shall be used to test installed soil throughout the work.
- E. Maintain moisture conditions within the Planting Soil during installation or modification to allow for satisfactory compaction. Suspend operations if the Planting Soil becomes wet. Apply water if the soil is overly dry.
- F. Provide adequate equipment to achieve consistent and uniform compaction of the Planting Soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction. Use the same equipment and methods of compaction used to construct the Planting Soil mockup.
- G. Do not pass motorized equipment over previously installed and compacted soil except as authorized below.
 - 1. Light weight equipment such as trenching machines or motorized wheel barrows is permitted to pass over finished soil work.
 - 2. If work after the installation and compaction of soil compacts the soil to levels greater than the above requirements, follow the requirements of the paragraph "Over Compaction Reduction" below.

3.9 OVER COMPACTION REDUCTION

- A. Any soil that becomes compacted to a density greater than the specified density and/or the density in the approved mockup shall be dug up and reinstalled. This requirement includes compaction caused by other sub-contractors after the Planting Soil is installed and approved.
- B. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6 inches or greater below finished grade.

3.10 INSTALLATION OF CHEMICAL ADDITIVES

- A. Following the installation of each soil and prior to fine grading and installation of the Compost till layer, apply chemical additives as recommended by the soil test, and appropriate to the soil and specific plants to be installed.
- B. Types, application rates and methods of application shall be approved by the Owner's Representative prior to any applications.

3.11 FINE GRADING

- A. The Owner's Representative shall approve all rough grading prior to the installation of Compost, fine grading, planting, and mulching.
- B. Grade the finish surface of all planted areas to meet the grades shown on the drawings, allowing the finished grades to remain higher (10 – 15% of depth of soil modification) than the grades on the grading plan, as defined in paragraph Planting Soil Installation, to anticipate settlement over the first year.
- C. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or

slightly compressed.

- D. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify the Owner's Representative in the event that conditions make it impossible to achieve positive drainage.
- E. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after settlement is one or two inches below all paving surfaces or as directed by the drawings.
- F. Fill all dips and remove any bumps in the overall plane of the slope. The tolerance for dips and bumps in shrub and ground cover planting areas shall be a 2 inch deviation from the plane in 10 feet. The tolerance for dips and bumps in lawn areas shall be a 1 inch deviation from the plane in 10 feet.

3.12 INSTALLATION OF COMPOST TILL LAYER

- A. After Planting Soil Mixes are installed in planting bed areas and just prior to the installation of shrub or groundcover plantings, spread 3 – 4 inches of Compost over the beds and roto till into the top 4 - 6 inches of the Planting Soil. This step will raise grades slightly above the grades required in paragraph "Fine Grading". This specification anticipates that the raise in grade due to this tilling will settle within a few months after installation as Compost breaks down. Additional settlement as defined in paragraph "Planting Soil and Planting Soil Mix installation" must still be accounted for in the setting of final grades.

3.13 CLEAN-UP

- A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.
 - 1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.
- B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Owner's Representative seals are to remain on the trees and removed at the end of the warranty period.
 - 1. Make all repairs to grades, ruts, and damage to the work or other work at the site.
 - 2. Remove and dispose of all excess Planting Soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

3.14 PLANTING SOIL AND MODIFIED EXISTING SOIL PROTECTION

- A. The Contractor shall protect installed and/or modified Planting Soil from damage including contamination and over compaction due to other soil installation, planting operations, and operations by other Contractors or trespassers. Maintain protection during installation until acceptance. Utilize fencing and matting as required or directed to protect the finished soil work. Treat, repair or replace damaged Planting Soil immediately.
- B. Loosen compacted Planting Soil and replace Planting Soil that has become contaminated as determined by the Owner's Representative. Planting Soil shall be loosened or replaced at no expense to the Owner.
 - a. Till and restore grades to all soil that has been driven over or compacted during the installation of plants.

- b. Where modified existing soil has become contaminated and needs to be replaced, provide imported soil that is of similar composition, depth and density as the soil that was removed.

3.15 PROTECTION DURING CONSTRUCTION

- A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers.
 - 1. Maintain protection during installation until the date of plant acceptance (see specifications section – Planting). Treat, repair or replace damaged work immediately.
 - 2. Provide temporary erosion control as needed to stop soil erosion until the site is stabilized with mulch, plantings or turf.
- B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Owner's Representative shall determine when such cleaning, replacement or repair is satisfactory. Damage to existing trees shall be assessed by a certified arborist.

3.16 SUBSTANTIAL COMPLETION ACCEPTANCE

- A. Upon written notice from the Contractor, the Landscape Architect shall review the work and make a determination if the work is substantially complete.
- B. The date of substantial completion of the planting soil shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

3.17 FINAL ACCEPTANCE / SOIL SETTLEMENT

- A. At the end of the plant warrantee and maintenance period, (see Specification section - Planting) the Owner's Representative shall observe the soil installation work and establish that all provisions of the contract are complete and the work is satisfactory.
 - 1. Restore any soil settlement and or erosion areas to the grades shown on the drawings. When restoring soil grades remove plants and mulch and add soil before restoring the planting. Do not add soil over the root balls of plants or on top of mulch.
- B. Failure to pass acceptance: If the work fails to pass final acceptance, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owner's Representative.

END OF SECTION

SECTION 32 92 00 - TURF AND GRASSES

PART 1 - GENERAL

1.1

SUMMARY

- A. Section Includes:
 - 1. Seeding.
 - 2. Bark mulching.

1.2 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of grass seed.
 - 1. Certification of grass seed mixture.
- C. Product certificates.

1.4 QUALITY ASSURANCE

- A. Installer's Field Supervision: Installer shall maintain an experienced full-time supervisor on Project site when work is in progress.
 - 1. Pesticide Applicator: State licensed, commercial.
- B. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory.
 - 1. The soil-testing laboratory shall oversee soil sampling.
 - 2. Report suitability of tested soil for turf growth.
 - a. State recommendations for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals; if present, provide additional recommendations for corrective action.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

1.6 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
 - 1. Seeded Turf: 60 days from date of planting completion.
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

PART 2 - PRODUCTS

2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with Passaic County Soil Conservation District guidelines.
- B. Seed Species: Passaic Soil Conservation District approved seed of grass species as follows:
 - 1. Temporary Seeding Mix – Early Spring/Late Summer to Early Fall: See drawings for locations.
 - 2. Permanent Seeding Mix – LAWNS – Quality Sun and Shade: See drawings for locations.
- C. Grass Seed Mix: Seed mix as follows:
 - 1. Temporary Seeding Mix: 100% Perennial Ryegrass, Rate: 100 lbs/acre
 - 2. Permanent Seed Mix: 20% Perennial Ryegrass, 30% Chewings Fescue, 35% Creeping Red Fescue, 15% Kentucky Bluegrass, Rate 200 lbs/acre

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
 - 2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.
- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture, with a pH range of 3.4 to 4.8.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 FERTILIZERS

- A. See SEEDBED PREPARATION, Section 3.1 below
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - 1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.5 PLANTING SOILS

- A. A. Field exploration should be made to determine whether quantity and/or quality of surface soil justifies stripping.
- B. A 6-inch stripping depth is typical, but may vary depending on the particular soil structure or pre-existing use.
- C. Stockpiles should be located so as not to obstruct natural drainage or cause off-site environmental damage, and shall be delineated on the Certified Soil Erosion and Sediment Control Plan and be constructed in accordance with the Topsoil Stockpile Detail.
- D. Stockpiles should be Temporarily Stabilized according to the Passaic County Soil Conservation District Standards.

2.6 MULCHES

- A. Use shredded hardwood bark mulch derived from the bark of hardwood trees. Ensure that it contains no leaves, twigs, wood shavings, dirt, stones, weed seeds, toxic material, or other foreign material. With each shipment, provide a delivery ticket indicating source and weight of the shredded hardwood bark. Mulch the specified plant pits of individual trees or shrubs, including the saucer to its outer edge and the entire area where material is planted in beds, with a 2-inch layer or as detailed on the Plans
- C. Apply mulch within three days of plant installation.

2.7 PESTICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 SEED BED PREPARATION

- A. Topsoil Required:
 - Min. Depth: 5" (unsettled)
 - pH: 6.0 to 8.0
 - Organic Matter Content: 2.75% min.
 - Nitrate N2: 50 lbs/acre (50% water insoluble)
 - Phosphorous: 100 lbs/acre
 - Potassium: 50 lbs/acre
- B. The contractor should be aware of the possibility, depending upon the site conditions, that all topsoil may have to be provided from an off-site source.
- C. Topsoil should be handled only when dry enough to work without damaging soil structure.
- D. Apply a uniform 5 inches (unsettled) of topsoil on all disturbed areas. Soils with a pH of 4.0 or less or containing iron sulfide shall be covered with a minimum depth of 12 inches of soil having a pH of 5.0 or more and the top 5 inches shall conform to the Topsoil STANDARD and shall be limed according to the specifications.
- E. If the topsoil becomes compacted, the surface must be scarified 6" to 12" to provide good seed-to-soil bond.
- F. Apply limestone and fertilizer according to soil test recommendations such as those offered by Rutgers University Cooperative Extension. If soil testing is not feasible, fertilizer (10-20-10) with 50% water insoluble nitrogen should be applied at the typical rate of 500 lbs/acre or 11 lbs/1,000 square feet.
- G. Apply limestone equivalent to 50% calcium plus magnesium oxides (pulverized dolomitic limestone is preferred for most soils south of the New Brunswick – Trenton Fall Line) as follows:
 - Soil Texture Tons/Acre lbs/1,000 sq. ft.
 - Clay, clay loam, high organic 3 135
 - Sandy loam, loam, silt loam 2 90
 - Loamy sand, sand 1 45
- H. Work lime and fertilizer into the soil to a depth of 4 inches. The final harrowing or disc operation should be on the general contour. Continue tillage until a uniform, fine seedbed is prepared.
- I. Remove from the surface all stones 2 inches or larger in any dimension, and other objectionable stones or debris such as wire, tree roots, pieces of concrete, clods, lumps, or other unsuitable material.

3.2 SEEDING

- A. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Apply seed uniformly by hand, cyclones, drop seeder, drill cultipacker, or hydroseeder*. The latter may be justifiable for large, steep areas where conventional applications are not feasible. Hydroseeding shall be a two step process: mulch shall not be mixed with the seed; the seed

must be applied first to assure proper seed to soil contact. The hydromulch is then sprayed over the seeding. For optimum results, the seed should be incorporated into the soil to a depth of ¼ to ½ inch depending upon species.

*The use of hydro-mulch, as opposed to straw, is limited to optimum seeding dates as listed in the STANDARDS.

After seeding, the soil should be packed with a corrugated roller. When performed on the contour, rolling will

Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

- C. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre or 3 tons/ acre in lawn areas to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
- D. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch or peat mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.3 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
- B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.
- C. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.4 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by the Engineer:
 - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
 - 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

END OF SECTION

SECTION 32 93 00 – PLANTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bed preparation.
 - 2. Plant materials.
 - 3. Plant Installation and Maintenance.
- B. Related Sections:
 - 1. Division 01 - Administrative, procedural, and temporary work requirements.
 - 2. Section 31 2200 - Grading.

1.2 REFERENCES

- A. American National Standards Institute (ANSI) Z60.1 - Nursery Stock.

1.3 SUBMITTALS

- A. Submit name of nursery and listing of all proposed plant cultivars for approval.

1.4 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating plants specified in this Section with minimum three years experience.
- B. Installer Qualifications: Company specializing in installing plants specified in this Section with minimum three years experience.
- C. Maintenance Services: Performed by installer.
- D. Regulatory Requirements: Comply with requirements of authorities having jurisdiction for fertilizer and plant materials.
- E. Plant Materials: Described by ANSI Z60.1.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and manufacturer.
- B. Deliver plant materials immediately prior to installation; keep moist and protect from damage until planted.

1.6 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Do not install plant materials at ambient temperatures below 35 degrees F or above 95 degrees F.
 - 2. Do not install plants when wind velocity exceeds 30 MPH.

1.7 MAINTENANCE

- A. Maintenance Service:
 - 1. Maintain plant life immediately after placement until plants are well established and exhibit vigorous growing condition. Include fertilization, weeding, pruning, and insect and disease control.
 - 2. Warranty new plants for a period of two years following completion of work. Replace dead or dying plants with plants of same size and species specified; plant in next growing season.
 - 3. Water and maintain all new plant, including trees, shrubs and perennials, for a period of two years after completion of work.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Plants:
 - 1. Species and size as indicated in plant schedule; grown in climatic conditions similar to those at site.
 - 2. Free of disease, hazardous insects, and defects including weak or broken limbs, crotches, and damaged trunks, roots, or leaves
- B. Backfill: Topsoil as specified in Section 31 2200.
- C. Mulch for planting beds: Shredded wood or wood chip, free from growth or germination inhibiting ingredients.
- D. Fertilizer: General purpose type, 1-2-1 ratio.
- E. Herbicides:
 - 1. Translocating type.
 - 2. Pre-emergent type.
- F. Bracing Materials:
 - 1. Stakes: Softwood lumber.
 - 2. Wires: Non-corrosive material.
 - 3. Protectors: Rubber or other suitable material.

2.2 MIXES

- A. Prepared Topsoil Mixture: Mix fertilizer with topsoil at rate of 2 pounds per inch of caliper for trees, and 1/2 pound per container plant.

PART 3 EXECUTION

3.1 PREPARATION

- A. Bed Preparation:
 - 1. Apply translocating herbicide to grass in areas to be planted.
 - 2. Remove foreign materials, large rocks, and lumps.
 - 3. Mix in 10 pounds of fertilizer per 1000 square feet. Apply pre-emergent herbicide.
 - 4. Till to 6 inch depth, then fine grade to lines and levels indicated.

5. Request approval of bed preparation and location by Architect.
- B. Plant Materials:
1. Remove synthetic and treated cloths, twines, and pots.
 2. Untreated organic cloths may be left in place; loosen from root collar to prevent girdling.
 3. Locate plants and request approval of location by Architect.

3.2 INSTALLATION

- A. Dig pits and beds 6 inches larger than plant root system.
- B. Set plants vertically; place for best appearance.
- C. Set plants in pits or beds, on prepared topsoil mixture. Lay bare-rooted plants so roots lie in natural position.
- D. Place prepared topsoil mix around plant; settle with water when hole is half full and again when full; remove air pockets.
- E. Brace plants against wind damage:
- F. Install guy wires with protectors where wires contact trees. Stake in position.
- G. Position to prevent hazards to pedestrians where possible.
- H. Do not restrict plant movement under light wind loads or damage bark.
- I. Cover bare soil with minimum 2- inch layer of mulch.
- J. Aerate entire planting circle around large tree in center of playground area prior to installing preparing planting bed and installing new plantings. The cost of aeration shall be included in the price bid for the various plantings.

PART 4 MEASUREMENT AND PAYMENT

4.1 MAINTENANCE

- A. The unit price bid for the various plant items and seeding of grass areas shall include the cost of maintenance and continued watering throughout the maintenance period.

END OF SECTION

SECTION 32 94 00 – MEADOW MIX

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the meadows as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:
 - 1. Site preparation of meadow areas.
 - 2. Seeding meadow areas.
 - 3. Establishment and maintenance of meadows.

1.3 SUBMITTALS

- A. Shop Drawing: Contractor to submit work plan and schedule for all meadows to be seeded. Work plans shall be coordinated with planting schedule as required in specification Section 329300.
- B. Samples
 - 1. Contractor to provide living samples of all seed mixes for review by Landscape Architect. Samples must be clearly labeled with name of seed mix, project name and date.
- C. Maintenance Instructions: Submit manual recommending procedures to be established by Owner for maintenance of meadow work for three years. Submit prior to expiration of required maintenance period(s).
- D. Certification: Submit certificates of inspection as required by governmental authorities and manufacturer's or vendor's certified analysis for soil amendments, herbicides and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.
 - 1. Submit seed vendor's certified statement for each meadow seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Installations of work specified in this section shall be by firm(s) which can exhibit proof of a minimum of twenty years prior successful experience with installations of equivalent type and similar scope of this Project.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
- B. All Meadow Seed shall be delivered in sealed standard size bags of the vendor showing weight, analysis, and name of vendor. It shall be stored as directed by the Manufacturer, in such a manner that its effectiveness will not be impaired.
 - 1. The Landscape Architect reserves the right to reject, on or after delivery, all material which does not, in the Landscape Architect's opinion, meet these specifications.

1.6 PROJECT CONDITIONS

- A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.
- B. Utilities: Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, correct conditions before planting.
- D. Coordination with Meadows: Plant trees and shrubs after final grades are established and prior to planting of meadows, unless otherwise acceptable to Landscape Architect. If planting of trees and shrubs occurs after such work, protect meadow areas and promptly repair damage to meadows resulting from planting operations.
- E. Planting Restrictions and Seasons: Plant during one of the following periods, weather permitting. Coordinate planting periods with initial maintenance periods to provide required maintenance.
 - 1. Spring Planting - Meadows
 - a. Seed: April 1 to May 1.
 - 2. Fall Planting - Meadows
 - a. Seed: Oct 1 – Until ground freezes.

PART 2 PRODUCTS

2.1 MEADOW MATERIALS

- A. Meadow Seed: Provide fresh, clean, new crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixture composed of grass and wildflower species, proportions and

minimum percentages of purity, germination, and maximum percentage of weed, seed, as specified.

1. Meadow seed mix shall be: Deer Resistant Seed Mix and Seed Mix Enhancement for Drier Soils. Provided by Prairie Moon Nursery, 866-417-8156.
- B. Seed mix option to be selected by client after bid has been submitted.
- C. Herbicides:
 1. Low impact broadleaf formula 2,4-D mixed with glyphosate.

2.2 PREPARATION OF PLANTING SOIL

- A. Coordinate with Section 329100.

PART 3 EXECUTION

3.1 PREPARATION OF MEADOW

- A. Site Preparation (Spring- Summer)
 1. Remove existing vegetation as indicated on demolition plans and specifications. Back fill all voids left from Plant removal and compact as specified.
 2. Begin herbicide application in late winter, early spring. Repeat herbicide application (3- 4) times in growing season to prevent newly germinated weeds and eliminate existing seed bank. Waiting 6 weeks between treatments.
 3. Decompact top 4" of subgrade using steel rakes. In areas severe compaction, decompact top 6" using rototiller. In areas with surface tree roots- gently decompact using hand tools. See section 329100.
 4. Rake smooth and fill in any voids or depressions.
- B. Seeding New Meadows (Fall)
 1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
 2. Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds five miles per hour. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.
 3. Sow meadow seed at vendor's recommendation per 1000 square feet of area.
 4. Pack or roll lightly, and water with a fine spray.
 5. Protect seeded slopes against erosion with erosion netting or other methods acceptable to the Landscape Architect.

3.2 MAINTENANCE OF MEADOWS

- A. Maintain meadows for not less than the period stated below, and longer as required to establish an acceptable meadow.
 - 1. Meadows: For first growing season.
 - a. If seeded in fall and not given full 90 days of maintenance, or if not considered acceptable at that time, continue maintenance during the following spring until an acceptable meadow is established.
- B. Maintain meadows through first growing season by watering, weeding, mowing when plant height reaches 8-10 inches to a height of 4 inches, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, acceptable meadow, free of eroded or bare areas.
- C. Satisfactory Seeded Meadow: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 3 by 3 inches.
- D. Reestablish meadows that do not comply with requirements and continue maintenance until meadows are satisfactory.
- E. Install temporary protective around perimeter of newly seeded areas. Fence type shall be proposed by contractor and reviewed and approved by Owner and Landscape Architect. In area of bare root planting, snow fencing can be adjusted to be used as temporary protective fence. Contractor to maintain approved protective fence for 12 months in areas of seed.
- F. After first growing season, mow or manually remove thatch in early spring (late February to mid-April).

3.3 CLEANUP AND PROTECTION OF MEADOWS

- A. During landscape work, keep pavements clean and work area in an orderly condition.
- B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.4 INSPECTION AND ACCEPTANCE

- A. When landscape work is completed, including maintenance, Landscape Architect will, upon request, make an inspection to determine acceptability.
 - 1. Landscape work may be inspected for acceptance in parts agreeable to Landscape Architect, provided work offered for inspection is complete, including maintenance.

- B. Where inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by Landscape Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.

END OF SECTION

SECTION 33 34 00 – STORM AND SANITARY SEWERAGE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

1.2 SCOPE

A. This section covers all work necessary for the construction of new storm and sanitary sewer piping systems and related items complete, including catch basin, manholes, filter fabric, clean out, and miscellaneous structures, and cleaning and flushing the existing storm sewer system to ensure proper working condition.

B. This specification covers the following types of materials for sanitary sewer, storm sewer, leader drains, and miscellaneous applications:

1. Reinforced Concrete Pipe and Fittings
2. Corrugated A.D S N-12 polyethylene pipe.
3. Ductile Iron Pipe.
4. Polyvinyl Chloride (PVC) Pipe
5. Corrugated Metal Pipe

C. Sewer pipe shall be of the size shown on the drawings and shall meet all requirements of these specifications.

D. Definitions.

1. Abbreviations
 - a. AASHTO - American Association of State Highway and Transportation Officials
 - b. ACI - American Concrete Institute
 - c. ASTM - American Society for Testing and Materials.

1.3 RELATED SECTIONS

- A. 31 20 00 Earth Moving
- B. 31 23 00 Excavation and Fill

1.4 QUALITY ASSURANCE

Control of Materials

A. All material shall be furnished by the Contractor and shall be new unless otherwise specifically prescribed in the Contract Documents

1.3 SUBMITTALS

- A. Submit manufacturer's product
 1. Ductile Iron Pipe and Fittings
 2. Ductile Iron Pipe Joints:
 - a. Push-on joints
 - b. Flexible couplings
 3. Reinforced concrete pipe joints.
 4. Cast Iron Soil Pipe
 5. Plastic Pipe
 6. Corrugated Metal Pipe
 7. Pipe plugs for abandoned-in-place pipe ends
 8. Grout and bonding agent

- B. Submit certifications that pipe, joints and gaskets are in conformance with the requirements of these specifications and in compliance with applicable provisions of the Building Code.
- C. At completion of the installation, the Contractor shall prepare and submit "As-Built" drawings for each portion of the work installed.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Unload and store materials at the site with a minimum of handling. Do not store materials directly on the ground. For piping and appurtenances, comply with the provisions specified in Section 2, "Inspection, Storage and Handling" of AWWA Standard C600.
- B. All synthetic and natural rubber materials shall be stored in a cool location out of direct sunlight; and shall not be allowed to come in contact with petroleum products.
- C. Handle materials so they are delivered to the trench in sound, undamaged condition. Pipe and fittings shall be carried to the trench, not dragged.

1.5 CONSTRUCTION SCHEDULE

At each work location it shall be the responsibility of the Contractor to plans and schedule his operations and to carry out the work in conformance with the approved overall schedule for all work under this Contract.

PART 2 – PRODUCTS

2.1 PIPE MARKING - MATERIALS – GENERAL

Materials for sewer lines and other appurtenances shall be in conformance with the applicable Building Code and shall be as specified herein and shown on the drawings.

2.2 REINFORCED CONCRETE PIPE

Pipes types, sizes and locations shall be constructed as indicated on drawings. Reinforced concrete pipe shall be Class III Wall B RCP installed as per the Owner's specifications. Lay drain lines at an even gradient, and insure position of pipe to proper grade by blocking or otherwise. Place backfill in 6" layers, and compact thoroughly. Take necessary precautions during backfill operations to prevent misalignment, longitudinally, laterally or vertically. Install all pipes in accordance with manufacturers' directions, laying reinforced pipe with bell an upgrade. Join so that spigot enters to full depth of socket. Seal joints with 1.2 Portland Cement mortar. Replace pipe damaged or broken in laying backfill. Cap uncompleted lines until ready for final connections, after which thoroughly clean and leave unobstructed.

2.3 PLASTIC PIPE

Pipe types, sizes and locations shall be constructed as indicated on drawings. Pipe shall either be ADS N-12 corrugated plastic pipe with smooth interior walls, or PVC SDR 35 pipe. Lay drain lines at an even gradient, and insure position of pipe to proper grade. Place backfill in 6" layers, and compact thoroughly. Take necessary precautions during backfill operations to prevent misalignment, longitudinally, laterally or vertically. Install all pipes in accordance with manufacturer's directions. Connections to polyethylene drainage structures will be silt-tight fittings.

2.4 DUCTILE IRON PIPE

- A. Ductile iron pipe shall meet the requirements of ANSI Specification A21.51 (AWWA Standard C151). Design and manufacture pipe for a working pressure of 150 psi plus 100 psi surge and a safety factor of 2 and a depth of cover indicated on the drawings and specified in this Section. Minimum thickness class shall be Class 52.

- B. Pipe joints shall be push-on type. Joints shall meet the requirements of NASE/AWWA A21.11/C111. Restrained joints shall be Lok-Ring, Lok-Fast, Lok Tyte, or equal.
- C. Mark each length of pipe. Marking shall include pipe class, casting period, manufacturer's name or trademark, and year of manufacture. Marking shall meet the requirement of ANSI Specification A21.51 (AWWA Standard C151).

2.5 CORRUGATED METAL PIPE

A. Corrugated Aluminum Pipe (CAP)

- 1. CAP shall be manufactured from aluminum coils conforming to the applicable requirements of AASHTO M-197 or ASTM B 744
- 2. Pipe shall be manufactured in accordance with the applicable requirements of AASHTO M-196 or ASTM B 745
- 3. Aluminum alloy angles, as used on coupling bands, shall meet the requirements of ASTM Designation Alloy 6063-T6. Angles shall have a minimum nominal dimension of 2"x2"x 3/16" and shall be 12" wide.
- 4. 3/8" diameter galvanized steel bolts and nuts shall on aluminum couplings for pipe sizes 6", 8" and 10" diameter. 2" diameter galvanized steel bolts and nuts shall on aluminum couplings for pipe sizes 12" diameter and greater.
- 5. Bulkheads shall be made of 0.125 A thick aluminum plate (Alloy 5052-H141).
- 6. CAP shall be made of 16 gage and of 3"x 1" corrugation.

B. Corrugated Steel Pipe (CSP)

- 1. CSP shall be manufactured from Type 2 aluminized steel coils conforming to the applicable requirements of AASHTO M-274 or ASTM A 929
- 2. Pipe shall be manufactured in accordance with the applicable requirements of AASHTO M-36 or ASTM A 760.
- 3. CSP shall be made of 16 gage and of 3"x 1" corrugation for round pipes and 2 2/3"x 2" for pipe-arch.

2.6 MANHOLES, INLETS AND YARD DRAINS

A. Yard drain bodies shall be one piece injection molded units. They shall be uniform in quality, free from shrinkage, distortion and other defects. Component parts shall fit together in a satisfactory manner.

- 1. Material for molded grates and adapter housings shall be structural foam polyethylene with ultraviolet inhibitors. Open surface area for grates shall not exceed +/5% of grate surface area as designated in manufacturer's specifications.

B. Manholes and inlets shall be site constructed or constructed from precast sections. Precast manhole sections shall conform to requirements of ASTM Specification C478, latest revision. Alternatives for pre-cast concrete manholes and other precast concrete structures shall be considered upon submission of shop drawings and approval by the Engineer.

C. Materials for pre-cast manholes, and miscellaneous pre-cast concrete structures shall comply with the following:

- 1. Cement shall be Portland cement and shall meet the requirements of ASTM Specification C150, ACI 301, and ACI 318. Concrete for precast manhole sections shall be 3000 psi concrete. Maximum size of aggregate shall be 3/4 inch.
- 2. Forms for chamber and structures shall be plywood or other approved materials. Steel forms shall be used for the inside face of monolithic concrete manholes.
- 3. Reinforcing steel shall conform to ASTM A615, Grade 60 deformed bars, or ASTM A616

- Grade 60 deformed bars.
4. Mortar Materials:
 - a. Sand - ASTM Designation C144, passing a No. 8 sieve.
 - b. Cement - ASTM Designation C150, Type 1.
 - c. Water - shall be potable.
 5. The manufacturer shall provide openings for sewers entering and leaving the manhole. Any additional openings need to be made in field shall be made by drilling holes at least 2 inch in diameter with a maximum spacing of 3 inches.
 6. Manhole casting shall be of good quality cast iron and/or ductile iron, conforming to ASTM Designation A536. Castings shall conform to the design of the manhole casting as shown on the detail sheet.
 7. Manhole steps shall be made from an aluminum alloy (T6061-T6) to the dimensions specified on the detail drawing or an approved equal and shall be encapsulated in a copolymer polypropylene resin. The manhole steps shall equal or exceed OSHA requirements.
 8. Any other special manholes an miscellaneous concrete structures shall be constructed as detailed on the drawings.

PART 3 – EXECUTION

3.1 INSPECTION AND REJECTION OF PIPE

- A. The quality of all materials, the process of manufacture, and the finished pipe shall be subject to inspection and approval by the Engineer. Such inspection may be made at the place of manufacture or on the work after deliver, or at both places; and the pipe shall be subject to rejection at any time on account of failure to meet any of the specifications' requirements even though sample pipes may have been accepted as satisfactory at the place of manufacture.
- B. Prior to being lowered into the trench, each pipe shall be carefully inspected and those not meeting the specifications shall be rejected and at once removed from the work.
- C. The Engineer shall have the right to cut cores from such pieces of the concrete pipe as he desires for such inspection an tests as he may wish to apply.
- D. Holes left by the removal of cores shall be filled in an approved manner by and at the expense of the manufacturer of the pipe.
- E. The Engineer shall also have the right to the samples of concrete after it has been mixed, or as it is being placed in the forms or models, and to make such inspection and tests thereof as he may wish.
- F. Any pipe which has been damaged after delivery will be rejected and replaced solely at the Contractor's expense.

3.2 HANDLING PIPE

Each pipe section shall be handled into its position in the trench only in such manner and by such means as the Engineer approves as satisfactory. As far as practicable, the Contractor will be required to furnish sling straps, and other approved devices to permit satisfactory support of all parts of the pipe when it is lifted.

3.3 NOTICE TO ENGINEER

The Engineer shall be notified when the pipes are to be laid in the trench. At least 15 feet of the pipe

shall, under ordinary circumstances be laid before covering begins.

3.4 LAYING PIPE

- A. All pipe shall be reinspected for soundness and damage due to handling immediately before being lowered into the trench. Any pipe found to be unsound or damaged will be rejected and shall be removed immediately from the site of the work.
- B. All pipe shall be laid accurately to the required line and grade as shown on the drawings, and in the manner prescribed by the pipe manufacturer and appropriate ASTM Specifications, to form a closed, concentric joint with the adjoining pipe and to bring the invert of each section to the required grade. The supporting of pipe on block will not be permitted.
- C. Pipe laying shall proceed upgrade, beginning at the lower end of the sewer. Each pipe sections shall be laid in a firm foundation of bedding material and haunched and backfilled with care.
- D. Practically watertight work is required, and the Contractor shall construct the sewers with the type of joint specified.
- E. All pipe shall be laid to the line and grade as shown on the drawings. Variations from a uniform line and grade as shown on the drawings shall be cause for the line to be rejected.
- F. The ends of the pipe shall be satisfactorily cleaned just before laying, and the joint shall be made in a satisfactory manner in accordance with the recommendations of the manufacturer on particular type of joint and the directions of the Engineer. All joint work shall be done by experienced workmen.
- G. All pipe shall be bedded as described in this specification under pipe bedding. Bell holes shall be excavated in advance of pipe laying so the entire pipe barrel will bear uniformly on the prepared sub-grade.
- H. Each length of pipe shall be mechanically pulled "home" with a winch or "come-along" against the section previously laid and held in place until the trench and bedding are prepared for the pipe section. Care shall be taken in laying the pipe so not to damage the bell end of the pipe. Mechanical means consisting of cable placed inside the pipe with a winch, jack, or come-along shall be considered to pull the pipe home where pushing the pipe will not result in a joint going completely home and staying in place.
- I. The contractor shall use laser beam equipment, surveying instruments, or other proven techniques to maintain accurate alignment and grade.
- J. Open excavation shall be satisfactorily protected at all times. At the end of each day's work, the open ends of all pipes shall be protected against the entrance of animals, children, earth, or debris by bulkheads or stoppers. The bulkheads or stoppers shall be perforated to allow passage of water into the installed pipe line to prevent flotation of the pipe line. Any earth or other material that may find entrance into the main sewer or into an lateral sewer through an such open end of unplugged branch must be removed at the Contractor's expense. The cost of all such plugs, and the labor connected therewith, must be included in the regular bid for the sewers.

3.5 PIPE BEDDING AND HAUNCHING

- A. Each pipe section shall be laid in a firm foundation of bedding material and haunched and filled with care.
- B. Prior to pipe installation, carefully bring bedding material to grade along the entire length of pipe

- to be installed. To provide adequate support for the pipe, the following bedding procedures are recommended.
1. When Class I material is used for bedding, little or no compaction is necessary due to the nature of the angular particles. A depth of 4 to 6 inches is generally sufficient to provide uniform bedding. If Class I material is used for bedding, it must also be utilized for hunching up to or higher than the spring line of the pipe to avoid loss of side support through migration of Class II hunching material into the bedding.
 2. Take care with Class II material bedding, to provide a uniformly compacted bedding. Excavate the bedding material or place it to a point above the pipe bottom, determining such point by the dept of loose material resulting in the preparation of the bedding and the amount of compaction that will be required to bring the material to grade. Use hand or mechanical tamping to compact the bedding material to a minimum 85% Standard Proctor Density.
 3. Slightly damp material will generally result in maximum compaction with a minimum of effort. If water is added to improve compaction or if water exists in the trench, take care to avoid saturation of Class II material, which could result in additional stability problems. Check grade of bedding after compaction.
- C. Bedding material shall have a minimum thickness beneath the pipe of 4 inches (100 mm) or one-eighth of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe one-sixth of the outside diameter of the pipe.
- D. The rigid pipe, such a vitrified clay, concrete, or ductile iron, back fill between the bedding material and a plane 12 inches (300mm) over the top of the pipe shall be hand-placed finely divided earth, free from debris and stoned, or granular backfill if required.
- E. For flexible pipe, corrugated metal pipe, the placement of embedment material or haunching around the pipe must be done with care. The ability of the pipe to withstand loading in a trench depends a large part on the method employed in its installation. If crushed stone, pea gravel, or graded gravel or sand is used to backfill between the bedding material and a plane 12 inches (33mm) over the top of the pipe, it shall be hand place. If fine sand, silt, or clayey gravel are used for initial backfilling over the pipe, the material shall be hand placed in 6-to 8-inch layers and hand compacted on both sides of the pipe to an elevation 12 inches (300mm) over the top of the pipe. Corrugated aluminum pipe shall installed in accordance with manufacturers recommendations, and shall be in accordance with AASHTO Standard Specifications for Highway Bridges, Section 26, Division II, or ASTM B 788. Corrugated steel pipe shall installed in accordance with manufacturers recommendations, and shall be in accordance with AASHTO Standard Specifications for Highway Bridges, Section 26, Division II, or ASTM A 7988. Heavy construction load exceeding HS20 design load shall not pass over the pipe without adequate protection.
- F. In yielding subsoils the trench bottom shall be undercut to the depth necessary and backfilled with graded, crushed stone to form a firm foundation. No additional payment shall be made for stabilizing yielding subsoils.
- G. Where excavation occurs in rock or hard shale, the trench bottom shall be undercut and a minimum of 6 inches crushed stone bedding placed prior to pipe installation. Additional payment of rock excavation shall be made on "unit cost" projects only, and as prescribed under basis for payment.
- 3.6 CONCRETE CRADLE (CLASS "A" BEDDING)
Concrete cradles where required shall be constructed of Class "B" concrete and of the design shown on the detailed drawings.

3.7 MANHOLES, INLETS, AND OTHER STRUCTURES

- A. Manholes, inlets, and other structures are to be constructed at locations shown on the drawings and in accordance with the following specifications:
- B. Manholes and inlets shall be site constructed or constructed from precast sections. Precast concrete manhole sections shall conform to ASTM Designation C478, except as modified herein:
 - 1. The joint design of the precast sections shall consist of a bell or groove on one end of the unit of pipe and a spigot or tongue on the adjacent end of the joint section.
 - 2. The joint shall consist of a flat rubber gasket attached to the spigot end of the precast manhole section and shall conform to Sections 6.1.6, 6.1.7 and 9 of ASTM Designation 443, latest revision.
- C. Openings in manhole sections for sewer connections shall be cut at the point of manufacture and shall be circular or horseshoe shaped with grooved or roughened surfaces to improve mortar bond. Any additional holes cut in the field shall be accomplished in a manner approved by the Engineer.
- D. Manhole base shall be cast-in-place concrete, reinforced as shown on the drawings. Manhole bases shall be cast on a minimum of 8 inches of compacted crushed stone.
- E. Manholes channels or inverts shall be preformed and poured with Class "B" concrete to the spring line of the connecting pipe. The finished invert shall be a semi-circular shaped smooth channel directing the flow to the downstream sewer.
- F. Manhole frames and lids shall be of good quality cast iron, conforming to ASTM designation A48 and as shown on the Standard Detail Sheet. Unless specifically designated otherwise, manhole castings shall be the non-locking type. The joint between the casting frame and cone section shall be fully mortared or gasketed and coated with a coal tar epoxy upon reaching its final set to become a water tight joint.
- G. Manhole steps shall be made from an aluminum alloy (T6061-T6) to the dimensions specified on the detail drawing or an approved equal. Steps shall be placed as shown on the drawings.

3.8 LEAKAGE TESTS

- A. Test all sewer lines in accordance with the requirements of the municipal building codes and national codes that govern this type of work. All test shall be witnessed by a representative of the Architect/Engineer.
- B. Prior to connecting the sewer pipe at the building, or at the designated connection point, plug the new section of pipe at both ends. The leak test shall be an open-trench test. However, the pipe line may be backfilled between joints to hold the line in place during the test. Fill the new pipe sections with water. Provide for the removal of all air from the test section.
- C. Pressurize the test section to a minimum head of 10 feet and maintain for at least 15 minutes. Visually inspect all joints and connections to check for leakage.
- D. Leaks or other defects revealed by the test shall be corrected by the contractor and the line retested as described above.

3.9 FINAL SEWER CLEANING

- A. Prior to final acceptance and final inspection of the sewer system by the Engineer, flush and clean all parts of the system. Remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the sewer system at or near the closest downstream manhole. If necessary, use mechanical rodding or bucketing equipment.

- B. Upon the engineer's final inspection of the sewer system, if any foreign matter is still present in the system, re-flush and clean the sections and portions of the lines as required.
- C. The existing system including piping and drainage structures shall be cleaned and flushed to the nearest off-site drainage structure to insure clear and free operation at the completion of all sewerage and drainage work.

END OF SECTION