

PROJECT MANUAL

103rd AIR CONTROL SQUADRON

FY 2002

MILITARY CONSTRUCTION

REPLACE FACILITIES AT

ORANGE AIR NATIONAL GUARD STATION

SKXJ97955

By:

MAGUIRE GROUP INC.

Architects/Engineers/Planners

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GEOTECHNICAL REPORT

2. Accessible construction includes, but is not limited to, following:
 - a. Walks, Floors, and Accessible Routes.
 - b. Ramps and Curb Ramps.
 - c. Stairs.
 - d. Handrails.
 - e. Entrances.
 - f. Doors and Finish Hardware.
 - g. Toilet Facilities and Accessories.
3. This Project has been designed to and requires full compliance with ADA regulations, whether or not specific references or notes to ADA are made on Drawings or in Specifications.

1.04 COORDINATION RESPONSIBILITIES

- A. Coordinate work of various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.
- B. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Mechanical/Electrical:
 1. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings.
 2. Follow routing shown for pipes, ducts, and conduits, as closely as practicable.
 3. Make runs parallel with lines of building.
 4. Utilize spaces efficiently to maximize accessibility for other installations, maintenance, and repairs.
 5. In finished areas, except as otherwise shown, conceal pipes, ducts, and wiring in construction.
 6. Coordinate locations of fixtures and outlets with finish elements.
- D. Subcontractor Coordination:
 1. Ensure subcontractors are knowledgeable of all Division 1, General Requirements, Sections, and are responsible for conforming to applicable requirements and instructions stated.

marked with action taken and corrections or modifications required.

4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until a copy of reviewed Product Data is in the Installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 1. Submit Samples in the manner to facilitate review of qualities indicated. Include the following:
 - a. Specification Section number and reference.
 - b. Generic description of the Sample.
 - c. Sample source.
 - d. Product name or name of the manufacturer, including any catalogue or other identification number
 - e. Compliance with recognized standards.
 - f. Availability and delivery time.
 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in

1.02 DEFINITIONS

- A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
- B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
- C. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

1.03 SUBMITTAL PROCEDURES

- A. Coordination:
 - 1. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay, with all submittals transmitted by electronic means (email) as follows:
 - a. Include USP&FO Form 3000 in Microsoft Work 97 format.
 - b. Include product data in Microsoft Word 97 format, Adobe PDF format, or scanned TIFF format; submit all product data in full color.
 - c. Distribute email as directed by Contracting Officer who will submit email addresses at Preconstruction Meeting.
 - 2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that requires sequential activity.
 - 3. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Contracting Officer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
 - 4. Processing: To avoid the need to delay installation as a result of the time required to

12. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
 13. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Contracting Officer's procedures necessary for certification of Substantial Completion.
- B. Phasing: On the schedule, show how requirements for phased completion to permit partial occupancy by the Government affect the sequence of Work.
- C. Distribution: Following response to the initial submittal, print and distribute copies to the Contracting Officer, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
 2. Instruct recipients to report promptly to Contractor, in writing, problems apparent from projections shown on Schedule.
- D. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule to the Contracting Officer twice monthly; on the 15th and on the last business day of the month concurrent with Application for Payment.
- E. Submit Project Schedule for approval within 10 days of Notice to Proceed.
- 1.05 SUBMITTAL SCHEDULE
- A. After development and acceptance of the Contractor's Progress Schedule, Contractor shall prepare a complete schedule of submittals. Submit the schedule within 10 days of the date of the contracting Officers acceptance of the contractor's Progress Schedule.
1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of

- e. Compliance with recognized standards.
- f. Availability and delivery time.
2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
 - d. Samples not incorporated into the Work, or otherwise designated as the Government's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.
 - a. The Contracting Officer will review and return preliminary submittals with the notations indicating selection and other action.
4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Contracting Officer will return one set marked with the action taken.

- D. Required Resubmittals: Make corrections or changes to submittals required by Contracting Officer and resubmit until approved. Revise initial shop drawings or product data. And resubmit as specified for initial submittal. Indicate changes made other than those requested by Contracting Officer. Submit new samples as required for initial submittal.

1.13 DISTRIBUTION BY CONTRACTOR

- A. Distribution: When submittal is marked "APPROVED", or "APPROVED AS NOTED", make prints and copies and distribute to the Contracting Officer, subcontractors, suppliers, fabricators, and other parties requiring information from submittal for proper coordination and performance or Work. Print copies of shop drawings from approved reproducible only.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

ATTACHMENT 2

**Contractor Hazardous Material Identification Form
Close-Out Procedures**

Part II

Attach this part to Part I
The Contractor shall accompany the Contracting Officer's Representative and the Environmental Manager on the close-out inspection to ensure all used and unused HM has been removed from the installation.

Close-out Approval Signatures:	<u>Signature</u>	<u>Date</u>
Contractor	_____	_____
Contracting Officer's Representative	_____	_____
EM (Environmental Manager)	_____	_____

***** END OF SECTION *****

SECTION 02051

BUILDING DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:

1. Demolition and removal of buildings and structures.
2. Demolition and removal of site improvements adjacent to a building or structure to be demolished.
3. Removing below-grade construction, footings, foundations and utilities.
4. Disconnecting, capping or sealing, and abandoning in place and removing site utilities as indicated.
5. Removal of all site features, miscellaneous structures including knee walls, retaining walls, concrete stairs, sidewalks, slabs, fences, posts, mechanical equipment, debris, etc., which may or may not be indicated on the Drawings but are within the Limits of Work.
6. Removal and/or abandonment of site utilities, including electric, telephone, water, sewer, as indicated on the Drawings and described in this Specification. Utility locations were compiled from the best available information supplied by the Housing Authority. The Contractor shall confirm the extent of existing utilities.
7. Removal and legal disposal and/or recycling of demolished materials.
8. All concrete shall be processed and recycled to the greatest extent possible. All asbestos and lead paint contaminated materials shall be properly disposed of off-site.
9. All sites must be backfilled to grade with compacted granular material and seeded in accordance with the appropriate Specification sections and Drawings.
10. Hazardous waste abatement within buildings to be demolished to be completed by others.

- B. Scope of Work for Utility Termination: The Contractor shall perform work prior to demolition and notify the local utilities before proceeding with work:

1. Water: The site potable water distribution shall remain functional to existing building until Hazmat Removal Phase. Terminations shall be made at each building and at the main distribution header without contaminating the main distribution system. New isolation valves shall be installed by the Contractor as required. The Contractor shall not close valves or terminate lines that will cut off water service to occupied buildings. If termination is to be performed at existing shutoff valves, the Contractor shall test valve operation and replace if necessary. All terminated subsurface water lines will be removed as necessary for construction.

2. Sanitary Sewer: Sanitary sewer lateral lines shall be terminated at each building. All terminated subsurface sanitary sewer laterals will be removed. Main sewer lines shall be abandoned in place.
3. Electric Distribution System: The Contractor shall arrange to have all designated electrical utilities disconnected by the Power Company as required within the Limits of Work or as indicated on the Drawings.
4. Telephone and Communication Lines: The Contractor shall arrange to have all designated telephone and communication lines disconnected within the Limits of Work as indicated on the Drawings.
5. Drainage: The Contractor shall remove and dispose catch basins and drain pipes as indicated and as phased. Interior drainage piping shall be maintained by contractor.

C. Related Sections include the following:

1. Division 1 Section "Summary" for use of the premises and phasing requirements.
2. Division 1 Section "Work Restrictions" for restrictions on use of the premises due to Government or tenant occupancy of adjacent structures.
3. Division 1 Section "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
4. Division 1 Section "Photographic Documentation" for preconstruction photographs taken before building demolition.
5. Division 1 Section "Temporary Facilities and Controls" for temporary construction, protection facilities, and environmental-protection measures for building demolition operations.
6. Division 1 Section "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
7. Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of building demolition.
8. Division 15 Sections for demolishing or relocating site mechanical items.
9. Division 16 Sections for demolishing or relocating site electrical items.

1.03 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or recycled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Government.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or recycled.

1.04 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to

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Government that may be encountered during building demolition remain Government's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Government.

1. Coordinate with Government, who will establish special procedures for removal and salvage.

1.05 SUBMITTALS

- A. Qualification Data: For demolition firm.
- B. Proposed Environmental-Protection Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- C. Schedule of Building Demolition Activities: Indicate the following:
 1. Detailed sequence of demolition and removal work, with starting and ending dates for each activity.
 2. Interruption of utility services.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Locations of temporary protection and means of egress.
 5. Coordination of Government's continuing occupancy of adjacent buildings and partial use of premises.
- D. Inventory: After building demolition is complete, submit a list of items that have been removed and salvaged.
- E. Predemolition Photographs and Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by building demolition operations. Submit before Work begins.
- F. Recycling: All demolished materials removed from the Government site are required to be recycled to the maximum extent possible. Provide documentation indicating receipt and acceptance of all recyclable materials by facilities licensed to accept such materials.
- G. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
- H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.06 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

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- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
 - C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
 - D. Standards: Comply with ANSI A10.6 and NFPA 241.
 - E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to building demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalize protection requirements.
- 1.07 PROJECT CONDITIONS
- A. Buildings to be demolished will be vacated and their use discontinued before start of Work.
 - B. Government will occupy another building immediately adjacent to demolition area. Conduct building demolition so Government's operations will not be disrupted.
 - 1. Provide not less than 72 hours' notice to Government of activities that will affect Government's operations.
 - 2. Maintain access to existing walkways, exits, and other adjacent occupied or used facilities.
 - a. Do not close or obstruct walkways, exits, or other occupied or used facilities without written permission from authorities having jurisdiction.
 - C. Government assumes no responsibility for buildings and structures to be demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Government as far as practical.
 - 2. Before building demolition, Government will remove a specified list of items:
 - a. To be determined.
 - D. Hazardous Materials: Hazardous materials are to be removed by others. Contractor to coordinate.
 - E. Storage or sale of removed items or materials on-site is not permitted.

1.08 COORDINATION

- A. Arrange demolition schedule so as not to interfere with Government's on-site operations.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Division 2 Section "Earthwork."

PART 3 - EXECUTION

3.01 DEMOLITION FIRMS

- A. Qualified Demolition Firms: One of the following:
 - 1. Demolition contractor must be prequalified by the Government.

3.02 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of building demolition required.
- B. Review Project Record Documents of existing construction provided by Government. Government does not guarantee that existing conditions are the same as those indicated in Project Record Documents.
- C. Inventory and record the condition of items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to Contracting Officer.
- E. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- F. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.03 PREPARATION

- A. Refrigerant: Remove and store refrigerant according to 40 CFR 82 and regulations of authorities having jurisdiction.
- B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

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1. Arrange to shut off indicated utilities with utility companies.
 2. If utility services are required to be removed, relocated, or abandoned, before proceeding with building demolition provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 3. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
- C. Existing Utilities: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
1. Remove and recycle refrigerant from air-conditioning equipment before starting demolition.
- D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of demolition.
- E. Removed and Salvaged Items: Comply with the following:
1. Clean salvaged items of dirt and demolition debris.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Government.
 4. Transport items to Government's storage area.
 5. Protect items from damage during transport and storage.

3.04 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations.
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by Contracting Officer, items may be removed to a suitable, protected storage location during demolition and reinstalled in their original locations after demolition operations are complete.
- C. Existing Utilities: Maintain utility services indicated to remain and protect them against damage during demolition operations.
1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Government and authorities having jurisdiction.
 2. Provide temporary services during interruptions to existing utilities, as acceptable to Government and to authorities having jurisdiction.
 - a. Provide at least 72 hours' notice to Government if shutdown of service is required during changeover.

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- D. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 1 Section "Temporary Facilities and Controls."
 - 1. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 2. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - 3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 4. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 - 5. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 - 6. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise from occupied portions of adjacent buildings.

3.05 DEMOLITION, GENERAL

- A. General: Demolish indicated existing buildings and structures and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain adequate ventilation when using cutting torches.
 - 3. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Engineering Surveys: Perform surveys as the Work progresses to detect hazards that may result from building demolition activities.
- C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Government or building manager and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.06 MECHANICAL DEMOLITION

- A. Remove buildings and structures and site improvements intact when permitted by authorities having jurisdiction.

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- B. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - C. Remove debris from elevated portions by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - 1. Remove structural framing members and lower to ground by method suitable to minimize ground impact or dust generation.
 - D. Concrete: Cut concrete full depth at junctures with construction indicated to remain, using power-driven saw, then remove concrete between saw cuts.
 - E. Masonry: Cut masonry at junctures with construction indicated to remain, using power-driven saw, then remove masonry between saw cuts.
 - F. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished at junctures with construction indicated to remain, then break up and remove.
 - G. Structural Steel: Dismantle field connections without bending or damaging steel members. Do not use flame-cutting torches unless otherwise authorized by the Government.
 - 1. Transport steel trusses and joists as whole units without dismantling them further.
 - H. Carpet and Pad: Remove in large pieces and roll tightly after removing demolition debris, trash, adhesive, and tack strips.
 - I. Equipment: Disconnect equipment at nearest fitting connection to services, complete with service valves. Remove as whole units, complete with controls.
 - J. Below-Grade Construction: Demolish foundation walls and other below-grade construction that is within 5 feet (1.5 m) outside of footprint indicated for new construction. Abandon below-grade construction outside this area.
 - 1. Remove below-grade construction, including basements, foundation walls, and footings, completely.
 - K. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
 - 1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - 2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.
- 3.07 EXPLOSIVE DEMOLITION
- A. Explosives: Use of explosives for building demolition is not permitted.

3.08 SITE RESTORATION

- A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
- B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.09 REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by building demolition operations.
- B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
- C. Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

3.10 RECYCLING DEMOLISHED MATERIALS

- A. General: Separate recyclable demolished materials from other demolished materials to the maximum extent possible. Separate recyclable materials by type.
 - 1. Provide containers or other storage method approved by Contracting Officer for controlling recyclable materials until they are removed from Project site.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from demolition area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Transport recyclable materials off Government's property and legally dispose of them.
- B. Recycling Haulers and Markets: List below is provided for information only; available recycling haulers and markets include, but are not limited to, the following:
 - 1. List to be provided.
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling building demolition materials shall accrue to Contractor.
- D. Asphalt: Pulverize or grind asphalt to maximum 1-1/2-inch size for reuse as base material.
- E. Clean Unpainted Concrete: Pulverize and grind to maximum 1½" size for reuse as base material. Separate rebar from demolished concrete.
- F. Painted Concrete: Remove from site.

- G. Masonry: Remove from site.
- H. Wood Materials: Sort and stack members according to size, type, and length. Separate dimensional and engineered lumber, panel products, and treated wood materials.
- I. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
 - 3. Rebar: Separate and stack all rebar to be recycled.
- J. Roofing: Separate organic and glass-fiber shingles and felts. Remove nails, staples, and accessories.

3.11 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Government's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill or recycling facility.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Government's property and legally dispose of them.

3.12 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION 02051

SECTION 02230

SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees and vegetation to remain.
 - 2. Removing trees and other vegetation.
 - 3. Clearing and grubbing.
 - 4. Topsoil stripping.
 - 5. Removing above-grade site improvements.
 - 6. Disconnecting, capping or sealing, and abandoning site utilities in place.
 - 7. Disconnecting, capping or sealing, and removing site utilities.
- B. Related Sections include the following:
 - 1. Division 2 Section "Tree Protection and Trimming" for protecting trees remaining on-site that are affected by site operations.
 - 2. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

1.03 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of weeds, roots, and other deleterious materials.

1.04 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled or to remain Government's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.05 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
 - 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements of the General Contractor.

1.07 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 Government and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Government's property will be obtained by Government before award of Contract.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Government's premises where indicated.
- D. Notify utility locator service for area where Project is located before site clearing.

PART 2 - PRODUCTS (Not Applicable)

2.01 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- D. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Government.

3.02 TREE PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
 - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Contracting Officer.
 - 1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
 - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

3.03 UTILITIES

- A. Government will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing when requested by Contractor.
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Government will arrange to shut off indicated utilities when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Contracting Officer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Contracting Officer's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

3.04 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
 - 4. Use only hand methods for grubbing within drip line of remaining trees.
- 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 8-inch (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

3.05 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
 - 2. Do not stockpile topsoil within drip line of remaining trees.
 - 3. Dispose of excess topsoil as specified for waste material disposal.
 - 4. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.06 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.07 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Government's property.

END OF SECTION 02230

SECTION 02240

DEWATERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes construction dewatering.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for excavating, backfilling, and site grading.

1.03 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. Maintain dewatering operations to ensure erosion is controlled, stability of excavations and constructed slopes is maintained, and flooding of excavation and damage to structures are prevented.
 - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 4. Accomplish dewatering without damaging existing buildings adjacent to excavation.

1.04 SUBMITTALS

- A. Shop Drawings: For dewatering system. 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 layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 - 2. Include a written report outlining control procedures to be adopted if dewatering problems arise.
 - 3. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.
- D. Record drawings at Project closeout identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.
- E. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that dewatering system is capable of meeting performance requirements.

1.05 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.

1.06 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Government or others unless permitted in writing by the Contracting Officer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Project Site Information: A geotechnical report has been prepared for this Project and is available for information only. The report is not part of the Contract Documents. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. Government will not be responsible for interpretations or conclusions drawn from this data by Contractor.
 - 1. The geotechnical report will be available upon request.
- C. Survey adjacent structures and improvements, employing a qualified professional engineer or surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During dewatering, resurvey benchmarks weekly, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Contracting Officer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 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.

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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 without permission from Government and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

3.02 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 60 inches (1500 mm) 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 mm) below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION 02240

SECTION 02273

EROSION CONTROL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. The work included for erosion control shall include but not necessarily be limited to:
 - 1. Furnishing and installation of silt fences, hay bales, check dams, gravel, mulches, channels, grading to control runoff, hay bales and all other devices required to control erosion.
 - 2. Continual maintenance of all installed devices to control erosion.
 - 3. Removal and clean-up.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for soil disturbance and grading.
 - 2. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.

1.04 DEFINITIONS – Not Used

1.05 SUBMITTALS

- A. Implementation Plan

Prior to commencement of the work, the Contractor shall:

- 1. Meet with the Contracting Officer to develop mutual understandings relative to compliance with the provisions of this Section and administration of the erosion and sediment control program.
- 2. Should the Contractor desire to change or modify the specified erosion controls then he shall submit in writing his plans to the Government for implementing erosion and sediment control including, but not limited to, placement of hay bales, silt fence, mulch and temporary channels, as well as a description of all construction techniques intended to minimize erosion and sedimentation, and a program for maintenance of these facilities throughout the performance of construction activities.
- 3. The Contractor, should he desire to modify the specified plan, shall submit to the Government and Contracting Officer his detailed erosion and sedimentation plan for approval at least two weeks prior to initiation of work.

1.06 QUALITY ASSURANCE

- A. Conduct all construction in a manner and sequence that causes the least practical disturbance of the physical environment.
- B. Stabilize disturbed earth surfaces in the shortest practical time and employ any and all such temporary erosion control devices as may be necessary until such time as adequate soil stabilization has been achieved or permanent erosion control devices are operational.
- C. The erosion control devices specified herein represent the minimum required work for erosion control. The Contractor shall add to these minimum devices any and all measures to effectively prevent migration of sediment from the work area.

1.07 PROJECT CONDITIONS

- A. In order to prevent erosion and sedimentation from construction activities related to the performance of this project, the Contractor and his subcontractors shall comply with permits issued for the project, all applicable federal, state and local laws and regulations concerning erosion and sediment control, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

PART 2 - PRODUCTS

2.01 HAY BALES

- A. Bales shall be made of hay with forty pounds minimum weight and one hundred and twenty pounds maximum weight. They should be either wirebound or string tied. Wood stakes shall be a minimum of 2 inches by 2 inches nominal size by a minimum of 3 feet long.

2.02 TEMPORARY COVER

- A. Temporary Mulching - Mulches will consist of organic material such as hay and straw, shredded corn stalks, wood chips, bark or shavings, sawdust, wood, excelsior and wood fiber. Wood chips or bark mulch must be at least 50% decomposed for use as mulch. Mulch may also consist of erosion control blankets and mats designed and manufactured specifically for the purpose of soil retention. Mats and/or blankets are the preferred method of application of mulch on steep slopes such as exposed landfill faces.

2.03 SILT FENCES – As indicated on drawings.

2.04 Provide silt bays per CTDOT Standards.

PART 3 - EXECUTION

3.01 GENERAL EROSION CONTROL REQUIREMENTS

- A. All materials and installation shall be in accordance with the approved erosion and sediment control plan.
- B. The Government has the authority to control the surface area of each material exposed by construction operations and to direct the Contractor to immediately provide permanent or temporary erosion control measures to prevent contamination of adjacent streams, watercourses, lakes, ponds or other areas of water impoundment. Every effort shall be made by the Contractor to prevent erosion on the site and abutting property.
- C. All exposed slopes shall be stabilized by mulching, or otherwise protected as the work progresses to comply with the intent of this specification. All damaged slopes shall be repaired as soon as possible. The Government shall limit the surface area of earth material exposed if the Contractor fails to sufficiently protect the slopes to prevent pollution.
- D. The Contractor shall at all times have on hand the necessary materials and equipment to provide for early slope stabilization and corrective measures to damaged slopes.
- E. The erosion control features installed by the Contractor shall be maintained by the Contractor, and he shall remove such installations upon completion of the Work or if ordered by the Government.
- F. The Contractor shall operate all equipment and perform all construction operations so as to minimize pollution. The Contractor shall cease any of his operations which will increase pollution during rain storms.
- G. The Contractor shall place additional erosion and sedimentation controls as required by laws and regulations.

3.02 SEEDING

- A. Temporary Mulching - Temporary mulching will be used on all planted surfaces to maintain surface stability until the vegetation becomes established. Mulching will also be used to stabilize surfaces during the off-season pending planting during the growing season.

Organic mulches will be spread uniformly, by hand or machine and will be anchored to the soil surface by netting, pegs and twine, or cut into the soil surface with anchoring tools (spade or disk) to a depth of about 3 inches. where hydromulching is used in seeding surfaces, the application rate will be 1,500 pounds per acre on flats and 3,000 pounds per acre on slopes. Erosion control blankets and mats will be installed and secured in accordance with the manufacturer's specifications.

Mulch maintenance will consist of periodic inspection, particularly after rainstorms, for, erosion damage to mulch cover, failure of anchoring mechanisms, washouts, dislocation or other failures. Where any of these conditions is observed, the damage will be repaired and the mulch will be replaced and reanchored as needed. Inspections will continue until vegetative cover is established as indicated by grasses of uniform height and density at a minimum height of three inches.

3.03 HAY BALE INSTALLATION

- A. Bales shall be R.I. Standard 9.1 set lengthwise on the contour for sheet flow applications. They shall be held in place by two wooden stakes in each bale as detailed. Bales shall be maintained or replaced until they are no longer necessary for the purpose intended or are ordered removed by the Government.
- B. After the bale end joints shall be chinked with loose straw to close any gaps. Excavated soil shall then be backfilled against the uphill side of the barrier to a depth of 4 inches above the downhill grade.
- C. Following compaction of the backfill, loose straw shall be scattered over the surface directly behind the barrier.

3.04 DIVERSIONS

- A. Diversions for directing surface runoff or existing stream to allow sediment removal away from and/or around excavating and other construction operations shall be installed and stabilized in advance of new work.
- B. The minimum capacity of the diversion shall be sized to accommodate a 2-year design storm.
- C. Periodic cleaning shall be done to maintain capacity.

3.05 MAINTENANCE

Contractor shall remove sediment which has built up to half the height of the hay bales. Reset bales and silt fences as necessary.

3.06 REMOVAL AND CLEAN-UP

- A. All temporary erosion control facilities and accumulated sediments, shall be removed in a neat and workmanlike manner when all disturbed areas have been satisfactorily stabilized.
- B. All debris removed, sediments and other earth materials shall not leave the project site, but shall be hauled to and stockpiled at the location designated by the Government. All loading, hauling and stockpiling shall be performed by the Contractor at no additional expense.

END OF SECTION 02273

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Subbase course for concrete walks and pavements.
 - 5. Base course for asphalt paving.
 - 6. Subsurface drainage backfill for walls and trenches.
 - 7. Excavating and backfilling trenches within building lines.
 - 8. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- B. Related Sections include the following:
 - 1. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
 - 2. Division 2 Section "Dewatering" for lowering and disposing of ground water during construction.
 - 3. Division 2 Section "Tree Protection and Trimming" for protecting and trimming trees to remain.
 - 4. Division 2 Section "Excavation Support and Protection."

1.03 UNIT PRICES

- A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:
 - 1. 24 inches (600 mm) outside of concrete forms other than at footings.
 - 2. 12 inches (300 mm) outside of concrete forms at footings.
 - 3. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
 - 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - 5. 6 inches (150 mm) beneath bottom of concrete slabs on grade.
 - 6. 6 inches (150 mm) beneath pipe in trenches, and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.
- B. Unit prices for rock excavation include replacement with approved materials.

1.04 DEFINITIONS

- A. Backfill: Soil materials 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: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Additional Excavation: Excavation below subgrade elevations as directed by Contracting Officer. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavations more than 10 feet (3 m) in width and pits more than 30 feet (9 m) in either length or width.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Contracting Officer. Unauthorized excavation, as well as remedial work directed by Contracting Officer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm).
- 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: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.05 SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of plastic warning tape.
- B. Samples: For the following:
 - 1. 30-lb (14-kg) samples, sealed in airtight containers, of each proposed soil material from on-site or borrow sources.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.
 - 3. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

1.06 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Preexcavation Conference: Conduct conference at Project site to comply with requirements in of the General Contractor.

1.07 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted in writing by Contracting Officer and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Contracting Officer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Contracting Officer's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

- B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Backfill and Fill: Satisfactory soil materials.
- E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (38-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.
- G. Structural Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.
- H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

2.02 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 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.

- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.02 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.

3.03 EXPLOSIVES

- A. Explosives: Use of explosives to be approved by Government and Contracting Officer based on a submitted blasting plan from the Contractor.

3.04 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. Classified Excavation: Excavation to subgrade elevations classified as earth and rock. Rock excavation will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 - 2. Rock excavation includes removal and disposal of rock.
 - a. Do not excavate rock until it has been classified and cross-sectioned by Contracting Officer.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended for bearing surface.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.07 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: 12 inches (300 mm) on each side of pipe or conduit.
 2. Clearance: As indicated.
- C. 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.
 1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 3. Excavate trenches 8 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.08 APPROVAL OF SUBGRADE

- A. Notify Contracting Officer when excavations have reached required subgrade.
- B. If Contracting Officer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

- C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Contracting Officer.

3.09 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 may be used when approved by Contracting Officer.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Contracting Officer.

3.10 STORAGE OF SOIL MATERIALS

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

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for record documents.
 - 3. Inspecting and testing underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course 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.
- B. Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings; fill with concrete to elevation of bottom of footings.
- C. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.
 - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

- D. Coordinate backfilling with utilities testing.
- E. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.
- F. Place and compact final backfill of satisfactory soil material to final subgrade.
- G. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use structural fill.
 - 4. Under building slabs, use structural fill.
 - 5. Under footings and foundations, use structural fill.

3.14 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill 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.

3.15 COMPACTION OF BACKFILLS AND FILLS

- A. Place backfill and fill materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 85 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
 2. Walks: Plus or minus 1 inch (25 mm).
 3. Pavements: Plus or minus 1/2 inch (13 mm).
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBSURFACE DRAINAGE

NOT USED

3.18 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course on prepared subgrade and as follows:
 1. Place base course material over subbase.
 2. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
 3. Shape subbase and base to required crown elevations and cross-slope grades.
 4. When thickness of compacted subbase or base course is 6 inches (150 mm) or less, place materials in a single layer.
 5. When thickness of compacted subbase or base course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.
- B. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency: Government will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades 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 Contracting Officer.
- 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 one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet (30 m) or less of wall length, but no fewer than two tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet (46 m) or less of trench length, but no fewer than two 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.

3.20 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.
 - 1. Scarify or remove and replace soil material to depth as directed by Contracting Officer; reshape and recompact.
- 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 the greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Government's property.
- B. The Government has a tentative agreement with the abutting Gravel Bank owner to accept surplus satisfactory soil material, described herein, thereby eliminating the need for long haul disposal. Contractor to verify and coordinate.

END OF SECTION 02300

SECTION 02510

WATER DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes water-distribution piping and specialties outside the building for the following:
 - 1. Combined water service and fire-service mains.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.03 DEFINITIONS

- A. Combined Water Service and Fire-Service Main: Exterior water piping for both domestic-water and fire-suppression piping.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Valves and accessories.
 - 2. Fire hydrants.
- B. 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.
- C. Field Quality-Control Test Reports: From Contractor.
- D. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals, include the following:
 - 1. Valves.
 - 2. Fire hydrants.

1.05 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, 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 standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
2. 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. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, 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, including fire hydrants, 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.

1.07 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Contracting Officer not less than two days in advance of proposed utility interruptions.

1.08 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.01 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. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.03 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint, bell- and plain-spigot end unless grooved or flanged ends are indicated.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111, rubber.

2.04 CORROSION-PROTECTION ENCASUREMENT FOR PIPING

- A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

2.05 GATE VALVES

- A. AWWA, Cast-Iron Gate Valves:
 - 1. Available Manufacturers:
 - a. American AVK Co.; Valves & Fittings Div.
 - b. American Cast Iron Pipe Co.; American Flow Control Div.
 - c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. East Jordan Iron Works, Inc.
 - f. Grinnell Corporation; Mueller Co.; Water Products Div.
 - g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - h. McWane, Inc.; Kennedy Valve Div.

- i. McWane, Inc.; Tyler Pipe; Utilities Div.
- j. NIBCO INC.
- k. United States Pipe and Foundry Company.

2.06 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Valve Boxes: Comply with AWWA 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- (125-mm-) diameter barrel.
 - 1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.07 FREESTANDING FIRE HYDRANTS

- A. Dry-Barrel Fire Hydrants: UL 246, FM-approved, one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure, and 150-psig (1035-kPa) minimum working-pressure design.
 - 1. Available Manufacturers:
 - a. American AVK Co.; Valves & Fittings Div.
 - b. American Cast Iron Pipe Co.; American Flow Control Div.
 - c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.
 - d. American Foundry Group, Inc.
 - e. East Jordan Iron Works, Inc.
 - f. Grinnell Corporation; Mueller Co.; Water Products Div.
 - g. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).
 - h. McWane, Inc.; Kennedy Valve Div.
 - i. McWane, Inc.; M & H Valve Company Div.
 - j. Troy Valve.
 - k. United States Pipe and Foundry Company.
 - 2. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - 3. Operating and Cap Nuts: Pentagon, 1-1/2 inches (40 mm) point to flat.
 - 4. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
 - 5. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.
- C. Do not use flanges, unions, or keyed couplings for underground piping.
- D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground Water-Service Piping: Use any of the following piping materials for each size range:
 - 1. NPS 5 and NPS 6 (DN 125 and DN 150): Use NPS 6 (DN 150) PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 fabricated push-on-joint, ductile-iron mechanical-joint, ductile-iron fittings; and gasketed joints.
- F. Underground Combined Water-Service and Fire-Service-Main Piping: Use the following:
 - 1. NPS 6 to NPS 12 (DN 150 to DN 300): Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed or mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
 - 2. NPS ¾ to NPS 2 (DN 20 to DN 50): Soft copper tube, Type K (Type A); wrought-copper fittings; and soldered joints.

3.03 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.

3.04 JOINT CONSTRUCTION

- A. See Division 2 Section "Utility Materials" for basic piping joint construction.
- B. Make pipe joints according to the following:
 - 1. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

3.05 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated on the drawings.
- B. Water-Main Connection: Connect to existing water main according to requirements of water utility company and of size and in location indicated.
- C. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

3.06 ANCHORAGE INSTALLATION

- A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
 1. Fire-Service-Main Piping: According to NFPA 24.
- B. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.07 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.

3.08 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. AWWA-Type Fire Hydrants: Comply with AWWA M17.
- C. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

3.09 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.
 1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.10 IDENTIFICATION

- A. Install continuous underground warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 2 Section "Earthwork" for underground warning tapes.
- B. Permanently attach equipment nameplate or marker, indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Utility Materials" for identifying devices.

3.11 ADJUSTING

- A. Adjust drinking fountain flow regulators for proper flow and stream height.

3.12 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping or as described below. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 02510

SECTION 02530

SANITARY SEWERAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes sanitary sewerage outside the building.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork for Soil Materials" excavating backfilling and site grading."
 - 2. Division 3 Section "Cast-in-Place Concrete" for concrete structures.

1.03 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.04 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.05 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, details, and attachments for the following:
 - 1. Precast concrete manholes, including frames and covers.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.07 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.

- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Contracting Officer not less than two days in advance of proposed utility interruptions.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.02 PIPES AND FITTINGS

- A. PVC Sewer Pipe and Fittings: According to the following:
 - 1. PVC Sewer Pipe and Fittings, NPS 15 (DN375) and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.
 - a. Gaskets: ASTM F 477, elastomeric seals.

2.03 MANHOLES

- 1. Precast Concrete Manholes shall conform with CTDOT Standard Specifications, latest edition, Section 5.07.
- B. Manhole Frames and Covers shall conform with CTDOT Standard Specifications, latest edition, Section 5.07.

2.04 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.
- C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious materials ratio. Include channels and benches in manholes.
 - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 1 percent through manhole.
 - b. Invert Slope: 2 percent through manhole.
 - 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 8 percent.

b. Slope: 4 percent.

- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.
1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 400), deformed steel.

2.05 PROTECTIVE COATINGS

- A. Description: One- or two-coat, coal-tar epoxy; 15-mil (0.38-mm) minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:
1. Concrete Manholes: On exterior surface.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.02 IDENTIFICATION

- A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.
1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.03 PIPING APPLICATIONS

- A. General: Include watertight joints.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.
- C. Gravity-Flow Piping: Use the following:
1. NPS 8 and NPS 10 (DN200 and DN250): PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.

3.04 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

- C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.
 - 1. Install piping pitched down in direction of flow, at minimum slope of 2 percent, unless otherwise indicated.
 - 2. Install piping with 36-inch (1000-mm) minimum cover.

3.05 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to installations indicated.
- B. Refer to Division 2 Section "Utility Materials" for basic piping joint construction and installation.
- C. PVC Sewer Pipe and Fittings: As follows:
 - 1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
 - 2. Join profile sewer pipe fittings with gaskets according to ASTM D 2321 and manufacturer's written instructions.
 - 3. Install according to ASTM D 2321.

3.06 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Form continuous concrete channels and benches between inlets and outlet.
- C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere, unless otherwise indicated.
- D. Install precast concrete manhole sections with gaskets according to ASTM C 891.
- E. Construct cast-in-place manholes as indicated.
- F. Install fiberglass manholes according to manufacturer's written instructions.

3.07 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.08 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
 - 1. Place plug in end of incomplete piping at end of day and when work stops.

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2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.
 1. Submit separate reports for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate reports for each test.
 5. If authorities having jurisdiction do not have published procedures, perform tests as follows:
 - a. Sanitary Sewerage: Perform hydrostatic test.
 - 1) Allowable leakage is maximum of 50 gal. per inch of nominal pipe size per mile (4.6 L per millimeter of nominal pipe size per kilometer) of pipe, during 24-hour period.
 - 2) Close openings in system and fill with water.
 - 3) Purge air and refill with water.
 - 4) Disconnect water supply.
 - 5) Test and inspect joints for leaks.
 - 6) Option: Test ductile-iron piping according to AWWA C600, Section "Hydrostatic Testing." Use test pressure of at least 10 psig (69 kPa).
 - b. Sanitary Sewerage: Perform air test according to UNI-B-6.
 - 1) Option: Test concrete piping according to ASTM C 924 (ASTM C 924M).
 6. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).
 7. Leaks and loss in test pressure constitute defects that must be repaired.
 8. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 02530

SECTION 02630

STORM DRAINAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes storm drainage outside the building.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork for Soil Materials" excavating, backfilling and site grading for foundation drains connecting to storm drainage.

1.03 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.04 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.05 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, details, and attachments for the following:
 - 1. Precast concrete manholes and other structures, including frames, covers, and grates.
- B. Coordination Drawings: Show manholes and other structures, pipe sizes, locations, and elevations. Include details of underground structures and connections. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between piping and proximate structures.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.07 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Contracting Officer not less than two days in advance of proposed utility interruptions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.02 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.03 PIPES AND FITTINGS

- A. PVC Sewer Pipe and Fittings: According to the following:
 - 1. PVC Sewer Pipe and Fittings, NPS 15 (DN375) and Smaller: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.
 - a. Gaskets: ASTM F 477, elastomeric seals.
- B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M), Class III, Wall B, for gasketed joints.
 - 1. Gaskets: ASTM C 443 (ASTM C 443M), rubber.

2.04 MANHOLES

- 1. Precast Concrete Manholes shall conform with CTDOT Standard Specifications, latest edition, Section 5.07.
- B. Manhole Frames and Covers shall conform with CTDOT Standard Specifications, latest edition, Section 5.07.

2.05 CATCH BASINS

- 1. Precast Concrete Catch Basins shall conform with CTDOT Standard Specifications, latest edition, Section 5.07.
- B. Frames and Grates: ASTM A 536, Grade 60, ductile iron designed for heavy-duty service. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 by 24 inches (610 by 610 mm) minimum, unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2.06 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed steel.
- C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water-cementitious ratio.
 1. Include channels and benches in manholes.
 - a. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - 1) Invert Slope: 1 percent through manhole.
 - 2) Invert Slope: 2 percent through manhole.
 - 3) Invert Slope: None.
 - b. Benches: Concrete, sloped to drain into channel.
 - 1) Slope: 8 percent.
 - 2) Slope: 4 percent.
 2. Include channels in catch basins.
 - a. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - 1) Invert Slope: 1 percent through catch basin.
 - 2) Invert Slope: 2 percent through catch basin.
 - 3) Invert Slope: None.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious ratio.
 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed steel.

2.07 PROTECTIVE COATINGS

- A. Description: One- or two-coat, coal-tar epoxy; 15-mil (0.38-mm) minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:
 1. Concrete Manholes: On exterior surface.
 2. Catch Basins: On exterior surface.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.02 IDENTIFICATION

- A. Materials and their installation are specified in Division 2 Section "Earthwork." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.
 - 1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.03 PIPING APPLICATIONS

- A. General: Include watertight, silttight, or soiltight joints, unless watertight or silttight joints are indicated.
- B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated.
- C. Gravity-Flow Piping: Use the following:
 - 1. NPS 8 to NPS 15 (DN200 to DN375): PVC sewer pipe and fittings, solvent-cemented joints, or gaskets and gasketed joints.
 - 2. NPS 18 to NPS 36 (DN450 to DN900): Reinforced-concrete sewer pipe and fittings, gaskets, and gasketed joints.

3.04 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.
- C. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.
- D. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping with 36-inch (1000-mm) minimum cover.

F. Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

3.05 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.

B. Refer to Division 2 Section "Utility Materials" for basic piping joint construction and installation.

C. PVC Sewer Pipe and Fittings: As follows:

1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
2. Install according to ASTM D 2321.

D. Concrete Pipe and Fittings: Install according to ACPA's "Concrete Pipe Installation Manual." Use the following seals:

1. Round Pipe and Fittings: ASTM C 443 (ASTM C 443M), rubber gaskets.

E. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.

F. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

3.06 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Form continuous concrete channels and benches between inlets and outlet.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere, unless otherwise indicated.

D. Install precast concrete manhole sections with gaskets according to ASTM C 891.

3.07 CATCH-BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.08 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.09 DRAINAGE SYSTEM INSTALLATION

- A. Assemble and install components according to manufacturer's written instructions.
- B. Assemble and install stainless-steel drainage systems according to ASME A112.3.1 and manufacturer's written instructions.
- C. Install with top surfaces of components, except piping, flush with finished surface.
- D. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.
- E. Embed channel sections and drainage specialties in 4-inch (100-mm) minimum concrete around bottom and sides.
- F. Fasten grates to channel sections if indicated.
- G. Assemble trench sections with flanged joints.
- H. Embed trench sections and drainage specialties in 4-inch (100-mm) minimum concrete around bottom and sides.
- I. Make piping connections and install stainless-steel piping with gasketed joints between system components.

3.10 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place plug in end of incomplete piping at end of day and when work stops.
 - 3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.

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- C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate reports for each test.
 - 5. Where authorities having jurisdiction do not have published procedures, perform tests as follows:
 - a. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
 - 6. Leaks and loss in test pressure constitute defects that must be repaired.
 - 7. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 02630

SECTION 16760

PAGING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish, install and test all components related to the paging system as shown on the drawings and specified herein.

1.02 RELATED SECTIONS

- A. Section 16010 – Basic Electrical Requirements.

1.03 SUBMITTALS

- A. The vendor shall provide the following documentation and service.
 - 1. Shop Drawings; 3 sets. These drawings shall include the manufacturers' specification sheets, including all the component parts.
 - 2. The submittal shall include a detailed description of exactly how the system submitted shall function. All functions as described herein shall be provided.
 - 3. As Built Drawings; 3 sets. These drawings shall include the information in (paragraph 1.03 A.1). They should include up-to-date drawings that include any changes made to the system during installation. Circuit diagrams and a detailed system operation shall be a part of the as built drawings.
- B. All material and/or equipment necessary for the proper operation of the system, even though not specifically mentioned in the contract documents, shall be deemed part of this contract.

1.04 QUALIFICATIONS

- A. To establish continuity in manufacturers, major systems components shall be the standard product of one manufacturer. Further, an effort shall be made to establish common sources for equipment of this system. The manufacturer of the equipment will have a minimum of five (5) years experience in the manufacture of products specified in this Section.
 - 1. The work to be provided under this Section consists of furnishing all equipment, required for complete, operable, single-zone, paging system. This system will be referred to as the "ELECTRONIC SYSTEM" and their supplier as the "ELECTRONIC CONTRACTOR".
 - 2. All empty conduit, cable and power required for the electronic systems will be supplied by the electrical contractor as a complete raceway system or as directed by the Government.

- B. The electrical contractor will accept bids from prequalified electronic contractors/suppliers. Prices will reflect cost of electronic systems as completely installed, but the conduit, cable, installation, loudspeaker installation or raceway for these systems should not be included in this figure. The electrical contractor's base bid will include the BASE BID SYSTEMS as specified. Should the electrical contractor wish to supply information on alternate systems, see paragraphs 1.07 and 1.08. Special Note: Any additional conduit or wire for alternate equipment shall be included in the ALTERNATE SYSTEM cost. It is the electrical contractor's responsibility to thoroughly investigate the possible effects of ALTERNATE EQUIPMENT on the conduit/raceway/wire system. Conduit will be provided as indicated on the plans. The Government will not pay any additional cost for additional conduit or wire required to implement alternate equipment.

- C. To establish single source responsibility for installation and future service of electronic systems, a contract or subcontract will be issued to a single qualified electronic contractor. This electronic contractor will supply and install the electronic systems. Further, this contractor will supply and install all necessary components for complete, working and functionally acceptable electronic systems.

- D. The electronic contractor must be a factory authorized representative or distributor of all equipment utilized in the electronic systems. Further, this contractor must have a minimum of five years of experience in the specific application of the equipment proposed for these systems. Provide a letter signed by an officer of the manufacturer attesting to the contractor's direct affiliation with the manufacturer.
 - 1. Equipment shall be furnished and installed by Authorized Dukane Distributor; A+ Technology, 500 Summer Street, Stamford, CT. (203) 326-5656.

1.05 REGULATORY REQUIREMENTS

- A. The entire installation will comply with all applicable electrical and safety codes. All central equipment amplifiers, processor and additional applicable equipment shall be listed by Underwriters' Laboratories, cUL, or CSA Listed. Furnish an original, dated specimen of the approving agencies listing card with the submittal.

1.06 MAINTENANCE SERVICE

- A. The communication bidder supplying the equipment shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system, including replacement parts. The vendor shall be prepared to offer a service contract for the maintenance of the system after the guarantee period. The bidder shall produce evidence that they have had a fully experienced and factory trained service organization for at least five years and proven satisfactory installations during that time.

PART 2 - PRODUCTS

2.01 PAGING SYSTEM

- A. The initial phase shall consist of a single zone paging system. In future expansion programs, the system shall be expanded to support additional systems as well as a telephone accessible, multi-zone paging system with all conduit, wire, outlets, loudspeakers, amplifiers and equipment as shown on the drawings and as herein specified to provide a complete paging system.

2.02 SYSTEM PARAMETERS

- A. The system specified herein shall provide simultaneous single zone paging as shown on the drawings. Certain groups of loudspeakers shall be wired into "Zones" as shown on the drawings. For this initial phase, these zones shall be made a part of the single zone paging system. In a future expansion, these zones shall be divided individually, to provide multi-zone capabilities. The systems loudspeaker wiring shall not require any changes or re-wiring to provide zone paging capabilities.
- B. Paging shall originate from a desk mounted microphone with a touch bar paging button. This microphone shall be located at the "Front Desk" location 1310. Future expansion shall allow any enabled telephone to provide multi-zone paging access into any or all of the "Zones" shown on the drawings. In the future expansion, the telephone supplier shall provide a simultaneously functioning page port for each zone and All Call.

2.03 CENTRAL EQUIPMENT

- A. The central equipment for the initial phase shall be located on a shelf provided by others. This shelf shall be sized to accommodate the specified amplifier dimensions and weight.
- B. In a future expansion, this amplifier and additional equipment shall be mounted in a surface mounted cabinet mounted in the same location as the shelf. This cabinet shall provide space for the amplification equipment, power supplies and associated equipment to accommodate the zone paging capabilities as specified herein.
- C. **AMPLIFIER;** Provide an amplifier to serve the zones shown on the drawings. The shelf mounted amplifier shall be Dukane Model 1A1725 and shall deliver 125 Watts of continuous power with less than 1% distortion from 20Hz to 20,000Hz (direct). The signal to noise ratio shall be greater than 70dB for auxiliary and telephone/page inputs. The signal to noise ratio for other inputs shall be greater than 60dB for low impedance microphone inputs. Input 5 shall be reserved for the future expansion, for the telephone page input from the building system. The amplifier shall contain individual controls for each inputs, using modules, 2A42, 2A45, 1-5, the tone controls, the master control and the illuminated power switch shall be front panel accessible. Each input shall provide space to logically identify the controls use. These shall be labeled during installation.
 - 1. Amplifier shall be sized to allow 80% headroom. Under no circumstances shall any amplifier, used herein, be allowed to be loaded to more than 80% of its capacity.

2. Loudspeakers mounted in 20' ceilings shall be set at 1W. Loudspeakers mounted in 10" ceilings shall be set at 1/2W.

2.04 LOUDSPEAKERS, BAFFLES AND BACKBOXES

A. Flush, round, ceiling mounted baffle/speaker/transformer/backbox:

1. Baffle: Material - Brushed Aluminum
Dimensions: 12-3/4" diameter and 5/16" deep
2. Loudspeaker and Dual Voltage Transformer Assembly:
Speaker Diameter: 8" (20.3 cm) PM type
Normal Wattage: 8 Watts
Program Wattage: 12 Watts
Voice Coil Impedance: 8 Ohms
Voice Coil Diameter: 3/4" (2 cm)
Magnet Weight: 4.8 Ounces (134 g), Ceramic
Axial Sensitivity: 91dB at 1 Meter (3.3 ft.) for 1 Watt Input
Transformer Taps:
 Primary: 25 Volt and 70 Volt
 Secondary: 1/2, 1 and 2 Watts on the 25V
 1/2, 1, 2 and 4 Watts on the 70V
3. Dukane Baffle; 6A335,
4. Dukane Speaker/transformer Model 5A606
5. Dukane 667-67 speaker support bridge

B. Volume Control

1. Flush wall mounted single gang area loudspeaker volume control with built in relay. Note; By-pass relay to be utilized in phase two expansion.
2. Each volume control shall be located as shown on the plans.
3. Dukane Model 9A1553A

2.04 DESK MICROPHONE

A. Desk Mounted microphone shall be located as shown on the drawings.

1. Microphone shall be Omni-direction Controlled Magnetic.
2. Frequency range of 100-10,000 Hz.
3. Dual impedance, 150 or high.
4. Output level shall be .28mv (-71.0db)
5. The microphone shall contain an on-off switch operated by finger-tip control bar.
6. The switch shall contain contacts prewired for remote relay operation.
7. Dukane Model; 7A766

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as shown on Drawings.
- C. Verify that required utilities are available, in proper location, and ready for use.
- D. Beginning of installation means installer accepts conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions. The contractor shall have equipment installed on the AC voltage supply taking care to arrest damaging electrical transients and spikes which can cause damage to the microprocessor components of the system.
- B. Install flush and surface loudspeakers and horns as shown on the plans, taking care to avoid heating ducts and other impediments hidden behind the ceiling covering.
- C. Install and wire system in accord with manufacturer's approved drawings and diagrams.
- D. Provide field technician services to make final signal cable connections to sound paging and telephone equipment.
- E. Prepare and start systems.

3.03 ADJUSTING

- A. Adjust controls to achieve proper operations.
- B. The specified equipment shall be supplied, installed, adjusted, tested and guaranteed by a factory authorized communications contractor for the products furnished. The vendor is responsible for verifying the completeness of the parts list and the suitability of the equipment to meet the intended purpose of the specifications and to serve the best interests of the Government.

3.04 DEMONSTRATION

- A. Provide systems demonstration and instructions. Allow a minimum of 8 hours.
- B. Employ manufacturer's field representative to demonstrate system operation to designated Government personnel.
- C. Use submitted operation and maintenance manual as reference during demonstration and training.

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- D. Training: Provide the Government with a training program designed to make all administrative control station users familiar with the operation of the voice communications system.
- E. Submit field reports indicating satisfactory installation and testing of system.
- F. Electronic Contractor shall supply a descriptive operation manual for the paging system.

END OF SECTION

SECTION 02741

HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Hot-mix asphalt paving.
 - 2. Pavement-marking paint.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.03 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. DOT: Department of Transportation.

1.04 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of the State of Connecticut Department of Transportation.
 - 1. Standard Specification: Standard Specifications for Roads, Bridges and Incidental Construction.

1.05 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Job-Mix Designs: For each job mix proposed for the Work.
- D. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international graphics symbol, spaces dedicated to people with disabilities.

- E. Samples: For each paving fabric, 12 by 12 inches (300 by 300 mm) minimum.
- F. Qualification Data: For manufacturer.
- G. Material Test Reports: For each paving material.
- H. Material Certificates: For each paving material, signed by manufacturers.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by State of Connecticut Department of Transportation.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with State of Connecticut Specifications for Roads, Bridges and Incidental Construction.
- D. Asphalt-Paving Publication: Comply with AIMS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- E. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - 2. Review condition of subgrade and preparatory work.
 - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.08 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F (15.5 deg C).
 - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.

3. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.5 deg C) 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 (4 deg C) for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.01 AGGREGATES

- A. Provide aggregate materials accordance with State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Section M.05.

2.02 ASPHALT MATERIALS

- A. Use bituminous materials in accordance with State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Section M.04.

2.03 AUXILIARY MATERIALS

- A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 3 minutes.
1. Color: As indicated.

2.04 MIXES

- A. Provide job-mixes in accordance with CTDOT Standard Specifications Section M.04.03 Class 1 for binder course and Class 2 for top course.

2.05 PRECAST CONCRETE CURB

- A. Provide precast concrete curb materials in accordance with State of Connecticut Standard Specifications for Roads, Bridges and Incidental Construction, Section 8.21.

2.06 BITUMINOUS CONCRETE CURB

- A. Provide bituminous concrete curb materials in accordance with State of Connecticut Standard Specifications for Roads, Bridges and Incidental Construction, Section 8.15.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.02 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 (300 mm) 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. (0.2 to 0.7 L/sq. m).
 - 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: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.03 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).
 - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
 - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.04 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.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 2. Protect primed substrate from damage until ready to receive paving.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
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.

3.05 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. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 2. Place hot-mix asphalt surface course in single lift.
 3. Spread mix at minimum temperature of 250 deg F (121 deg C).
 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 5. 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 (3 m) wide unless infill edge strips of a lesser width are required.
1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- 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.

3.06 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 (150 mm).
 3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.07 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).
- 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: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 - 2. 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. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.08 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch (13 mm).
 - 2. Surface Course: Plus 1/4 inch (6 mm), no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch (6 mm).
 - 2. Surface Course: 1/8 inch (3 mm).

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.09 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Contracting Officer.
- B. Allow paving to age for 30 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 (0.4 mm).
 1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal. (0.72 kg/L).

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 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.
 - 1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 02741

SECTION 02821

CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Galvanized steel chain-link fabric.
 - 2. Galvanized steel framework.
 - 3. Barbed wire.
 - 4. Gate operator.
 - 5. Grounding and bonding.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for filling and for grading work.
 - 2. Division 3 Section "Cast-in-Place Concrete".
 - 3. Division 16 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches.

1.03 DEFINITIONS

- A. CLFMI: Chain Link Fence Manufacturers Institute.

1.04 SUBMITTALS

- A. Product Data: Material descriptions, construction details, dimensions of individual components and profiles, and finishes for the following:
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements, and attachments.
 - 3. Gates and hardware.
 - 4. Barbed wire.
 - 5. Gate operators, including operating instructions.
 - 6. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: Show locations of fence, each gate, posts, rails, and tension wires and details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, elevations, sections, gate swing and other required installation and operational clearances, and details of post anchorage and attachment and bracing.

1. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 2. Wiring Diagrams: Power and control wiring and communication features and access control features. Differentiate between manufacturer-installed and field-installed wiring and between components provided by gate operator manufacturer and those provided by others.
- C. Product Certificates: Signed by manufacturers of chain-link fences and gates certifying that products furnished comply with requirements.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Field Test Reports: Indicate and interpret test results for compliance of chain-link fence and gate grounding and bonding with performance requirements.
- F. Maintenance Data: For the following to include in maintenance manuals specified in Division 1:
1. Gate operator.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.
- C. Source Limitations for Chain-Link Fences and Gates: Obtain each color, grade, finish, type, and variety of component for chain-link fences and gates from one source with resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. UL Standard: Provide gate operators that comply with UL 325.
- F. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators serving as a required means of access.

1.06 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Contracting Officer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Contracting Officer's written permission.
- B. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.02 CHAIN-LINK FENCE FABRIC

- A. Steel Chain-Link Fence Fabric: Height indicated on Drawings. Provide fabric fabricated in one-piece widths for fencing in height of 12 feet (3.6 m) and less. Comply with CLFMI's "Product Manual" and with requirements indicated below:
 - 1. Mesh and Wire Size: 2-inch (50-mm) mesh, 0.192-inch (4.88-mm) diameter.
 - 2. Zinc-Coated Fabric: ASTM A 392, with zinc coating applied to steel wire with the following minimum coating weight:
 - a. Class 2: Not less than 2 oz./sq. ft. (610 g/sq. m) of uncoated wire surface.
 - 3. Coat selvage ends of fabric that is metallic coated during the weaving process with manufacturer's standard clear protective coating.
- B. Selvage: Twisted at top selvage and knuckled at bottom.

2.03 INDUSTRIAL FENCE FRAMING

- A. Round Steel Pipe: Standard weight, Schedule 40, 2.875 inch diameter galvanized steel pipe complying with ASTM F 1083. Comply with ASTM F 1043, Material Design Group IA, external and internal coating Type A, consisting of not less than 1.8-oz./sq. ft. (0.55-kg/sq. m) zinc; and the following strength and stiffness requirements:
 - 1. Line, End, Corner, and Pull Posts and Top Rail: Per requirements for Light Industrial Fence.
- B. Post Brace Rails: Provide brace rail with truss rod assembly for each gate, end, and pull post. Provide two brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.

- C. Extended Members: Extend posts above top of chain-link fabric as required to attach barbed wire assemblies.

2.04 TENSION WIRE

- A. General: Provide horizontal tension wire at the following locations:
 - 1. Location: Extended along top and bottom of fence fabric.
- B. Metallic-Coated Steel Wire: 9 gauge, marcelled tension wire complying with ASTM A 824 and the following:
 - 1. Coating: Type II, zinc coated (galvanized) by the hot-dip process, with the following minimum coating weight:
 - a. Class 1: Not less than 0.8 oz./sq. ft. (244 g/sq. m) of uncoated wire surface.

2.05 INDUSTRIAL SWING GATES

- A. General: Comply with ASTM F 900 for the following swing-gate types:
 - 1. Single gate.
 - 2. Double gate.
- B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.
- C. Frames and Bracing: Fabricate members from round galvanized steel tubing with outside dimension and weight according to ASTM F 900 for the following gate fabric height:
 - 1. Gate Fabric Height: More than 6 feet (1.83 m).
- D. Frame Corner Construction: As follows:
 - 1. Welded.
 - 2. Assembled with corner fittings and 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.
- E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and weight according to ASTM F 900 for the following gate fabric heights and leaf widths:
- F. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame as required to attach barbed wire assemblies.
- G. Hardware: Latches permitting operation from both sides of gate, hinges, and, for each gate leaf more than 5 feet (1.5 m) wide, keepers.

2.06 INDUSTRIAL HORIZONTAL SLIDE GATES

- A. General: Comply with ASTM F 1184 for the following slide-gate types:
 - 1. Double gate.
 - 2. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
- B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.

- C. Frames and Bracing: Fabricate from round galvanized steel tubing with outside dimension and weight according to ASTM F 1184 for the following gate characteristics:
 - 1. Gate Fabric Height: Over 6 feet (1.83 m).
- D. Frame Corner Construction: As follows:
 - 1. Type II Cantilever Slide Gates: Welded.
- E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and minimum weight according to ASTM F 1184 for the following gate characteristics:
 - 1. Type II Gate Opening Width: 12 feet (3.7 m) or less.
 - 2. Type II Gate Opening Width: Over 12 feet (3.7 m) but not over 30 feet (9.1 m).
- F. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame as required to attach barbed wire assemblies.
- G. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- H. Guide Posts and Roller Guards: As required per ASTM F 1184 for Type II, Class 1 gates.
- I. Hardware: Latches permitting operation from both sides of gate, locking devices, roller assemblies and stops fabricated from galvanized steel.

2.07 FITTINGS

- A. General: Provide fittings for a complete fence installation, including special fittings for corners. Comply with ASTM F 626.
- B. Post and Line Caps: Hot-dip galvanized pressed steel. Provide weathertight closure cap for each post.
 - 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Tension and Brace Bands: Hot-dip galvanized pressed steel.
- D. Tension Bars: Hot-dip galvanized steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- E. Truss Rod Assemblies: Hot-dip galvanized steel rod and turnbuckle or other means of adjustment.
- F. Barbed Wire Arms: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide the following type, according to ASTM F 626, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts, integral with post cap; one for each post, unless otherwise indicated. Provide line posts with arms designed with opening to accommodate tension wire. Provide corner arms at fence corner posts, unless extended posts are indicated.
 - 1. Type I, single slanted arm.

- G. Tie Wires, Clips, and Fasteners: Provide the following types according to ASTM F 626:
1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch- (3.76-mm-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
 2. Power-driven fasteners.
 3. Round Wire Clips: Hot-dip galvanized steel or aluminum for attaching chain-link fabric to H-beam posts.
 4. Round Wire Hog Rings: Hot-dip galvanized steel or aluminum for attaching chain-link fabric to horizontal tension wires.
- H. Pipe Sleeves: For posts set into concrete, provide preset hot-dip galvanized steel pipe sleeves complying with ASTM A 53, not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) more than outside dimension of post, and flat steel plate forming bottom closure.

2.08 BARBED WIRE

- A. Zinc-Coated Steel Barbed Wire: Comply with ASTM A 121, Standard grade for the following two-strand barbed wire:
1. Standard Size and Construction: 12 gauge line wire with 14 gauge 4 point barbs spaced 5 inches apart.

2.09 GATE OPERATOR

- A. General: Provide factory-assembled automatic gate operation system designed for gate size, type, weight, construction, use, traffic-flow patterns, and operation frequency. Provide operation system for gate specified, of size and capacity and with features, characteristics, and accessories suitable for Project conditions, recommended by gate manufacturer complete with electric motor and factory-rewired motor controls, remote-control stations, control devices, power disconnect switch, obstruction detection device, lockable weatherproof enclosures protecting controls and all operating parts, and accessories required for proper operation. Provide enclosures with corrosion-resistant-protective and decorative finish and two keys per lock. Include wiring from motor controls to motor. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 2. Provide operator with UL-approved components.
 3. Provide electronic components with built-in troubleshooting diagnostic feature.
 4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
- B. Comply with NFPA 70.
- C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.

- D. Electromechanical Operation: Provide unit designed for concrete base/pad mounting; consisting of electric motor and factory-prewired motor controls, starter, speed control device, chain-drive assembly, brake, clutch or torque limiter, and as follows:
1. Enclosed worm gear reducer, roller chain drive.
 2. Enclosed worm gear and chain and sprocket reducers, roller chain drive.
 3. V-belt and chain and sprocket reducers, roller chain drive.
 4. Enclosed worm gear reducer, wheel and rail drive.
- E. Operation Cycle Requirements: Design gate operator to operate for not less than the following duty and cycles per hour. One cycle equals one gate opening plus one gate closing.
1. Medium Duty: 10 cycles per hour.
 2. Heavy Duty: 25 cycles per hour.
 3. Peak Duty: 20 cycles per hour at peak periods.
- F. Gate Operation Speed: Minimum 60 fpm (0.305 m/s).
- G. Electric Motors: High-starting torque, reversible, continuous-duty, insulated electric motors, complying with NEMA MG 1, sized to start and operate size and weight of gate considering Project's service conditions without exceeding nameplate ratings or considering service factor.
1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 2. Enclosure: Totally enclosed, nonventilated or fan-cooled motors, fitted with plugged drain.
 3. Thermal Protection: Internal automatic reset.
 4. Motors Smaller Than 1/2 hp: Motor horsepower as recommended by operator manufacturer.
 5. Motors 1/2 hp and Larger: Polyphase, Motor horsepower as recommended by operator manufacturer.
- H. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
1. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
 2. Action: Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
 3. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 4. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using gate edge transmitter and operator receiver system.
 - a. Along entire gate leaf leading edge.
 5. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in partition's path by interruption of an infrared beam in the zone pattern without obstruction contacting gate.
- I. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
- J. Emergency Release Mechanism: Quick disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design system so control circuit power is disconnected during manual operation.

1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.
2. Type: Mechanical device, key, or crank-activated release.

K. Operating Features: Include the following:

1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability of monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
2. Fully Systems Compatible: With controlling circuit board capable of accepting any type of input from external devices.
3. Master/Slave Capability: Control stations designed and wired for gate pair operation.
4. Automatic Closing Timer: With adjustable time delay before closing and timer cut-off switch.
5. Open Override Circuit: Designed to override closing commands.
6. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
7. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
8. Clock Timer: Seven-day programmable for regular events.

L. Accessories: Include the following:

1. Mounting kit including pedestal.
2. Audio Warning Module: Provide ADA-compliant audible alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
3. Visual Warning Module: Provide ADA-compliant visible constant- strobe-light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
4. Battery Backup System: Battery-powered drive and access control system, independent of primary drive system, opening gate if power fails.
5. External electric-powered lock with delay timer allowing time for lock to release before gate operates.
 - a. Type: Solenoid for swing gate.
 - b. Type: Solenoid for slide gate.
6. Postal box.
7. Fire strobe, siren sensor.
8. Intercom System: Refer to security requirements.
9. Instructional, Safety, and Warning Labels and Signs: Manufacturer's standard for components and features specified.

2.10 CAST-IN-PLACE CONCRETE

- A. General: Comply with ACI 301 for cast-in-place concrete.
- B. Materials: Portland cement complying with ASTM C 150 aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94.
 1. Concrete Mixes: Normal-weight concrete with not less than 3000-psi (20.7- MPa) compressive strength (28 days), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum size aggregate.

- C. Materials: Dry-packaged concrete mix complying with ASTM C 387 for normal-weight concrete mixed with potable water according to manufacturer's written instructions.

2.11 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.

2.12 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material On or Below Finished Grade: Copper.
 - 2. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Ground Rods: Listed in UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic welded type.
 - 2. Ground Rods: Copper-clad steel.
 - a. Size: 5/8 inch by 96 inches (16 by 2400 mm).

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.
 - 1. Do not begin installation before final grading is completed, unless otherwise permitted by Contracting Officer.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.03 INSTALLATION, GENERAL

- A. General: Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
 - 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

- C. Post Setting: Hand-excavate holes for post foundations in firm, undisturbed or compacted soil. Set all posts in concrete footing. Protect portion of posts aboveground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Using mechanical devices to set line posts per ASTM F 567 is permitted. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.
1. Dimensions and Profile: As indicated on Drawings.
 2. Exposed Concrete Footings: Extend concrete 2 inches (50 mm) above grade, smooth, and shape to shed water.
 3. Concealed Concrete Footings: Stop footings below grade as indicated on Drawings to allow covering with surface material.
 4. 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, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
 5. Posts Set into Concrete in Voids: Form or core drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

3.04 CHAIN-LINK FENCE INSTALLATION

- A. 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 30 degrees or more.
- B. Line Posts: Space line posts uniformly at 10 feet (3.05 m) o.c.
- C. Post Bracing Assemblies: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at midheight of fabric on fences with top rail and at two-thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- D. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (609 mm) o.c. Install tension wire in locations indicated before stretching fabric.
1. Top Tension Wire: Install tension wire through post cap loops.
 2. Bottom Tension Wire: Install tension wire within 6 inches (150 mm) of bottom of fabric and tie to each post with not less than same gage and type of wire.
- E. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch (25.4 mm) between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

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- F. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) o.c.
- G. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts 12 inches (304 mm) o.c. and to braces 24 inches (609 mm) o.c.
- H. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.
- I. Barbed Wire: Install barbed wire uniformly spaced angled toward security side of fence. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

3.05 GATE INSTALLATION

- A. General: Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.06 GATE OPERATOR INSTALLATION

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for Concrete Bases/Pads: Hand-excavate holes for bases/pads, in firm, undisturbed or compacted soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated on Drawings.
- C. Concrete Bases/Pads: Cast-in-place or precast concrete, made of not less than 3000-psi (20.7-MPa) compressive strength (28 days), depth not less than 12 inches (300 mm), dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
- D. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.07 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 1,000 feet (330m) except as follows:
 - 1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1) Bond metal gates to gate posts.

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- 2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
 - C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2, unless otherwise indicated.
 - D. Grounding Method: At each grounding location, drive a ground rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:
 1. Each Barbed Wire Strand: Make grounding connections to barbed wire with wire-to-wire connectors designed for this purpose.
 2. Each Barbed Tape Coil: Make grounding connections to barbed tape with connectors designed for this purpose.
 - E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
 - F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 - G. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.
- 3.08 FIELD QUALITY CONTROL
- A. Ground-Resistance Testing Agency: Engage a qualified independent testing agency to perform field quality-control testing.
 - B. Ground-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure ground resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by two-point method according to IEEE 81.
 - C. Desired Maximum Grounding Resistance Value: 25 ohms.

- D. Excessive Ground Resistance: If resistance to ground exceeds desired value, notify Contracting Officer promptly. Include recommendations to reduce ground resistance and proposal to accomplish recommended work.
- E. Report: Prepare test reports, certified by testing agency, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.09 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operator: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.
 - 1. Electrohydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Test controls, alarms, and safeties. Remove damaged and malfunctioning units, replace with new units, and retest.
- C. Lubricate hardware, gate operator, and other moving parts.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Government's personnel to adjust, operate, and maintain gates.
 - 1. Test and adjust operators, controls, alarms, safety devices, hardware, and other operable components. Replace damaged or malfunctioning operable components.
 - 2. Train Government's personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 3. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 - 4. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 5. Schedule training with Government, with at least seven days' advance notice.

END OF SECTION 02821

SECTION 02833

PRECAST CONCRETE UNIT RETAINING WALLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Precast concrete gravity retaining walls without soil reinforcement.
 - 2. This item shall govern for the construction of Doublewal Retaining Walls, or approved equal, in accordance with these specifications and with the lines, grades and dimensions shown on the plans or established by the Contracting Officer. The Contractor's particular attention is directed to the fact that "Doublewal Retaining Walls" are a patented process of Doublewal Corporation, 7 West Main Street, Plainville, CT 06062, or approved equal.
- B. Related Sections include the following:
 - 1. Division 2 Section "Earthwork" for excavation for segmental retaining walls.

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide segmental retaining walls capable of withstanding the effects of loads due to soil pressures resulting from grades indicated.
 - 1. Include the effects of backfill to the grades as indicated on Drawings.
 - 2. Include the effects of superimposed loads as indicated on Drawings.

1.04 SUBMITTALS

- A. Product Data: For each type of precast concrete unit retaining wall and other manufactured products specified.
 - 1. For installed systems indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- B. Samples for Verification: Sets for each color, finish, and pattern of unit required. Include 4 or more samples in each set showing the full range of variations expected.
- C. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

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D. Shop Drawings:

Shop Drawings shall include a numbered module layout for fabrication and erection purposes. They shall further include horizontal and vertical alignment of the walls, as well as the existing and proposed ground lines, all as shown in the contract plans. The shop drawings shall also reflect all information needed to fabricate and erect the walls including the proposed footing elevations; the shape and dimensions of modules; the size and details of the joint fillers; the size of leveling pad; and any additional details necessary pertaining to coping and traffic barrier.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed precast concrete unit retaining walls similar in material, design, and extent to that indicated for Project that has resulted in construction with a record of successful in-service performance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project Site in an undamaged condition.
- B. Store and handle retaining wall units and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, or other causes.
- C. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Concrete for the precast modular units shall be air-entrained, composed of portland cement, fine and coarse aggregates, admixtures and water. The air-entraining feature may be obtained by the use of either air-entraining portland cement or an approved air entraining admixture. The entrained air content shall be not less four percent or more than seven percent at the time concrete is deposited in the forms.
- B. The concrete utilized shall be a mix which will attain a minimum 28 days strength (f 'C) of 4,500 psi. The mix design will be furnished to the Contracting Officer if requested.
1. Coarse Aggregate shall consist of crushed stone having a maximum size of 3/4 inches. An abrasion loss of 50 percent in the Los Angeles test shall be permitted.
 2. Type III or Type IIIa portland cement may be used.
 3. Water-Reducing Admixture: The contractor may submit, for approval of the Contracting Officer, water-reducing admixture for the purpose of increasing workability and reducing the water requirement for the concrete.
 4. Calcium Chloride: The addition to the mix of calcium chloride or admixtures containing calcium chloride will not be permitted.
 5. Concrete for toe footings, leveling beams, and cast-in-place concrete for parapets shall attain a minimum 28-day strength (f'c) of 3,000 psi.

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Reinforcing Steel: All Steel reinforcing shall conform to the requirements of ASTM A-615 and to the grade shown on the Doublewal standards.

Lifting Hooks and Threaded Inserts: Devices and attachments shall be of the size indicated on the plans or of a design satisfactory for the purpose intended.

Imbedded Items: Imbedded items shall conform to details on the plans. Galvanizing, if required, shall conform to ASTM A-153.

Joint Filler: No filler is required between vertical joints. Horizontal joint filler shall be pre-formed cork conforming to AASHTO M 153, Type 11, and a premium grade closed cell polyethylene foam backer rod and shall be placed as detailed on the shop drawings. Rubber pads shall be "MASTICORD T.M." as manufactured by J.V.I. INC., SKOKIE, ILLINOIS. Filter fabric shall be Amoco Propex 4545, Mirafi 140 N, or approved equal.

Select backfill material shall be used in all Doublewal units and shall be pervious and free from organic or otherwise deleterious material. Unless otherwise noted on the shop drawings, backfill material, in the structure volume behind the wall, shall be ordinary embankment with a minimum angle of internal friction as shown on the approved drawings.

The select backfill material within the modules shall conform to the following gradation limits as determined by AASHTO T-27.

SIEVE SIZE	PERCENT PASSING
6"	100
3"	75-100
No 40	0-50
No 200	0-10

Materials not conforming to these specifications shall not be used.

C. Manufacture:

The precast modular units shall be "DOUBLEWAL" manufactured by a licensee of the Doublewal Corporation. The units shall be manufactured in a concrete products plant with approved facilities. Before proceeding with production, a model precast modular unit shall be provided by the Fabricator for the Contracting Officer's approval. This model shall be kept at the Fabricator's plant to be used for comparison purposes during production. Surface finish for the exposed face shall be a uniform steel form finish, unless stated differently on the contract plans.

Forms: Forms for the units shall be constructed of steel with dimensional tolerances that will assure the production of uniform units.

Mixing and Placing Concrete: The components of the designed concrete mix shall be proportioned by weight and thoroughly mixed in a batch mixer to produce a homogeneous concrete conforming to the specified requirements. The transporting, placement and vibration of concrete shall be by methods that will prevent segregation and displacement of reinforcing steel

from its proper position. Concrete shall be carefully placed in the forms and sufficiently vibrated, externally and internally, to produce a surface free from imperfections. The air content of the mixed concrete shall be checked daily in accord to the requirements of ASTM C231.

Reinforcing Steel: All reinforcing steel for precast modules and other components shall be fabricated and placed in accord with standards of Doublewal Corporation.

Test Cylinders: During the casting of the units, the contractors shall make test cylinders under the supervision of the Contracting Officer. A minimum of four (4) cylinders shall be taken during each production run or as ordered by the Contracting Officer. The dimensions and type of cylinder mold shall be standard or as specified by the Contracting Officer. Cylinders shall be cured under controls conforming to the requirements of ASTM C192 and shall be used to determine the 28-day compressive strength requirements (f_c). Failure of any of the 28-day test cylinders to meet 90 percent of the minimum compressive strength, or failure of the average to meet the full minimum compressive strength requirement, can, at the discretion of the Contracting Officer, be cause for rejection.

Curing: Precast units shall be cured by a method or combination of methods that will give satisfactory results in accord with accepted local practices and standards.

When steam curing is used, it shall be done under a suitable enclosure to contain the live steam in order to minimize moisture and heat losses. The initial application of the steam shall be from two to four hours after the final placement of the concrete to allow the initial set of the concrete to take place. If retarders are used, the waiting period before application of the steam shall be increased from four to six hours. Application of the steam shall not be directly on the concrete.

Repairs at Plant: Before shipment, surfaces of all precast units shall be examined. If the exposed face of a unit is below the standard of the approved model, then it shall be properly repaired to conform to the balance of the work with respect to appearance, strength and durability.

Handling and Storage: Lifting sleeves and/or inserts, shall be provided in each precast modular unit for the purpose of handling and placing. Care shall be taken during storage, transporting, hoisting and handling of all units to prevent cracking or damage. Units damaged by improper storing, transporting or handling shall be replaced or repaired to the satisfaction of the Contracting Officer.

Inspection and Rejection: The quality of materials, the process of manufacture, and the finished units shall be subject to inspection by the Contracting Officer prior to shipment. Precast units may be subject to rejection on account of failure to conform to the specification requirements. Individual units may be rejected because of any of the following:

1. Variations in the exposed face that substantially deviate from the approved model as to texture in accord with precast concrete industry standards.
2. Dimensions not conforming to the following tolerances:
 - Face of panel, length or height $\pm 3/16"$.
 - Deviation from square when measured on diagonal: $5/16"$ for modules up to 10' wide, $3/4"$ for larger units.
3. Honeycombed or open texture not properly repaired.
4. Defects which would affect the structural integrity of the unit.

- D. Shipment: The precast units shall not be shipped before attaining two-thirds of the required 28-day strength (fc').

2.02 INSTALLATION MATERIALS

- A. Base: Comply with requirements of Division 2 Section "Earthwork" for base material.
- B. Filter Fabric: Nonwoven pervious geotextile manufactured from polyester, nylon, or polypropylene fibers, as follows:
 - 1. Apparent Opening Size: No. 100 (0.15 mm) per ASTM D 4751.
 - 2. Permeability: 150 gpm/sq. ft. (100 L/s x sq. m) per ASTM D 4491.
 - 3. Grab Strength: 100 lbf (445 N) per ASTM D 4632.
- C. Drainage Pipe: Perforated, PVC sewer pipe and fittings complying with ASTM D 2729, bell-and-spigot ends, for loose joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas to receive precast concrete unit retaining walls and conditions under which walls will be installed, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of retaining walls.
 - 1. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 CONSTRUCTION METHODS

- A. The foundation bed for the structure shall be approved by the Contracting Officer before erection is started. Prior to wall construction, the foundation shall be compacted with a vibratory compactor. Any foundation soils found to be unsuitable shall be removed and replaced as directed by the Contracting Officer and compacted with a vibratory compactor to provide a firm in-place foundation.
- B. At each unit foundation level, either a precast or cast-in-place footing and/or leveling pad shall be provided as shown on the plans. The footings shall be given a wood float finish and shall reach a compressive strength of 2,000 psi, before placement of wall modules. The completed footing surface shall be constructed in accordance with grades and cross slopes shown on plans. When tested with a 10' straight edge, the surface shall not vary more than 1/8" in 10'. A greater variation than specified may require removal and replacement, as determined by the Contracting Officer.
- C. The modular units shall be installed in accordance with the manufacturer's recommendations. Special care shall be taken in setting the bottom course of units to true line and grade. Joint filler and rubber pads shall be installed in the horizontal joints, as detailed on the shop drawings. Joints at corners or angle points shall be closed as shown on the plans or in accord with recommendations of the manufacturer.

- D. All units above the first course shall interlock with the lower courses. Vertical joints shall be staggered with each successive course, or as shown on the plans. The vertical joint opening on the front face of the wall shall not exceed 3/4".
- E. All vertical joints between modules shall be covered on the back side of the front face of the wall by a filter fabric, 12" in width.
- F. When the modular backfill material is a rock backfill containing insufficient fines to fill the voids between particles in a compacted state, any exposed modular backfill material shall be covered by a layer of filter fabric to prevent migration of soil fines into the modular backfill material. Filter fabric shall overlap the exposed area a minimum of six inches.
- G. Doublewal units shall be filled one course at a time, with the specified structure backfill. Units four feet or less in height shall be filled in one layer, and then thoroughly consolidated with a vibratory tamping device. Units which are more than four feet in height shall be filled in two, approximately equal layers, and thoroughly consolidated after each layer is placed.
- H. Backfill behind the wall shall be ordinary embankment and shall be placed and compacted in accordance with the applicable requirements of the standard specifications.
- I. When erecting a battered wall, placement of backfill behind the wall shall closely follow erection of successive courses of units. At no time shall the difference in elevation between the backfill and the top of the last erected course exceed seven feet.
- J. Underdrain, if required, shall be placed in accordance with the details shown on the plans and in accordance with applicable standard specifications.
- K. The overall vertical tolerance of the wall (plumbness from top to bottom) shall not exceed 1/2 inch per 10 feet of wall height.

3.03 CONSTRUCTION TOLERANCES

- A. Variation from Level: For bed-joint lines along walls, do not exceed 1 inch in 40 feet (24 mm in 12 m) or more.
- B. Variation from Indicated Batter: For slope of face of wall, do not vary from indicated slope by more than 1/4 inch in 10 feet (6 mm in 3 m).
- C. Variation in Plan Position: For ends and faces of walls in relation to property lines, buildings, and other objects, do not vary from plan dimensions by more than 1 inch (25 mm) or from depicted plan relationship (scaled dimensions) by more than 3 inches (75 mm).
- D. Variation in Linear Wall Line: For walls indicated as straight, do not exceed 1 inch in 40 feet (24 mm in 12 m) or more from a straight line.

3.04 FIELD QUALITY CONTROL

- A. Comply with requirements of Division 2 Section "Earthwork" for in-place soil density testing.

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1. In each compacted backfill layer, perform at least 1 field in-place density test for each 100 feet (30 m) or less of retaining wall length, but no fewer than 2 tests along a wall face.

3.05 ADJUSTING AND CLEANING

- A. Repair precast concrete unit retaining walls of the following description:
 1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if methods and results are approved by Contracting Officer.

END OF SECTION 02833

