

UNITED STATES DEPARTMENT OF VETERANS AFFAIRS



PROJECT MANUAL

**VA MEDICAL CENTER
RIVER STREET WATERSHED IMPROVEMENTS
HOT SPRINGS, SOUTH DAKOTA**

Project Number **VA# 568-13-202**

FOR CONSTRUCTION SUBMITTAL

October 10, 2012

Prepared by:



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FF Project No. 10-1749-E12

SPEC SET NO.

Contracting Officer
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SPECIFICATIONS

**BLACK HILLS HEALTHCARE SYSTEM
DEPARTMENT OF VETERANS AFFAIRS**

**RIVER STREET WATERSHED IMPROVEMENTS
HOT SPRINGS, SD**

VA# 568-13-202

OWNER: Black Hills Healthcare System
Department of Veterans Affairs
500 North Fifth Street
Hot Springs, SD 57747

ENGINEER'S PROJECT NO.: 10-1749-E12

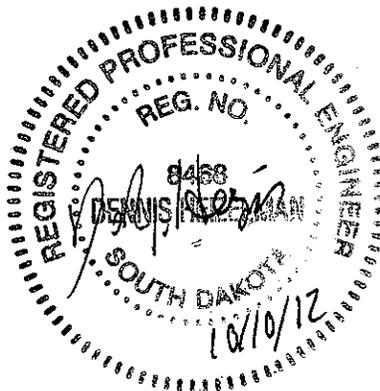
DATE: October 10, 2012

ENGINEER: FourFront Design, Inc.
517 Seventh Street
Rapid City, SD 57701

CERTIFICATION: I hereby certify that these specifications were prepared by me or under my direct supervision and that I am duly registered under the laws of the State of South Dakota.



Shane A. Matt, PE



Dennis Heizelman, PE

SPECIFICATIONS
BLACK HILLS HEALTHCARE SYSTEM, HOT SPRINGS SD
DEPARTMENT OF VETERANS AFFAIRS
RIVER STREET WATERSHED IMPROVEMENTS VA# 568-13-202
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GENERAL REQUIREMENTS

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for the River Street Watershed Improvements 568-13-202 as required by drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.
- C. NOT USED
- D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the VA Project Manager/COR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the VA Project Manager/COR.
- E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- F. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2) who has the 30-hour OSHA certification for Construction Safety will maintain a presence at the work site whenever the general or subcontractors are present.
- G. Training:
 - 1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team. Final approval of the equivalent training in lieu of the 10-Hour OSHA certification will be made by the Engineering Program Manager.

2. Submit training records of all such employees for approval before the start of work.

1.2 STATEMENT OF BID ITEM(S)

A. SCOPE OF WORK

Location: VA Black Hills Health Care System, Hot Springs, SD.

Provide all labor, materials, tools and equipment, necessary for the construction of a new storm sewer system along River Street.

- B. Description: The contractor shall construct approximately 3,240 feet of 18-inch HDPE storm sewer to include manholes, inlets, fittings, and other miscellaneous appurtenances as shown or described on the construction plans.

1. Demolition will consist of, but is not limited to: Removal and disposal of asphalt pavement, concrete curb and gutter, concrete sidewalks, waste or excess spoil material.
2. New construction will consist of, but is not limited to: earth moving, excavating, backfill and compaction, grading for the installation of new 18-inch HDPE storm sewer and relocated power for lighting, the repair or replacement of temporary or permanent roadway surfacing, concrete curb and gutter and sidewalks, grading and seeding/sodding of lawn areas where needed, erosion control and storm drainage protection.

C. Bidding: The estimated unit price bidding quantities are as follows:

VA Medical Center, Hot Springs, SD	General Requirements
#568-13-202 River Street Watershed Improvements	01 00 00 -2

ITEM #	BID ITEM DESCRIPTION	UNIT	EST. QUANT.
1	Remove Pavement	SY	25
2	Remove Curb and Gutter	LF	86
3	Remove Concrete Sidewalk	SY	326
4	Remove Tree & Stumps	EA	3
5	Relocate Tree	EA	1
6	Remove or Abandon Storm Sewer	LS	1
7	Remove RipRap	LS	1
8	Remove Electrical Wire and Conduit	LF	605
9	Stockpile Topsoil	CY	150
10	Exploratory Excavation	LS	1
11	Connect to Existing Storm Inlet/Pipe	EA	2
12	Connect to Existing Storm Sewer Manhole	EA	1
13	48" Standard Manhole	EA	4
14	48" Manhole w/ Cover Slab	EA	2
15	2' x 3' Type B Inlet	EA	2
16	5' Type E Inlet	EA	1
17	18" HDPE Tee Manhole	EA	1
18	18" HDPE Storm Sewer With Bedding	LF	1230
19	18" x 18" HDPE Tee	EA	2
20	4" Sidewalk	SF	2808
21	Curb and Gutter	LF	72
22	Asphalt Pavement	TON	10
23	Aggregate Base Course	TON	140
24	Place On-Site Fill	CY	25
25	Place Topsoil	CY	150
26	Mobilization	LS	1
27	Erosion Control	LS	1
28	Traffic Control	LS	1
29	Haul Excess Soils Off-Site	LS	1
30	Sod	SF	12000
31	Repair Irrigation System	LS	1
32	Remove Existing Electrical Wire and Conduit	LS	1
33	8" X 18" Non-metallic Junction Box	EA	1
34	2" Rigid Conduit, Schedule 40	LF	605
35	1/C #6 AWG Copper Wire	LF	1800
36	Disconnect and Reconnect Luminaire Wiring	EA	4
37	Remove and Reset Luminaire Pole	EA	1
38	2' Diameter Footing	LF	6

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

Contractor is responsible for printing all drawings and specifications from the FedBiz Website. The VA will not provide hard copy plans and specifications.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
3. No photography of VA premises is allowed without written permission of the Contracting Officer or VA Project Manager/COR.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the VA Project Manager/COR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

D. Document Control:

- 1. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
- 2. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.

E. Motor Vehicle Restrictions, Parking:

All contractor vehicles shall be parked in general parking areas. At no time shall there be a vehicle parked in patient/visitor only parking, or medical staff only parking except for immediate loading and unloading. No parking is permitted in fire department locations needed for access.

1.5 FIRE SAFETY

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

- 1. American Society for Testing and Materials (ASTM):
 - E84-2009.....Surface Burning Characteristics of Building Materials
- 2. National Fire Protection Association (NFPA):
 - 10-2010.....Standard for Portable Fire Extinguishers
 - 30-2008.....Flammable and Combustible Liquids Code
 - 51B-2009.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
 - 70-2011.....National Electrical Code
 - 241-2009.....Standard for Safeguarding Construction, Alteration, and Demolition Operations
- 3. Occupational Safety and Health Administration (OSHA):
 - 29 CFR 1926.....Safety and Health Regulations for Construction

- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to VA Project Manager/COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the VA Project Manager/COR that individuals have undergone contractor's safety briefing.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with VA Project Manager/COR.
- G. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- H. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- I. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas daily. Coordinate with, and report findings and corrective actions daily to VA Project Manager.
- J. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate

and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the VA Project Manager/COR. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer/VA Project Manager/COR and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.
- D. Working space and space available for storing materials shall be as determined by the VA Project Manager/COR.
- E. Workmen are subject to rules of Medical Center applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly

by patients or medical personnel, and Contractor's personnel, except as permitted by VA Project Manager/COR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.
2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. It is the contractor's responsibility to receive delivered materials; VA staff cannot receive items for the contractor. Provide unobstructed access to Medical Center areas required to remain in operation.

G. Phasing: To insure such executions, Contractor shall furnish the VA Project Manager/COR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, or portion thereof. In addition, Contractor shall notify the VA Project Manager/COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to insure accomplishment of this work in successive phases mutually agreeable to VA Project Manager/COR and Contractor.

H. NOT USED

I. NOT USED

J. NOT USED

K. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by VA Project Manager/COR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of VA Project Manager/COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be

- accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 11, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS for additional requirements.
2. Contractor shall submit a request to interrupt any such services to VA Project Manager/COR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
 3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
 4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the VA Project Manager/COR.
 5. In case of a contract construction emergency, service will be interrupted on approval of VA Project Manager/COR. Such approval will be confirmed in writing as soon as practical.
 6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- L. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the VA Project Manager/COR.

- M. Coordinate the work for this contract with other construction operations as directed by VA Project Manager/COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.7 ALTERATIONS

- A. Protection: Provide the following protective measures:

- 1. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.

1.8 INFECTION PREVENTION MEASURES

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to VA Project Manager/COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
 - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

1.9 DISPOSAL AND RETENTION

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
 - 1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by VA Project Manager/COR.

2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.

1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.
- C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

1.11 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the VA Project Manager/COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the VA Project Manager/COR before it is disturbed. Materials and workmanship used in

restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.12 PHYSICAL DATA

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
 - 1. The indications of physical conditions on the drawings and in the specifications are the result of site investigations by
Terracon Consultants

2026 Samco Road, Suite 101

Rapid City, SD 57702.
- B. Subsurface conditions have been developed by core borings and test pits. Logs of subsurface exploration are shown in the Geotechnical Engineering Report included in Appendix A and shall be considered part of the contract documents.

- C. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

1.13 PROFESSIONAL SURVEYING SERVICES

A South Dakota registered professional land surveyor whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or is not one who is a regular employee of the Contractor, and that the land surveyor has no financial interest in this contract.

1.14 LAYOUT OF WORK

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.
- B. Establish and plainly mark centerlines and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each utility and associated structures are in accordance with lines and elevations shown on contract drawings.
- C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey

control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of major utilities.

1. Such additional survey control points or system of points thus established shall be checked and certified by a South Dakota registered land surveyor. Furnish such certification to the VA Project Manager/COR before any work (such as utilities and other major controlling features) is placed.

D. During progress of work, Contractor shall have line grades checked and certified by a registered land surveyor as meeting requirements of contract drawings. Furnish such certification to the VA Project Manager/COR before any major items of concrete work are placed. In addition, Contractor shall also furnish to the VA Project Manager/COR certificates from a South Dakota registered land surveyor that the following work is complete in every respect as required by contract drawings.

1. Lines and elevations of sewers and of all outside distribution systems.

2. Lines and elevations of roads, streets and parking lots.

E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to VA Project Manager/COR.

F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

1.15 AS-BUILT DRAWINGS

A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.

B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the VA Project Manager/COR's review, as often as requested.

- C. Contractor shall deliver two approved completed sets of as-built drawings to the VA Project Manager/COR within 15 calendar days after each completed phase and after the acceptance of the project by the VA Project Manager/COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.16 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the VA Project Manager/COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

1.17 AVAILABILITY AND USE OF UTILITY SERVICES

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.
- C. Electricity (for Construction and Testing): Furnish all temporary electric services.
 - 1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- D. Water (for Construction and Testing): Furnish temporary water service.

1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.
2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at VA Project Manager/COR's discretion) of use of water from Medical Center's system.

1.18 TESTS

- A. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- B. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.19 NOT USED

1.20 NOT USED

1.21 RELOCATED EQUIPMENT AND ITEMS

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the VA Project Manager/COR.
- C. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- D. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.22 SAFETY AND CONSTRUCTION SIGN(S)

Provide a Safety Sign(s) where directed by VA Project Manager/COR, maintain sign(s) and remove it when directed by VA Project Manager/COR.

1.23 HISTORIC PRESERVATION

Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the VA Project Manager/COR verbally, and then with a written follow up.

- - - E N D - - -

**SECTION 010100
MEDICAL CENTER REQUIREMENTS**

PART 1 - GENERAL

1.1 DESCRIPTION

General Intention: This document pertains to station safety, health, and environmental policies for construction projects performed at the VA Black Hills Health Care System in Hot Springs, South Dakota. Safety and health concerns are taken seriously at this facility. Both our staff and yours are expected to strictly adhere to the regulations and requirements. This is exceedingly important, since we must be primarily concerned for the safety of our patients. In this regard, OSHA Standards may protect worker safety and health, but they have minimal benefit for protecting the safety and health of our patients, due primarily to their differing medical conditions. Review this information as orientation with your personnel performing work on site. In addition, construction can have significant impacts to the environment. It is the policy of this organization to minimize impacts in accordance with the facility's integrated Green Environmental Systems (GEMS). Where the requirements as outlined in this and Section 010000 are differing, the more stringent shall apply.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Data and Reports:
 - 1. Safety Plan
 - 2. Traffic Control Plan
 - 3. OSHA Cards
- C. All other Submittals as listed in each section of the specifications or as summarized in the submittal register at the end of 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

2.1 REQUIREMENTS:

- A. Security:
 - 1. Secure all construction areas, especially mechanical and electrical rooms against entry of unauthorized individuals including patients.
 - 2. Notify the Contracting Officer's Representative (COR) for permission to work after hours and weekends. Standard work

hours for the medical center are Monday-Friday, 7:00 a.m. to 4:30 p.m.

3. The VA will issue ID tags to contractor personnel. All contractor personnel are required to wear the VA provided ID at all times while working on government property. The Contractor will submit ID requests for each employee (including subcontractor employees) using the request form provided by COR.

B. Key Security:

1. Only a limited number of keys will be issued to the contractor. Key requests shall be made using the request form on provided by COR.
2. If the Contractor loses a key, a charge of \$30 will be billed for a replacement key.
3. Ensure all doors leading to and from construction are either monitored or locked to prevent access to the area from unauthorized persons.

C. Contractor General Safety Program and Training Requirements:

1. The Contractor shall appoint a "Competent Person" (CP) for the project. The CP will have primary responsibility for construction safety, OSHA compliance, and adherence to the Contractor's safety program. The Contractor shall provide for approval, as part of the submittal process, the name of the CP and documentation that the individual has had the necessary training, experience, and has the authority to carry out their responsibilities with respect to safety and health during construction activities. Evidence of training shall include completion of OSHA approved courses or other construction safety training consistent with the scope of the project.
2. The Contractor shall also provide for approval, as part of the submittal process, evidence of a company safety policy that includes, as a minimum, the following components: a) Safety is the first priority and will not be compromised, b) PPE is provided for employees, and the employees are trained in its use, c) Details of regularly scheduled safety training for jobs site employees in regards to OSHA requirements, construction related impacts, and Life Safety Code requirements. This may be accomplished through documented "tool box talks", or other similar methods.
3. The Contractors CP and primary workers will be required to view a VA provided video tape, "Playing It Safe", approximate viewing time 15 minutes. The video identifies concerns regarding patients safety, privacy, and infection control; and introduces Contractor's workers to the unique safeguards required when working in a hospital environment.
4. Adhere to the following:

- a. Follow all federal, state and local safety and health regulations.
- b. Maintain safety in the construction site/area in accordance with the provisions of the contract that includes the Occupational Safety and Health Administration (OSHA) Regulations; National Electrical Codes; National Fire Protection Association (NFPA) 70, National Electric Code; and NFPA 101, Life Safety Code. Work in a safe manner and take all proper precautions while performing your work. Extra precautions shall be taken when working around persons occupying the building during construction.
- c. Provide Personal Protective Equipment (PPE) for your employees.
- d. Post appropriate signs in specific hazardous areas.
- e. Keep tools, ladders, etc., away from patients to prevent injuries.

D. Safety Inspections:

1. The VA professional Occupational Safety and Health staff at this facility will perform safety inspections of all contract operations. Written reports of unsafe practices or conditions will be reported to the COR and Contracting Officer for immediate attention and resolution.
2. The Contractor's superintendent/CP is required to monitor work on a daily basis, including surveillance related to health and safety. The daily inspections are to be documented via the check list provided by COR. Completed Daily Logs should be provided to the COR at the end of each shift, and no later than the next working day.

E. Fire Alarms:

1. The fire alarm system connects all buildings at this facility, and is activated by various heat, duct, manual pull stations and smoke sensors. Manual pull stations are provided at each entrance. Survey the area in which you are working to locate the manual pull stations.
2. In the event of a fire alarm sounding, you are to remain in your area, unless medical center personnel (Safety, Nursing or Engineering) instruct otherwise, or unless a fire situation is in your area, in which case you should immediately evacuate.

3. Any work involving the fire protection systems requires written permission to proceed from the COR. *Do not tamper with or otherwise disturb any fire alarm system components without prior written permission. To do so without written permission will result in an adverse action.*

F. Hazardous Materials:

1. Many of the operations you are scheduled to perform may involve the use of hazardous materials. Prior to locating hazardous materials on site, submit all Material Safety Data Sheets (MSDS) through the COR for evaluation by the facility Safety Officer.
2. Storage of hazardous materials within buildings shall be minimal with only enough on hand to perform daily work tasks. Flammable materials must either be removed from buildings at the end of the work shift or stored in approved flammable storage containers.
3. Care must be taken to ensure adequate ventilation to remove vapors of hazardous materials in use. Many of the patients being cared for in the facility are susceptible to environmental contaminants, even when odors seem minimal. Isolate those areas where vapors are produced, and ventilate to the most extent possible to reduce the number of complaints.

G. Airborne Dust Control During Construction:

1. Generation of dust is of major concern within staff, and especially in patient occupied buildings. Where operations involve the generation of dust, all efforts shall be directed at reducing airborne generated dust to the lowest level feasible. This may be accomplished by a number of methods. These include misting the area with water, or use of tools attached to high efficiency particulate air (HEPA) filtering vacuums. Where large amounts of materials may be disturbed, resulting in airborne dust, establishment of full ceiling-to-floor barriers shall be required.

2. Classification of Jobs:

- a. CLASS I - Includes, but is not limited to, minor disturbances involving plumbing, electrical, carpentry, ductwork and minor aesthetic improvements.
- b. CLASS II - (projects require barrier precautions) - Includes, but is not limited to, construction of new walls, construction of new rooms, major utility changes, major equipment installation, demolition of wallboards, plaster, ceramic tiles or ceiling and floor tiles, removal of windows, removal of casework, etc.

H. Class I Procedures:

1. Mist (with water) work surfaces to control dust while cutting. Alternatively a high efficiency particulate air vacuum (HEPA) can be used by positioning the vacuum next to the equipment at the use site.
2. Tape doors for activities that produce large amounts of dust, and block off and seal air vents.
3. Cover holes/openings (penetrations), in walls, ceiling, floors or door that cannot be patched or fixed within 4 hours. Only approved fire-rated materials will be used to fill holes in fire/smoke walls.
4. Comply with the OSHA regulations regarding noise and vapor containment.
5. Cleanup and disposal: Construction waste must be contained before transport using plastic bags and/or covered transport receptacle and/or cart and tape covering.
6. Wet mop and/or HEPA vacuum before leaving work area.
7. Place dust mats at entrance and exit of work area, and clean or change daily to prevent tracking of dust into occupied areas.
8. After work completion, remove covering from air vents.

I. Class II (Post Construction Warning Signs):

1. Same procedures as Class I - however, use of a HEPA vacuum is mandatory.
2. Construct all dust barriers before construction begins per the following instructions: For single rooms, seal door/frame with tape and plastic. The sheet should be

divided vertically with a knife. Flaps should be taped on either side of the single sheet to create a flapped entrance.

J. Environmental Protection:

1. It may help you to be aware of the seriousness that the environmental protection requirements of each contract are regarded. Adherence to these requirements is subject to continuing scrutiny from the community and backed by severe penalties, such as fines and incarceration. These environmental requirements will be strictly enforced. Contractors are required to abide by all Federal, State, and Local environmental regulations.
2. No hazardous materials will be disposed of on Government property. Haul all waste off-site or dispose in contractor owned and operated waste removal containers.
3. Forward a copy of all waste manifests for special or hazardous wastes to the COR. Environmental requirements will be strictly enforced.

K. Permit Required Confined Spaces:

1. Contractors performing work on this facility shall follow all requirements outlined in OSHA Standards for working in confined spaces. There are numerous permit required confined spaces on this facility. These spaces have been identified. Some spaces have been posted, but the majority have not due to their configuration. A complete listing of these areas is located in the Fire Department.
2. Confined spaces are areas that are large enough to be entered, have limited egress/exit potential and are not designed for permanent human occupancy. If you encounter any space that meets this definition, and if it is a suspected confined space, contact the COR.
3. Contractors performing work in confined spaces are responsible for compliance with all applicable standards and regulations.

L. Housekeeping:

1. Protect patients and VA personnel in occupied areas from the hazards of dust, noise, construction debris and material associated with a construction environment. Keep work area clear, clean and free of loose debris, construction materials

and partially installed work that would create a safety hazard or interfere with VA personnel duties and traffic.

2. Wet mop occupied areas clean and remove any accumulation of dust/debris from cutting or drilling from any surface at the end of each workday.
3. Make every effort to keep dust and noise to a minimum at all times. Take special precautions to protect VA equipment from damage including excessive dust.
4. Maintain clear access to mechanical, electrical devices, equipment and main corridors. This will ensure access to existing systems in the event of an emergency.
5. Clean area of all construction debris and dust upon completion of demolition and/or renovation.
6. During construction operations, keep existing finishes protected from damage. Cover and protect all carpets during construction. Any carpets or surfaces damaged as a result of construction activities will be replaced at the contractor expense.

M. Hot Work Permits:

1. Any hot work operations including cutting, welding, thermal welding, brazing, soldering, grinding, thermal spraying, thawing pipes or any other similar activity, require a Hot Work Permit to be obtained by the Contractor from the Fire Department. The Contractor is responsible for conforming to all Medical Center regulations, policies and procedures concerning Hot Work Permits as outlined below:
 - a. Prior to the performance of hot work in patient-occupied buildings, request a Hot Work Permit from the Fire Department.
 - b. The Fire Department will inspect the area and ensure that the requirements of NFPA 241 and OSHA standards have been satisfied. The Hot Work Permit will be granted and must be posted in the immediate area of the work.
 - c. The Hot Work Permit will apply only to the location identified on the permit. If additional areas involve hot work, additional permits must be requested.

- d. Upon completion of all hot work, notify the Fire Department to perform a re-inspection of the area.
2. Do not use any of the extinguishers in the medical center for standby purpose while conducting hot work. Contractors are required to supply their own Class ABC extinguishers. Medical center extinguishers are only to be used in the event of a fire.
- N. Emergency Medical Services: Emergency medical services for stabilization purposes are available for contractors at this facility. For medical emergencies, dial 6911 when inside any building. Report the nature of the emergency and location. The operator will dispatch in-house personnel or coordinate an outside emergency assistance based on the nature of the emergency.
- O. Use of Government-Owned Material and Equipment: Use of Government-owned material and equipment is *prohibited*.
- P. Superintendent Communications: At all times during the performance of this contract, the Contractors Superintendent is to be available by cellular phone. At the beginning of the contract and prior to beginning any construction, supply the COR with the telephone number for the Superintendent.
- Q. Parking: Contractor employees shall be assigned a parking area during the preconstruction meeting.
- R. Traffic:
1. Traffic hazards are minimal at this facility. Drivers should be particularly concerned with pedestrian traffic.
 2. Seat belt use is mandatory on the station.
 3. Federal police officers maintain a 24-hour patrol of the area.
 4. Speed limits are to be observed, and are strictly enforced.
- S. Contractor's Trailers: Contractor's trailers shall be located at the area assigned. All utility connections to the trailer shall be installed at the contractor expense. Trailer removal is required upon completion of the contract, unless approved by the COR to leave in place.
- T. Smoking: No smoking is permitted in buildings or around hazardous areas. Any smoking inside a government building is subject to a fine without warning.

U. Lock out/tag out: Contractors performing work on equipment and systems are responsible for compliance with the facilities lock out/tag out policies.

V. Road Closures: For any work requiring closure of a road or parking lot, a request for closure shall be made in writing at least 5 days in advance for approval by the COR and Fire Department.

The following forms will be given to the contractor after award by the COR.

- A. Contractor ID Badge Request Form.
- B. Contractor Key Request Form.
- C. Contractor Daily Log Form.

- - - END - - -

3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
- C. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- D. Approved samples will be kept on file by the COR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- E. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
1. For each drawing required, submit one legible photographic paper or vellum reproducible.
 2. Reproducible shall be full size and marked neatly as reproducible copy.
 3. Each drawing shall have marked thereon, proper descriptive title, including Hot Springs VA location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 4. A space 4-3/4 by 5 inches shall be reserved on each drawing to accommodate approval or disapproval stamp.
 5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
 6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
811 Vermont Avenue, NW - Room 462
Washington, DC 20420
Telephone Numbers: (202) 461-8217 or (202) 461-8292
Between 9:00 AM - 3:00 PM

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AASHTO American Association of State Highway and Transportation
Officials

<http://www.aashto.org>

ACI American Concrete Institute

<http://www.aci-int.net>

ACPA American Concrete Pipe Association

<http://www.concrete-pipe.org>

ACPPA American Concrete Pressure Pipe Association

<http://www.acppa.org>

AGC Associated General Contractors of America

<http://www.agc.org>

AISC American Institute of Steel Construction

<http://www.aisc.org>

AISI American Iron and Steel Institute

<http://www.steel.org>

AITC American Institute of Timber Construction

<http://www.aitc-glulam.org>

AMCA Air Movement and Control Association, Inc.

<http://www.amca.org>

ANLA American Nursery & Landscape Association

<http://www.anla.org>

ANSI American National Standards Institute, Inc.

<http://www.ansi.org>

APA The Ced Wood Association

<http://www.apawood.org>

ARI Air-Conditioning and Refrigeration Institute

<http://www.ari.org>

ASAE American Society of Agricultural Engineers

<http://www.asae.org>

ASCE American Society of Civil Engineers

<http://www.asce.org>

ASHRAE American Society of Heating, Refrigerating, and
Air-Conditioning Engineers

<http://www.ashrae.org>

ASME American Society of Mechanical Engineers

<http://www.asme.org>

ASSE American Society of Sanitary Engineering

<http://www.asse-plumbing.org>

ASTM American Society for Testing and Materials
<http://www.astm.org>

AWI Architectural Woodwork Institute
<http://www.awinet.org>

AWS American Welding Society
<http://www.aws.org>

AWWA American Water Works Association
<http://www.awwa.org>

BHMA Builders Hardware Manufacturers Association
<http://www.buildershardware.com>

BIA Brick Institute of America
<http://www.bia.org>

CAGI Compressed Air and Gas Institute
<http://www.cagi.org>

CGA Compressed Gas Association, Inc.
<http://www.cganet.com>

CI The Chlorine Institute, Inc.
<http://www.chlorineinstitute.org>

CISCA Ceilings and Interior Systems Construction Association
<http://www.cisca.org>

CISPI Cast Iron Soil Pipe Institute
<http://www.cispi.org>

CLFMI Chain Link Fence Manufacturers Institute
<http://www.chainlinkinfo.org>

CPMB Concrete Plant Manufacturers Bureau
<http://www.cpmc.org>

CRA California Redwood Association
<http://www.calredwood.org>

CRSI Concrete Reinforcing Steel Institute
<http://www.crsi.org>

CTI Cooling Technology Institute
<http://www.cti.org>

DHI Door and Hardware Institute
<http://www.dhi.org>

EGSA Electrical Generating Systems Association
<http://www.egsa.org>

E EI Edison Electric Institute
<http://www.eei.org>

EPA Environmental Protection Agency
<http://www.epa.gov>

ETL ETL Testing Laboratories, Inc.
<http://www.etl.com>

FAA Federal Aviation Administration
<http://www.faa.gov>

FCC Federal Communications Commission
<http://www.fcc.gov>

FPS The Forest Products Society
<http://www.forestprod.org>

GANNA Glass Association of North America
<http://www.cssinfo.com/info/ganna.html/>

FM Factory Mutual Insurance
<http://www.fmglobal.com>

GA Gypsum Association
<http://www.gypsum.org>

GSA General Services Administration
<http://www.gsa.gov>

HI Hydraulic Institute
<http://www.pumps.org>

HPVA Hardwood Plywood & Veneer Association
<http://www.hpva.org>

ICBO International Conference of Building Officials
<http://www.icbo.org>

ICEA Insulated Cable Engineers Association Inc.
<http://www.icea.net>

\ICAC Institute of Clean Air Companies
<http://www.icac.com>

IEEE Institute of Electrical and Electronics Engineers
<http://www.ieee.org/>

IMSA International Municipal Signal Association
<http://www.imsasafety.org>

IPCEA Insulated Power Cable Engineers Association

NBMA Metal Buildings Manufacturers Association
<http://www.mbma.com>

MSS Manufacturers Standardization Society of the Valve and Fittings Industry Inc.
<http://www.mss-hq.com>

NAAMM National Association of Architectural Metal Manufacturers
<http://www.naamm.org>

NAPHCC Plumbing-Heating-Cooling Contractors Association
<http://www.phccweb.org.org>

NBS National Bureau of Standards
See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors
<http://www.nationboard.org>

NEC National Electric Code
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
<http://www.nema.org>

NFPA National Fire Protection Association
<http://www.nfpa.org>

NHLA National Hardwood Lumber Association
<http://www.natlhardwood.org>

NIH National Institute of Health
<http://www.nih.gov>

NIST National Institute of Standards and Technology
<http://www.nist.gov>

NLMA Northeastern Lumber Manufacturers Association, Inc.
<http://www.nelma.org>

NPA National Particleboard Association
18928 Premiere Court
Gaithersburg, MD 20879
(301) 670-0604

NSF National Sanitation Foundation
<http://www.nsf.org>

NWDA Window and Door Manufacturers Association
<http://www.nwwda.org>

OSHA Occupational Safety and Health Administration
Department of Labor
<http://www.osha.gov>

PCA Portland Cement Association
<http://www.portcement.org>

PCI Precast Prestressed Concrete Institute
<http://www.pci.org>

SSPC The Society for Protective Coatings
<http://www.sspc.org>

STI Steel Tank Institute
<http://www.steeltank.com>

SWI Steel Window Institute
<http://www.steelwindows.com>

TCA Tile Council of America, Inc.
<http://www.tileusa.com>

TEMA Tubular Exchange Manufacturers Association
<http://www.tema.org>

TPI Truss Plate Institute, Inc.
583 D'Onofrio Drive; Suite 200
Madison, WI 53719
(608) 833-5900

UBC The Uniform Building Code
See ICBO

UL Underwriters' Laboratories Incorporated
<http://www.ul.com>

ULC Underwriters' Laboratories of Canada
<http://www.ulc.ca>

WCLIB West Coast Lumber Inspection Bureau
6980 SW Varns Road, P.O. Box 23145
Portland, OR 97223
(503) 639-0651

WRCLA Western Red Cedar Lumber Association
P.O. Box 120786
New Brighton, MN 55112
(612) 633-4334

WWPA Western Wood Products Association
<http://www.wwpa.org>

1.5 CLAUSES INCLUDED BY REFERENCE

The following Federal Acquisition (FAR) Clauses and Veterans Affairs Acquisition Regulations (VAAR) are contained in the DESIGN BUILD ROAD REPLACEMENT RFP (Solicitation No. VA26310RP0236) documents. They are hereby incorporated into the Design-Build Project Specifications by Reference, as listed in the GENERAL CONDITIONS.

- - - END - - -

SECTION 01 45 29
TESTING LABORATORY SERVICES - RETAINED BY OWNER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes the following:
 - 1. Selection and payment.
 - 2. Contractor submittals.
 - 3. Testing Agency/Laboratory responsibilities.
 - 4. Testing Agency/Laboratory reports.
 - 5. Limits on testing agency/laboratory authority.
 - 6. Contractor responsibilities.
 - 7. Schedule of tests.

1.2 RELATED SECTIONS

- A. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES:
Manufacturer's certificates.
- B. Section 03 30 00 CAST-IN-PLACE CONCRETE.

1.3 REFERENCES

- A. ASTM C 1077 - Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- B. ASTM D 3740 - Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- C. ASTM D 4561 - Quality Control Systems for an Inspection and Testing Agency for Bituminous Paving Materials.
- D. ASTM E 329 - Use in the Evaluation of Inspection and Testing Agencies as Used in Construction.

1.4 SELECTION AND PAYMENT

- A. Employment and payment for services of an independent testing agency or laboratory to perform specified testing retained by Department of Veterans Affairs (Owner).
- B. Employment of testing agency or laboratory by the Owner in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

1.5 QUALITY ASSURANCE

- A. Comply with requirements of ASTM C 1077, ASTM D 3740, ASTM D 4561, and ASTM E 329.
- B. Laboratory: Authorized to operate in State in which Project is located.

- C. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.6 CONTRACTOR SUBMITTALS

- A. Prior to start of Work, submit schedule of anticipated testing intervals, for use by the Contracting Officer's Technical Representative and Testing Agency.

1.7 TESTING AGENCY/LABORATORY RESPONSIBILITIES

- A. Test samples of mixes submitted by Contractor.
- B. Provide qualified personnel at site. Cooperate with Contracting Officer's Technical Representative and Contractor in performance of services.
- C. Perform specified sampling and testing of Products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Contracting Officer's Representative and Contractor of observed irregularities or non-conformance of Work or Products.
- F. Perform additional tests required by Contracting Officer's Technical Representative.
- G. Attend preconstruction meetings and progress meetings, if requested.

1.8 TESTING AGENCY/LABORATORY REPORTS

- A. After each test, promptly submit two copies of report to Contracting Officer's Representative, COR, and to Contractor.
- B. Include:
 - 1. Date issued.
 - 2. Project title and number.
 - 3. Name of inspector.
 - 4. Date and time of sampling or inspection.
 - 5. Identification of product and specifications section.
 - 6. Location in the Project.
 - 7. Type of inspection or test.
 - 8. Date of test.
 - 9. Results of tests.
 - 10. Conformance with Contract Documents.

- C. When requested by Contracting Officer's Representative, provide interpretation of test results.

1.9 LIMITS ON TESTING AGENCY/LABORATORY AUTHORITY

- A. Testing agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Testing agency or laboratory may not approve or accept any portion of the Work.
- C. Testing agency or laboratory may not assume any duties of Contractor.
- D. Testing agency or laboratory has no authority to stop the Work.

1.10 CONTRACTOR RESPONSIBILITIES

- A. Deliver to testing agency/laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
- B. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
- C. Provide incidental labor and facilities:
 - 1. To provide access to Work to be tested.
 - 2. To obtain and handle samples at the site or at source of products to be tested.
 - 3. To facilitate tests.
 - 4. To provide storage and curing of test samples.
- D. Notify A/E and laboratory 24 hours prior to expected time for operations requiring testing services.
- E. Employ services of an independent qualified testing laboratory and pay for additional samples and tests required by Contractor beyond specified requirements.

1.11 SCHEDULE OF TESTS

- A. Individual Specification Sections: Tests required and standards for testing. Summary of Test tests shown in Part 3.

PART 2 - PRODUCTS

- 2.1 Not Used

PART 3 - EXECUTION

3.1 EARTHWORK:

- A. General: Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where

unsuitable results are observed, witness excavation of unsuitable material and recommend to Contracting Officer's Technical Representative the extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.

B. Testing Compaction of scarified, conditioned, and re-worked subgrade:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D 698 (Standard Proctor). Perform additional tests of on-site borrow, as directed by the COR, when soil type and consistency change.
2. Make field density tests in accordance with the primary testing method following ASTM D2922 (Nuclear Methods) wherever possible. Field density tests utilizing ASTM D1556 (sand cone) shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR before the tests are conducted.
3. Pavement Subgrade: One test for each 200 Lineal Feet of roadway but in no case less than five (5) tests per phase.

C. Testing Materials: Test suitability of on-site borrow as directed by Contracting Officer's Technical Representative.

3.2 ASPHALT CONCRETE PAVING:

A. Aggregate Base Course:

1. Determine maximum density and optimum moisture content for Aggregate base material in accordance with ASTM D698.
2. Density tests: One test for each 50 Lineal Feet of roadway/curb/sidewalk corridor. Make a minimum of three field density tests on each day's final compaction on each Aggregate course in accordance with ASTM D 3017 (water content by Nuclear Methods) and ASTM D 2922 (density by Nuclear Methods).

B. Testing of Asphalt Concrete:

1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T 27), wear (AASHTO T 96), and soundness (AASHTO T 104).
2. Sample and test aggregates in stock piles and hot-bins daily to insure compliance with specification requirements for moisture content (AASHTO T 180).
3. Temperature: Check temperatures of each load of asphalt concrete at mixing plant and at site of paving operation.
4. Density: Make a minimum of three field density tests in accordance with ASTM D 1188 of asphalt base and surface course for each day's paving operation. (92% minimum density per Rice test required).
5. Binder: Make a minimum of three field samples of asphalt base and surface course for each day's paving operation to insure compliance with specification requirements for binder (AASHTO T 308).
6. Air Voids: Make a minimum of three field samples of asphalt base and surface course for each day's paving operation to insure compliance with specification requirements for air voids (AASHTO T 209).

3.3 CAST-IN-PLACE CONCRETE TESTING:

- A. Compressive Strength: One set of four cylinders from the first 25-cy placed and one set for each 50-cy placed thereafter; being placed each day. Test one cylinder at 7-days, two at 28-days, and retain one "hold" cylinder for future use. Make additional cylinders as needed for determination of early compressive strength.
- B. Slump: Test slump of each load of concrete, after mix adjustment, or as requested by the COR.
- C. Air Content: One test per 25-cy placed and after a mix adjustment is made.
- D. Testing representative shall remain on site throughout the concrete placement.

3.4 TEST TYPE AND ESTIMATED QUANTITY

ESTIMATED NO. OF TESTS

A. Earthwork:

1. Laboratory Compaction Test, Proctor for Moisture-Density Relationship on Materials for Earthwork, Backfill and Granular Subgrades:

a. ASTM D 698: 2

2. Field Density, Soils for Earthwork, Trench Backfill and Road Subgrades:

a. ASTM D2922: As Needed

B. Aggregate Base (Road Base):

1. Laboratory Compaction Test

a. ASTM D698: As Needed

2. Field Density/ Moisture:

a. ASTM D2922 /ASTM D3017: As Needed

C. Concrete Testing:

1. Compressive Strength Cylinder Sets: 3

2. Air Content: 3

3. Slump Tests: 3

- - - END - - -

SECTION 01 57 00
ENVIRONMENTAL MANAGEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Special requirements for environmental management during construction operations.
- B. Implementation and maintenance of Storm Water Pollution Prevention Plan prepared for the project (only if project will disturb more than one acre).
- C. Working in and around protected species and associated environment
- D. Slope Protection and Erosion Control practices
- E. Monitoring requirements.
- F. Definitions.
- G. Environmental protection.

1.2 RELATED DOCUMENTS

- A. Storm Water Pollution Prevention Plan (SWPPP) for the Hot Springs VA to be procured by contractor prior to construction from South Dakota Department of Environmental and Natural Resources, for areas where runoff from construction could enter State waters.

1.3 DEFINITIONS

- A. Environmental Pollution and Damage: Presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade utility of environment for aesthetic, cultural, or historical purposes.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION

- A. Protection of natural resources: Comply with applicable regulations and these specifications. Preserve the natural resources within the Project boundaries and outside the limits of permanent Work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by Owner.
 - 1. Confine demolition and construction activities to work area limits indicated on the Drawings.
 - 2. Disposal operations for demolished and waste materials that are not identified to be salvaged, recycled or reused:
 - a. Remove debris, rubbish, and other waste materials resulting from demolition and construction operations, from site.
 - b. No burning permitted.

- c. Transport materials with appropriate vehicles and dispose off site to areas that are approved for disposal by governing authorities having jurisdiction.
 - d. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways. Remove spillage and sweep, wash, or otherwise clean project site, streets, or highways.
3. Water resources:
- a. Comply with requirements of the National Pollutant Discharge Elimination System (NPDES) and the State Pollutant Discharge Elimination System (SPDES).
 - b. Oily substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Store and service construction equipment at areas designated for collection of oil wastes.
 - c. Mosquito abatement: Prevent ponding of stagnant water conducive to mosquito breeding habitat. Provide positive drainage throughout construction
 - d. Prevent run-off from site during demolition and construction operations.
 - e. Stream Crossings: Equipment will not be permitted to ford live streams
4. Land resources: Prior to construction, identify land resources to be preserved within the Work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from Owner.
- a. Earthwork: As specified in Division 31 and as follows:
 - 1) Erodible Soils for Earthwork: Plan and conduct earthwork to minimize the duration of exposure of unprotected Soils for Earthwork, except where the constructed feature obscures borrow areas, quarries, and waste material areas. Clear areas in reasonably sized increments only as needed to use the areas developed. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
 - 2) Erosion and sedimentation control devices: Construct or install temporary and permanent erosion and

sedimentation control features as required and delineated in the SWPPP (if applicable), and in accordance with Best Management Practices (BMP) of SD DOT.

- 3) Prevent and eliminate tracking of Soils for Earthwork and loose materials off site through cleaning of vehicle tires and other vehicle surfaces prior to exiting the site. Clean public roads of any material tracked from the site.
5. Air Resources: Develop and comply with IAQ Management Plan, Dust Control Plan, and as follows:
 - a. Coordinate and comply with local Air Pollution Control District requirements.
 - b. Prevent creation of dust, air pollution, and odors.
 - c. Sequence construction to avoid disturbance to site to the greatest extent possible.
 - d. Use mulch, water sprinkling, temporary enclosures, and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level. Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.
 - e. Store volatile liquids, including fuels and solvents, in closed containers.
 - f. Properly maintain equipment to reduce gaseous pollutant emissions.
 6. Fish and Wildlife Resources: Manage and control construction activities to minimize interference with, disturbance of, and damage to fish and wildlife.
 - a. Do not disturb fish and wildlife.
 - b. Do not alter water flows or otherwise significantly disturb the native habitat related to the project and critical to the survival of fish and wildlife, except as indicated or specified.
 - c. Contractor to obtain clearance from Biologist if working within 500 feet of any nesting raptors.

3.2 ARCHEOLOGICAL/HISTORIC RESOURCES

- A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the Contracting Officer's Technical Representative verbally, and then with a written follow up.

3.3 FIELD QUALITY CONTROL

- A. Comply with requirements of agencies having jurisdiction and as specified.

3.4 RECLAMATION AND RE-SEEDING

- A. All disturbed areas resulting from this Project which are not occupied by permanent construction shall be re-claimed to pre-construction conditions. Re-establish turf of a quality and mix to match existing vegetation at the given location.

- - - END - - -

SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.
- B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
1. Adversely effect human health or welfare,
 2. Unfavorably alter ecological balances of importance to human life,
 3. Effect other species of importance to humankind, or;
 4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.
- C. Definitions of Pollutants:
1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
 2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
 3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
 4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
 5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
 6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

7. Sanitary Wastes:

- a. Sewage: Domestic sanitary sewage and human and animal waste.
- b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

- A. Establish and maintain quality control for the environmental protection of all items set forth herein.
- B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. U.S. National Archives and Records Administration (NARA):
33 CFR 328.....Definitions

1.4 SUBMITTALS

- A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
 - 1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Resident Engineer to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the COR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
 - a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
 - b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
 - c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
 - d. Description of the Contractor's environmental protection personnel training program.
 - e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

- f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
 - g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
 - h. Permits, licenses, and the location of the solid waste disposal area.
 - i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
 - j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
 - k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
- B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.
- B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and land forms without permission from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted.
 - 1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence

- isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
 - a. Box and protect from damage existing trees and shrubs to remain on the construction site.
 - b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
 - c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
 3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
 4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
 - b. Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 31 20 11, EARTH MOVING.
 - c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
 5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features shown. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
 6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

7. Manage and control spoil areas on and off Government property to limit spoil to areas shown on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.
 8. Protect adjacent areas from despoilment by temporary excavations and embankments.
 9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
 10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
 11. Handle discarded materials other than those included in the solid waste category as directed by the COR.
- C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
 2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
 3. Monitor water areas affected by construction.
- D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.
- E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of South Dakota Air Pollution Statutes, Rules, or Regulations and Federal emission and performance laws and standards.

Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
 2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
 3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
 4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.
- F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 5:00 p.m. unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75
 2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
 - a. Maintain maximum permissible construction equipment noise levels at 50 feet (dBA):

EARTHMOVING

MATERIALS HANDLING

FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	--
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

- b. Use shields or other physical barriers to restrict noise transmission.
 - c. Provide soundproof housings or enclosures for noise-producing machinery.
 - d. Use efficient silencers on equipment air intakes.
 - e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
 - f. Line hoppers and storage bins with sound deadening material.
 - g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 65 dB(A) noise level. Measure noise exposure at the property line or 50 feet from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at three to six feet in front of any building face. Submit the recorded information to the COR noting any problems and the alternatives for mitigating actions.
- G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.

H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the COR. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

- - - E N D - - -

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
 - 1. Waste Management Plan development and implementation.
 - 2. Techniques to minimize waste generation.
 - 3. Sorting and separating of waste materials.
 - 4. Salvage of existing materials and items for reuse or resale.
 - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
 - 1. Soil.
 - 2. Inerts (eg, concrete, masonry and asphalt).

1.2 RELATED WORK

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction Demolition waste includes products of the following:
 - 1. Excess or unusable construction materials.
 - 2. Packaging used for construction products.
 - 3. Poor planning and/or layout.
 - 4. Construction error.
 - 5. Over ordering.
 - 6. Weather damage.
 - 7. Contamination.
 - 8. Mishandling.
 - 9. Breakage.

- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- D. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- E. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- F. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- G. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
 - 1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
 - 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:
- B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
 - 1. Procedures to be used for debris management.
 - 2. Proposed storage locations and waste disposal sites
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Provide a summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling, at project completion.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
 - 1. U.S. Green Building Council (USGBC):
 - 2. LEED Green Building Rating System for New Construction

1.7 RECORDS

- A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, and invoices. Include the net total costs for each disposal.

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**SECTION 02 41 00
DEMOLITION**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from temporary construction trash dumps if authorized by the COR.

1.2 RELATED WORK:

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 11, EARTH MOVING (SHORT FORM).
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- F. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.

1.3 PROTECTION:

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.
- E. In addition to previously listed fire and safety rules to be observed in performance of work, include following:

1. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
 2. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- F. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the COR. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have COR's approval.
- G. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.4 UTILITY SERVICES:

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION:

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
 1. As required for installation of new utility service lines.
 2. To full depth within an area defined by hypothetical lines located 5 feet outside building lines of new structures.
- B. Debris, including concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of daily, off the Medical Center property to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Break up concrete slabs below grade that do not

require removal from present location into pieces not exceeding 24 inches square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

- C. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COR. When utility lines are encountered that are not indicated on the drawings, the COR shall be notified prior to further work in that area.

3.2 CLEAN-UP:

- A. On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to COR. Clean-up shall disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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**SECTION 03 30 53
MISCELLANEOUS CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies cast-in-place structural concrete for storm sewer inlets and junction boxes.

1.2 RELATED WORK:

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 TOLERANCES:

- A. ACI 117.
- B. Slab Finishes: ACI 117, F-number method in accordance with ASTM E1155.

1.4 REGULATORY REQUIREMENTS:

- A. ACI SP-66 ACI Detailing Manual
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Concrete Mix Design.
- C. Shop Drawings: Reinforcing steel: Complete shop drawings.
- D. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
 - 117R-06.....Tolerances for Concrete Construction and Materials
 - 211.1-91(R2002).....Proportions for Normal, Heavyweight, and Mass Concrete
 - 211.2-98(R2004).....Proportions for Structural Lightweight Concrete
 - 301-05.....Specification for Structural Concrete
 - 305R-06.....Hot Weather Concreting
 - 306R-2002.....Cold Weather Concreting
 - SP-66-04ACI Detailing Manual
 - 318/318R-05.....Building Code Requirements for Reinforced Concrete

- 347R-04.....Guide to Formwork for Concrete
- C. American Society for Testing And Materials (ASTM):
- A185-07.....Steel Welded Wire, Fabric, Plain for Concrete
Reinforcement
- A615/A615M-08.....Deformed and Plain Billet-Steel Bars for Concrete
Reinforcement
- A996/A996M-06.....Standard Specification for Rail-Steel and Axle-
Steel Deformed Bars for Concrete Reinforcement
- C31/C31M-08.....Making and Curing Concrete Test Specimens in the
Field
- C33-07.....Concrete Aggregates
- C39/C39M-05.....Compressive Strength of Cylindrical Concrete
Specimens
- C94/C94M-07.....Ready-Mixed Concrete
- C143/C143M-05.....Standard Test Method for Slump of Hydraulic
Cement Concrete
- C150-07.....Portland Cement
- C171-07.....Sheet Material for Curing Concrete
- C172-07.....Sampling Freshly Mixed Concrete
- C173-07.Air Content of Freshly Mixed Concrete by the Volumetric Method
- C192/C192M-07.....Making and Curing Concrete Test Specimens in the
Laboratory
- C231-08.....Air Content of Freshly Mixed Concrete by the
Pressure Method
- C260-06.....Air-Entraining Admixtures for Concrete
- C330-05.....Lightweight Aggregates for Structural Concrete
- C494/C494M-08.....Chemical Admixtures for Concrete
- C618-08.....Coal Fly Ash and Raw or Calcined Natural Pozzolan
for Use in Concrete
- D1751-04.Prefomed Expansion Joint Fillers for Concrete Paving and
Structural Construction (Non-extruding and
Resilient Bituminous Types)
- D4397-02.....Polyethylene Sheeting for Construction,
Industrial and Agricultural Applications
- E1155-96(2008).....Determining F_F Floor Flatness and F_L Floor
Levelness Numbers

PART 2 - PRODUCTS

2.1 FORMS:

Wood, plywood, metal, or other materials, approved by the COR, of grade or type suitable to obtain type of finish specified.

2.2 MATERIALS:

- A. Portland Cement: ASTM C150, Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33, Size 67. Size 467 may be used for footings and walls over 12 inches thick. Coarse aggregate for applied topping and metal pan stair fill shall be Size 7.
- D. Fine Aggregate: ASTM C33.
- E. Lightweight Aggregate for Structural Concrete: ASTM C330, Table 1
- F. Mixing Water: Fresh, clean, and potable.
- G. Air-Entraining Admixture: ASTM C260.
- H. Chemical Admixtures: ASTM C494.
- I. Vapor Barrier: ASTM D4397, 10 mil.
- J. Reinforcing Steel: ASTM A615 or ASTM A996, deformed. See structural drawings or details, if any, for grade.
- K. Welded Wire Fabric: ASTM A185.
- L. Expansion Joint Filler: ASTM D1751.
- M. Sheet Materials for Curing Concrete: ASTM C171.
- N. Abrasive Aggregates: Aluminum oxide grains or emery grits.
- O. Liquid Hardener and Dustproofer: Fluosilicate solution or magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer.
- P. Liquid Densifier/Sealer: 100 percent active colorless aqueous silicate solution.
- Q. Grout, Non-Shrinking: Premixed ferrous or non-ferrous, mixed and applied in accordance with manufacturer's recommendations. Grout shall show no settlement or vertical drying shrinkage at 3 days or thereafter based on initial measurement made at time of placement, and produce a compressive strength of at least 2000 psi at 3 days and 4,500 psi at 28 days.

2.3 CONCRETE MIXES:

- A. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- B. Compressive strength at 28 days shall be not less than 4000 psi.
- C. Establish strength of concrete by testing prior to beginning concreting operation. Test consists of average of three cylinders made and cured in accordance with ASTM C192 and tested in accordance with ASTM C39.
- D. Maximum slump for vibrated concrete is 4 inches tested in accordance with ASTM C143.
- E. Cement and water factor (See Table I):

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete Strength	Non-Air-Entrained		Air-Entrained	
	Min. Cement (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement (lbs/c. yd)	Max. Water Cement Ratio
Min. 28 Day Comp. Strength (psi)				
5000 ^{1,3}	630	0.45	650	0.40
4000 ^{1,3}	550	0.55	570	0.50
3000 ^{1,3}	470	0.65	490	0.55
3000 ^{1,2}	500	*	520	*

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 1200 psi in excess of f'c. For concrete strengths above 5000 psi, the proposed mix design shall achieve a compressive strength 1400 psi in excess of f'c.
 2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
 3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
- * Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

F. Air-entrainment is required for all exterior concrete and as required for Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS. Air content shall conform with the following table:

TABLE I - TOTAL AIR CONTENT
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)

Nominal Maximum Size of Coarse Aggregate	Total Air Content Percentage by Volume
3/8 in	6 to 10
1/2 in	5 to 9
3/4 in	4 to 8
1 in	3-1/2 to 6-1/2
1-1/2 in	3 to 6

2.4 BATCHING & MIXING:

- A. Store, batch, and mix materials as specified in ASTM C94.
1. Job-Mixed: Concrete mixed at job site shall be mixed in a batch mixer in manner specified for stationary mixers in ASTM C94.
 2. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to project,

ready-mixed concrete producer shall furnish, in duplicate, certification as required by ASTM C94.

PART 3 - EXECUTION

3.1 FORMWORK:

- A. Installation shall conform to ACI 347. Sufficiently tight to hold concrete without leakage, sufficiently braced to withstand vibration of concrete, and to carry, without appreciable deflection, all dead and live loads to which they may be subjected.
- B. Treating and Wetting: Treat or wet contact forms as follows:
 - 1. Coat plywood and board forms with non-staining form sealer. In hot weather cool forms by wetting with cool water just before concrete is placed.
 - 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
 - 3. Use sealer on reused plywood forms as specified for new material.
- C. Inserts, Sleeves, and Similar Items: Flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned and built into construction, and maintained securely in place.
- D. Construction Tolerances:
 - 1. Contractor is responsible for setting and maintaining concrete formwork to assure erection of completed work within tolerances specified to accommodate installation or other rough and finish materials. Remedial work necessary for correcting excessive tolerances is the responsibility of the Contractor. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
 - 2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 REINFORCEMENT:

Details of concrete reinforcement, unless otherwise shown, in accordance with ACI 318 and ACI SP-66. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

3.3 VAPOR BARRIER:

- A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier.
- B. Place 4 inches of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
- C. Lap joints 6 inches and seal with a compatible pressure-sensitive tape.
- D. Patch punctures and tears.

3.4 PLACING CONCRETE:

- A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval of COR before placing concrete. Provide screeds at required elevations for concrete slabs.
- B. Before placing new concrete on or against concrete which has set, existing surfaces shall be roughened and cleaned free from all laitance, foreign matter, and loose particles.
- C. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1-1/2 hours. Do not allow concrete to drop freely more than 5 feet in unexposed work nor more than 3 feet in exposed work. Place and consolidate concrete in horizontal layers not exceeding 12 inches in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Vibration shall be carried on continuously with placing of concrete.
- D. Hot weather placing of concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.
- E. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 12 inches and to permit concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from COR.

3.5 PROTECTION AND CURING:

Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by COR.

3.6 FORM REMOVAL:

Forms remain in place until concrete has a sufficient strength to carry its own weight and loads supported. Removal of forms at any time is the Contractor's sole responsibility.

3.7 SURFACE PREPARATION:

Immediately after forms have been removed and work has been examined and approved by COR, remove loose materials, and patch all stone pockets, surface honeycomb, or similar deficiencies with cement mortar made with 1 part portland cement and 2 to 3 parts sand.

3.8 FINISHES:**A. Vertical and Overhead Surface Finishes:**

1. Unfinished Areas: Vertical and overhead concrete surfaces exposed in unfinished areas, above suspended ceilings in manholes, and other unfinished areas exposed or concealed will not require additional finishing.
2. Interior and Exterior Exposed Areas (to be painted): Fins, burrs and similar projections on surface shall be knocked off flush by mechanical means approved by COR and rubbed lightly with a fine abrasive stone or hone. Use an ample amount of water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and Exterior Exposed Areas (finished): Finished areas, unless otherwise shown, shall be given a grout finish of uniform color and shall have a smooth finish treated as follows:
 - a. After concrete has hardened and laitance, fins and burrs have been removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone or stone.
 - b. Apply grout composed of 1 part portland cement and 1 part clean, fine sand smaller than No. 30 sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits and honeycomb are filled.
 - c. After grout has hardened, but still plastic, remove surplus grout with a sponge rubber float and by rubbing with clean burlap.
 - d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish for any area in same day. Confine limits of finished areas to natural breaks in wall surface. Do not leave grout on concrete surface overnight.

B. Slab Finishes:

1. Scratch Finish: Slab surfaces to receive a bonded applied cementitious application shall all be thoroughly raked or wire broomed after partial setting (within 2 hours after placing) to roughen

surface to insure a permanent bond between base slab and applied cementitious materials.

2. Floating: Allow water brought to surface by float used for rough finishing to evaporate before surface is again floated or troweled. Do not sprinkle dry cement on surface to absorb water.
3. Float Finish: Ramps, stair treads, and platforms, both interior and exterior, equipment pads, and slabs to receive non-cementitious materials, except as specified, shall be screened and floated to a smooth dense finish. After first floating, while surface is still soft, surfaces shall be checked for alignment using a straightedge or template. Correct high spots by cutting down with a trowel or similar tool and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat the slab to a uniform sandy texture.
4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, future floor roof and all monolithic concrete floor slabs exposed in finished work and for which no other finish is shown or specified shall be steel troweled. Final steel troweling to secure a smooth, dense surface shall be delayed as long as possible, generally when the surface can no longer be dented with finger. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure on trowel to compact cement paste and form a dense, smooth surface. Finished surface shall be free of trowel marks, uniform in texture and appearance.
5. Broom Finish: Finish all exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after the surfaces have been floated.

3.9 PRECAST CONCRETE ITEMS:

Precast concrete items, not specified elsewhere, shall be cast using 4000 psi air-entrained concrete to shapes and dimensions shown. Finish surfaces to match corresponding adjacent concrete surfaces. Reinforce with steel as necessary for safe handling and erection.

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SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of cable and other items and arrangements for the specified items are shown on drawings.
- C. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

- A. References to the International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

- A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
 - 1. Listed; Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets

- appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled; Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
 3. Certified; equipment or product which:
 - a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
 - c. Bears a label, tag, or other record of certification.
 4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- B. Product Qualification:
 1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
 2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

Applicable publications listed in all Sections of Division are the latest issue, unless otherwise noted.

1.6 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class or type of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
 - 1. Components of an assembled unit need not be products of the same manufacturer.
 - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
 - 3. Components shall be compatible with each other and with the total assembly for the intended service.
 - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
 - 1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the COR a minimum of 15 working days prior to the manufacturers making the factory tests.
 - 2. Four copies of certified test reports containing all test data shall be furnished to the COR prior to final inspection and not more than 90 days after completion of the tests.
 - 3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.7 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested in accordance with Section 00 72 00, GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 EQUIPMENT PROTECTION

- A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
 - 1. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited

- to circuit protective devices, cables, wire, light fixtures, and accessories.
2. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
 3. Damaged equipment shall be, as determined by the COR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
 4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
 5. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

- A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
 2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.
 3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the COR and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways.
 4. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COR.

- D. For work on existing stations, arrange, phase and perform work to assure electrical service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interferences.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working spaces shall not be less than specified in the NEC for all voltages specified.
- C. Inaccessible Equipment:
 - 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
 - 2. "Conveniently accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.11 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 3. Submit each section separately.
- E. The submittals shall include the following:
1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
 2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
 3. Parts list which shall include those replacement parts recommended by the equipment manufacturer.
- F. Approvals will be based on complete submission of shop drawings.
- G. After approval and prior to installation, furnish the COR with one sample of each of the following:
1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
 2. Each type of conduit coupling, bushing and termination fitting.
 3. Conduit hangers, clamps and supports.
 4. Duct sealing compound.
 5. Each type of wire and cable splicing and terminating material and branch circuit single pole molded case circuit breaker.

1.12 SINGULAR NUMBER

Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.13 ACCEPTANCE CHECKS AND TESTS

The contractor shall furnish the instruments, materials and labor for field tests.

1.14 TRAINING

- A. Training shall be provided in accordance with Article 1.25, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- C. A training schedule shall be developed and submitted by the contractor and approved by the COR at least 30 days prior to the planned training.

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SECTION 26 05 21**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)****PART 1 - GENERAL****1.1 DESCRIPTION**

This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
- D. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of low-voltage conductors and cables in manholes and ducts.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

Low voltage cables shall be thoroughly tested at the factory per NEMA WC-70 to ensure that there are no electrical defects. Factory tests shall be certified.

1.5 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- 1. Manufacturer's Literature and Data: Showing each cable type and rating.
- 2. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the CORCOR:
 - a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
 - b. Certification by the contractor that the materials have been properly installed, connected, and tested.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

- B. American Society of Testing Material (ASTM):
 - D2301-04.....Standard Specification for Vinyl Chloride
Plastic Pressure-Sensitive Electrical Insulating
Tape
- C. National Fire Protection Association (NFPA):
 - 70-08.....National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA):
 - WC 70-09.....Power Cables Rated 2000 Volts or Less for the
Distribution of Electrical Energy
- E. Underwriters Laboratories, Inc. (UL):
 - 44-05.....Thermoset-Insulated Wires and Cables
 - 83-08.....Thermoplastic-Insulated Wires and Cables
 - 467-071.....Electrical Grounding and Bonding Equipment
 - 486A-486B-03.....Wire Connectors
 - 486C-04.....Splicing Wire Connectors
 - 486D-05.....Sealed Wire Connector Systems
 - 486E-94.....Equipment Wiring Terminals for Use with Aluminum
and/or Copper Conductors
 - 493-07.....Thermoplastic-Insulated Underground Feeder and
Branch Circuit Cable
 - 514B-04.....Conduit, Tubing, and Cable Fittings
 - 1479-03.....Fire Tests of Through-Penetration Fire Stops

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Conductors and cables shall be in accordance with NEMA WC-70 and as specified herein.
- B. Single Conductor:
 - 1. Shall be annealed copper.
 - 2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.
 - 3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.
- C. Insulation:
 - 1. XHHW-2 or THHN-THWN shall be in accordance with NEMA WC-70, UL 44, and UL 83.
 - 2. Direct burial: UF or USE shall be in accordance with NEMA WC-70 and UL 493.

D. Color Code:

1. Secondary service feeder and branch circuit conductors shall be color-coded as follows:

208/120 volt	Phase	480/277 volt
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

CORCOR2. Use solid color insulation or solid color coating for No. 12 AWG and No. 10 AWG branch circuit phase, neutral, and ground conductors.

3. Conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
 - a. Solid color insulation or solid color coating.
 - b. Stripes, bands, or hash marks of color specified above.
 - c. Color as specified using 0.75 inch wide tape. Apply tape in half-overlapping turns for a minimum of 3 inches for terminal points, and in junction boxes, pull-boxes, troughs, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

2.2 SPLICES AND JOINTS

- A. In accordance with UL 486A, C, D, E, and NEC.
- B. Aboveground Circuits (No. 10 AWG and smaller):
 1. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F, with integral insulation, approved for copper and aluminum conductors.
 2. The integral insulator shall have a skirt to completely cover the stripped wires.
 3. The number, size, and combination of conductors, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Aboveground Circuits (No. 8 AWG and larger):
 1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

2. Field-installed compression connectors for cable sizes 250 kcmil and larger shall have not fewer than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

D. Underground Branch Circuits and Feeders:

1. Submersible connectors in accordance with UL 486D, rated 600 V, 190° F, with integral insulation.

2.3 WIRE LUBRICATING COMPOUND

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with the NEC, and as specified.
- B. Install all wiring in raceway systems.
- C. Splice cables and wires only in outlet boxes, junction boxes, pull-boxes, manholes, or handholes.
- D. Wires of different systems (e.g., 120 V, 277 V) shall not be installed in the same conduit or junction box system.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. For wireways neatly form, train, and tie the cables in individual circuits.
- G. Seal cable and wire entering a building from underground between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- H. Wire Pulling:
1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables. Use lubricants approved for the cable.
 2. Use nonmetallic ropes for pulling feeders.
 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the CORCOR.
 4. All cables in a single conduit shall be pulled simultaneously.

5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

I. No more than three single-phase branch circuits shall be installed in any one conduit.

3.2 INSTALLATION IN MANHOLES

A. Install and support cables in manholes on the steel racks with porcelain or equivalent insulators. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

3.3 SPLICE INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure.

B. Tighten electrical connectors and terminals according to manufacturer's published torque values.

C. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

3.4 FEEDER IDENTIFICATION

A. In each manhole and handhole, provide tags of the embossed brass type, showing the circuit identification and voltage. The tags shall be the embossed brass type, 1.5 inch in diameter and 40 mils thick. Attach tags with plastic ties.

3.5 EXISTING WIRING

Unless specifically indicated on the plans, existing wiring shall not be reused for a new installation.

3.6 CONTROL AND SIGNAL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.

3.7 DIRECT BURIAL CABLE INSTALLATION

A. Tops of the cables:

1. Below the finished grade: Minimum 24 inch unless greater depth is shown.

2. Below road and other pavement surfaces: In conduit as specified, minimum 30 inches unless greater depth is shown.

3. Do not install cables under railroad tracks.

B. Work with extreme care near existing ducts, conduits, cables, and other utilities to prevent any damage.

C. Cut the trenches neatly and uniformly:

1. Excavating and backfilling is specified in Section 31 20 11, EARTH MOVING.

2. Place a 3 inch layer of sand in the trenches before installing the cables.
 3. Place a 3 inch layer of sand over the installed cables.
 4. Install continuous horizontal, 1 in x 8 in preservative impregnated wood planking 3 inches above the cables before backfilling.
- D. Provide horizontal slack in the cables for contraction during cold weather.
- E. Install the cables in continuous lengths. Splices within cable runs shall not be accepted.
- F. Connections and terminations shall be listed submersible-type designed for the cables being installed.
- G. Warning tape shall be continuously placed 12 inches above the buried cables.

3.8 ACCEPTANCE CHECKS AND TESTS

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices, such as fixtures, motors, or appliances. Test each conductor with respect to adjacent conductors and to ground. Existing conductors to be reused shall also be tested.
- B. Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.
- C. Perform phase rotation test on all three-phase circuits.
- D. The contractor shall furnish the instruments, materials, and labor for all tests.

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the general grounding and bonding requirements for electrical equipment and operations to provide a low impedance path for possible ground fault currents.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
 - 1. Clearly present enough information to determine compliance with drawings and specifications.
 - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the CORCOR:
 - 1. Certification that the materials and installation are in accordance with the drawings and specifications.
 - 2. Certification by the contractor that the complete installation has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

- A. American Society for Testing and Materials (ASTM):
- B1-07.....Standard Specification for Hard-Drawn Copper Wire
- B3-07.....Standard Specification for Soft or Annealed Copper Wire
- B8-04.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
- 81-1983.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- C2-07.....National Electrical Safety Code
- C. National Fire Protection Association (NFPA):
- 70-08.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
- 44-05Thermoset-Insulated Wires and Cables
- 83-08Thermoplastic-Insulated Wires and Cables
- 467-07Grounding and Bonding Equipment
- 486A-486B-03Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 44 or UL 83 insulated stranded copper, except that sizes No. 10 AWG [6 mm²] and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG [6 mm²] and smaller shall be ASTM B1 solid bare copper wire.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

2.2 CONCRETE ENCASED ELECTRODE

Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

2.3 GROUND CONNECTIONS

A. Below Grade: Exothermic-welded type connectors.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. System Grounding:
1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures, including ductwork, enclosures, raceways and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections, which are normally buried or otherwise inaccessible (except connections for which access for periodic testing is required), by exothermic weld.

3.3 RACEWAY

- A. Conduit Systems:
1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
 2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
- B. Branch Circuits: Install equipment grounding conductors with all lighting branch circuits.
- C. Boxes and Enclosures:
1. Bond the equipment grounding conductor to each pullbox, junction box, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:

1. Bond the metallic structures of wireway to provide 100% electrical continuity throughout the wireway system, by connecting a No. 6 AWG [16 mm²] bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 50 ft.
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.

E. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems.

3.4 CORROSION INHIBITORS

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.5 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.6 EXTERIOR LIGHT POLES

Provide 20 ft of No. 4 bare copper coiled at bottom of pole base excavation prior to pour, plus additional unspliced length in and above foundation as required to reach pole ground stud.

3.7 GROUND RESISTANCE

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined

resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- C. Services at power company interface points shall comply with the power company ground resistance requirements.
- D. Below-grade connections shall be visually inspected by the CORCOR prior to backfilling. The contractor shall notify the CORCOR 24 hours before the connections are ready for inspection.

3.8 GROUND ROD INSTALLATION

- A. Where permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.
- B. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

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SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground conduits.
- D. Section 31 20 11, EARTH MOVING: Bedding of conduits.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- A. Manufacturer's Literature and Data: Showing each cable type and rating. The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Shop Drawings:
 - 1. Size and location of main feeders.
 - 2. Size and location of panels and pull-boxes.
 - 3. Layout of required conduit penetrations through structural elements.
- C. Certifications:
 - 1. Two weeks prior to the final inspection, submit four copies of the following certifications to the CORCOR:
 - a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.
 - b. Certification by the contractor that the material has been properly installed.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
C80.1-05.....Electrical Rigid Steel Conduit
- C. National Fire Protection Association (NFPA):
70-08.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
5-04.....Surface Metal Raceway and Fittings
6-07.....Electrical Rigid Metal Conduit - Steel
50-95.....Enclosures for Electrical Equipment
467-07.....Grounding and Bonding Equipment
514B-04.....Conduit, Tubing, and Cable Fittings
514C-96.....Nonmetallic Outlet Boxes, Flush-Device Boxes and
Covers
651-05.....Schedule 40 and 80 Rigid PVC Conduit and
Fittings
651A-00.....Type EB and A Rigid PVC Conduit and HDPE Conduit
- E.....National Electrical Manufacturers Association
(NEMA):
TC-2-03.....Electrical Polyvinyl Chloride (PVC) Tubing and
Conduit
TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and
Tubing
FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies
for Conduit, Electrical Metallic Tubing and
Cable

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Conduit Size: In accordance with the NEC, but not less than 0.5 in unless otherwise shown. Where permitted by the NEC, 0.5 in flexible conduit may be used for tap connections to recessed lighting fixtures.
- B. Conduit:
1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
- C. Conduit Fittings:
1. Rigid steel:
a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable.

- c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
 - d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
 - e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
 - f. Sealing fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Electrical metallic tubing fittings:
- a. Setscrew couplings and connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding.
 - b. Indent-type connectors or couplings are prohibited.
 - c. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
3. Direct burial plastic conduit fittings:
Fittings shall meet the requirements of UL 514C and NEMA TC3.
4. Expansion and deflection couplings:
- a. Conform to UL 467 and UL 514B.
 - b. Accommodate a 0.75 in deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
 - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

PART 3 - EXECUTION

3.1 PENETRATIONS

- A. Cutting or Holes:

CORCOR1. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the COR as required by limited working space.

3.2 INSTALLATION, GENERAL

- A. In accordance with UL, NEC, as shown, and as specified herein.
- B. Install conduit as follows:
 - 1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
 - 2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished floors.
 - 3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
 - 4. Cut square, ream, remove burrs, and draw up tight.
 - 5. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
 - 6. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
 - 7. Do not use aluminum conduits in wet locations.
- C. Conduit Bends:
 - 1. Make bends with standard conduit bending machines.
 - 2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
 - 3. Bending of conduits with a pipe tee or vise is prohibited.
- D. Layout and Homeruns:
 - 1. Install conduit with wiring, including homeruns, as shown on drawings.
 - 2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the CORCOR.

CORCOR3.3 DIRECT BURIAL INSTALLATION

Refer to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

3.4 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
 - 1. Flush-mounted.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.
- C. Remove only knockouts as required and plug unused openings.

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SECTION 26 05 41
UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of precast manholes and pullboxes with ducts to form a complete underground raceway system.
- B. "Duct" and "conduit," and "rigid metal conduit" and "rigid steel conduit" are used interchangeably in this specification.

1.2 RELATED WORK

- A. Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings and boxes for raceway systems.
- E. Section 31 20 11, EARTH MOVING (SHORT FORM): Trenching, backfill and compaction.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Coordinate layout and installation of ducts, manholes, pullboxes, and pull-boxes with final arrangement of other utilities, site grading, and surface features, as determined in the field.

1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
 - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
 - 2. Include manholes, pullboxes, duct materials, and hardware. Submit plan and elevation drawings, showing openings, pulling irons, cable supports, cover, ladder, sump, and other accessories and details.
 - 3. Proposed deviations from details on the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes or

- pullboxes at locations other than shown on the drawings, show the proposed locations accurately on scaled site drawings, and submit four copies to the CORCOR for approval prior to construction.
- C. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the CORCOR:
1. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
 2. Certification by the contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Concrete Institute (ACI):
- Building Code Requirements for Structural Concrete
318/318M-05.....Building Code Requirements for Structural
Concrete & Commentary
- SP-66-04.....ACI Detailing Manual
- C. American National Standards Institute (ANSI):
- 77-07.....Underground Enclosure Integrity
- D. American Society for Testing and Materials (ASTM):
- C478-09.....Standard Specification for Precast Reinforced
Concrete Manhole Sections
- C858-09.....Underground Precast Concrete Utility Structures
- C990-09.....Standard Specification for Joints for Concrete
Pipe, Manholes and Precast Box Sections Using
Preformed Flexible Joint Sealants.
- E. Institute of Electrical and Electronic Engineers (IEEE):
- C2-07National Electrical Safety Code
- F. National Electrical Manufacturers Association (NEMA):
- TC 2-03.....Electrical Polyvinyl Chloride (PVC) Tubing And
Conduit
- TC 3-2004.....PVC Fittings for Use With Rigid PVC Conduit And
Tubing
- TC 6 & 8 2003.....PVC Plastic Utilities Duct For Underground
Installations

TC 9-2004.....Fittings For PVC Plastic Utilities Duct For
Underground Installation

G. National Fire Protection Association (NFPA):

70-08.....National Electrical Code (NEC)

H. Underwriters Laboratories, Inc. (UL):

6-07.....Electrical Rigid Metal Conduit-Steel

467-07.....Grounding and Bonding Equipment

651-05.....Schedule 40 and 80 Rigid PVC Conduit and
Fittings

651A-00.....Type EB and A Rigid PVC Conduit and HDPE
Conduit

651B-07.....Continuous Length HDPE Conduit

I. U.S. General Services Administration (GSA):

A-A-60005-1998.....Frames, Covers, Gratings, Steps, Sump and Catch
Basin, Manhole

1.6 STORAGE

Lift and support pre-cast concrete structures only at designated
lifting or supporting points.

PART 2 - PRODUCTS

2.1 PULLBOXES

A. General: Size as indicated on drawings. Provide pullboxes with
weatherproof, non-skid covers with recessed hook eyes, secured with
corrosion- and tamper-resistant hardware. Cover material shall be
identical to pullbox material. Covers shall have molded lettering,
ELECTRIC or SIGNAL as applicable. Pullboxes shall comply with the
requirements of ANSI/SCTE 77 Tier 15 loading. Provide pulling irons,
0.875 inch diameter galvanized steel bar with exposed triangular-shaped
opening.

B. Polymer Concrete Pullboxes: Shall be molded of sand, aggregate, and
polymer resin, and reinforced with steel, fiberglass, or both. Pullbox
shall have open bottom.

2.3. DUCTS

A. Number and sizes shall be as shown on drawings.

B. Ducts (direct-burial):

1. Plastic duct:

a. NEMA TC2 and TC3

b. UL 651, 651A, and 651B, Schedule 40 PVC or HDPE.

c. Duct shall be suitable for use with 167° F rated conductors.

2. Rigid metal conduit: UL6 and NEMA RN1 galvanized rigid steel, threaded type, half-lapped with 10 mil PVC tape.

2.3 WARNING TAPE

Standard 4-mil polyethylene 3 inches wide detectable tape, red with black letters, imprinted with "CAUTION - BURIED ELECTRIC CABLE BELOW" or similar.

2.4 PULL ROPE FOR SPARE DUCTS

Plastic with 200 lb minimum tensile strength.

PART 3 - EXECUTION

3.1 PULLBOX INSTALLATION

- A. Assembly and installation shall follow the printed instructions and recommendations of the manufacturer. Install pullboxes level and plumb.
 1. Units shall be installed on a 12 inches level bed of 90% compacted granular fill, well-graded from the 1 inch sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.
 2. Seal duct terminations so they are watertight.
- B. Access: Ensure the top of frames and covers are flush with finished grade.

3.2 TRENCHING

- A. Refer to Section 31 20 11, EARTH MOVING for trenching, backfilling, and compaction.
- B. Before performing trenching work at existing facilities, the Ground Penetrating Radar Survey shall be carefully performed by certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems.
- C. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.
- D. Cut the trenches neatly and uniformly.

3.3 DUCT INSTALLATION

- A. General Requirements:
 1. Ducts shall be in accordance with the NEC and IEEE C2, as shown on the drawings, and as specified.
 2. Slope ducts to drain towards manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 4 inches in 100 ft.

3. Stub-ups, sweeps, and risers to equipment mounted on outdoor concrete slabs shall be taped galvanized rigid steel, and shall extend a minimum of 5 ft away from the edge of slab.
4. Install insulated grounding bushings on the terminations.
5. Radius for turns of direction shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter. Use manufactured long sweep bends.
6. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
7. Duct lines shall be installed no less than 12 inches from other utility systems, such as water, sewer, and chilled water.
8. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
9. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
10. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
11. Seal conduits, including spare conduits, at building entrances and at outdoor equipment terminations with a suitable compound to prevent entrance of moisture and gases.

CORCORB. Direct-Burial Duct and Conduits:

1. Install direct-burial ducts and conduits only where shown on the drawings. Provide direct-burial ducts only for low-voltage systems.
2. Join and terminate ducts and conduits with fittings recommended by the conduit manufacturer.
3. Tops of ducts and conduits shall be:
 - a. Not less than 24 inches and not less than shown on the drawings, below finished grade.
 - b. Not less than 30 inches and not less than shown on the drawings, below roads and other paved surfaces.
4. Do not kink the ducts or conduits. Compaction shall not deform the ducts.

C. Direct-Burial Duct and Conduit Identification: Place continuous strip of warning tape approximately 12 inches above ducts or conduits before backfilling trenches. Warning tape shall be preprinted with proper identification.

D. Duct and Conduit Cleaning:

1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct. The mandrel shall be not less than 12 inches long, and shall have a diameter not less than 0.5 inch less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
2. Mandrel pulls shall be witnessed by the CORCOR.

E. Duct and Conduit Sealing: Seal the ducts and conduits at building entrances, and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of moisture and gases.

- - - E N D - - -

SECTION 31 20 11
EARTH MOVING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS

A. Unsuitable Materials:

1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 3 inches; organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to COR's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D698.

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK

A. Materials Testing and Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Protection of Existing Utilities, Fire Protection Services, Existing Equipment, Roads, and Pavements: Section 01 00 00, GENERAL REQUIREMENTS.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00 GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.
- B. Rock Excavation:
 - 1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
 - 2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 1 cubic yard capacity, properly used, having adequate power and in good running condition.
 - 3. Boulders or other detached stones each having a volume of 1/2 cubic yard or more.

1.5 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION

- A. Measurement: Cross section and measure the uncovered and separated materials, and compute quantities by the Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. Do not measure quantities beyond the following limits:
 - 1. 12 inches outside of the perimeter of formed footings.
 - 2. 24 inches outside the face of concrete work for which forms are required, except for footings.
 - 3. 6 inches below the bottom of pipe and not more than the pipe diameter plus 24 inches in width for pipe trenches.
 - 4. The outside dimensions of concrete work for which no forms are required (trenches, conduits, and similar items not requiring forms).
- B. Payment: No separate payment shall be made for rock excavation quantities shown. The contract price and time will be adjusted for overruns or underruns in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable.

1.6 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Rock Excavation Report:
 - 1. Certification of rock quantities excavated.
 - 2. Excavation method.
 - 3. Labor.
 - 4. Equipment.

- 5. Land Surveyor's or Civil Engineer's name and official registration stamp.
- 6. Plot plan showing elevations.
- C. Data and Test Reports
 - 1. Fill: Sources, gradation, liquid limit, plasticity, index, percentage of water.

1.7 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Nursery and Landscape Association (ANLA):
2004.....American Standard for Nursery Stock
- C. American Association of State Highway and Transportation Officials (AASHTO):
T99-01 (R2004).....Moisture-Density Relations of Soils Using a 5.5 lb Rammer
and a 12-inch Drop
T180-01 (2004).....Moisture-Density Relations of Soils Using a 10 lb Rammer and a 18-inch Drop
- D. American Society for Testing and Materials (ASTM):
D698-07.....Laboratory Compaction Characteristics of Soil Using Standard Effort
- E. Standard Specifications for Road and Bridge Construction, Wyoming State Department of Transportation, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fills: Materials approved from on site and off site sources having a minimum dry density of 110 pcf, a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.
- B. Granular Fill:
 - 1. Bedding for sanitary and storm sewer pipe:
 - a. Sand: Material shall be free of ice, clay, organic matter or other objectionable material, and shall conform to the following Gradation per ASTM C136:

<u>SIEVE SIZE</u>	<u>% BY WEIGHT PASSING SIEVE</u>
3/8"	100
#4	90-100
#50	10-40
#100	3-15
#200	0-7

- b. Type I Bedding Material: Shall be crushed limestone rock having a minimum of two fractured faces and meet the following gradation requirements by dry weight:

<u>SIEVE SIZE</u>	<u>% BY WEIGHT PASSING SIEVE</u>
1"	100
3/4"	90-100
3/8"	20-55
#4	0-10
#8	0-8

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. System Locates: The Contractor shall be responsible for making arrangements to call for underground locates prior to any clearing or excavation work. Underground utilities including irrigation lines, sprinkler heads and controls disturbed during construction shall be repaired back to the original operating condition.
- B. Clearing: Clearing within the limits of earthwork operations as described or designated by the COR. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the Medical Center property.
- C. Grubbing: Remove stumps and roots 3 inches and larger diameter. Undisturbed sound stumps, roots up to 3 inches diameter, and nonperishable solid objects which will be a minimum of 3 feet below subgrade or finished embankment may be left.
- D. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from the areas within 15 feet of new construction and 7'-6" of utility lines if such removal is approved in advance by the COR. Remove materials from the Medical Center. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semi-annually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until the conclusion of the contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in the construction area. Repair immediately damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including the roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Building materials shall not be

stored closer to trees and shrubs that are to remain, than the farthest extension of their limbs.

- E. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report if provided, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the COR. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 1/2 cubic foot in volume, from soil as it is stockpiled. Retain topsoil on the Medical Center property. Remove foreign materials larger than 2 inches in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.
- F. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 12 inches on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from the Medical Center Property.
- G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION

- A. Shoring, Sheet piling and Bracing: Shore, brace, or slope to its angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.
1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations. The Contractor is encouraged to use a trench box to minimize the trench width.

2. If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support in compliance with Specification Section 31 23 23.33, FLOWABLE FILL, under disturbed foundations, as directed by COR, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by COR.
- B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from COR. Approval by the COR is also required before placement of the permanent work on all subgrades. When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel. When removed disturbed material is located where it is not possible to install and properly compact disturbed subgrade material with mechanically compacted sand or gravel, the COR should be contacted to consider the use of flowable fill.
- C. Blasting: Blasting shall not be permitted.
- D. Trench Earthwork:
1. Storm sewer trenches:
 - a. Trench width below a point 6 inches above top of the pipe shall be 24 inches for up to and including 12 inches diameter and four-thirds diameter of pipe plus 8 inches for pipe larger than 12 inches. Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
 - b. The bottom quadrant of the pipe shall be bedded on undisturbed soil or granular fill.
 - 1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 12 inches above top of pipe shall be clean earth placed and tamped by hand.
 - 2) Select Granular Fill: Depth of fill shall be a minimum of 2 inches below the pipe to at least half way above the bottom of the pipe. Place and tamp fill material by hand.
 - c. Place and compact as specified the remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
 - d. Use granular fill for bedding where rock or rocky materials are excavated.
- E. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are

determined by the COR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the COR, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on yardage in cut section only.

- F. Finished elevation of subgrade shall be as follows:
1. Pavement Areas: Bottom of the pavement or base course as applicable.
 2. Planting and Lawn Areas: 4 inches below the finished grade, unless otherwise specified or indicated on the drawings.

3.3 FILLING AND BACKFILLING

- A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until pipes coming in contact with backfill have been installed, and inspected and approved by COR.
- B. Proof-Rolling Existing Subgrade: Proof-roll with a fully loaded dump truck. Make a minimum of one pass in each direction. Remove unstable uncompactable material and replace with granular fill material completed to mix requirements specified.
- C. Placing: Place material in horizontal layers not exceeding 8 inches in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.
- D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 10 feet of new or existing building walls without the prior approval of the COR. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer until there is no evidence of further compaction to not less than 95 percent of the maximum density determined in accordance with the following test method ASTM D698 for structural areas beneath pavements. Non-structural areas shall be compacted to a minimum of 90 percent at plus or minus 3 percent of optimum moisture content.

3.4 GRADING

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.
- C. Slope backfill outside the building away from the building walls for a minimum distance of 10 feet at a minimum five percent (5%) slope.
- D. The finished grade shall be 6 inches below bottom line of windows or other building wall openings unless greater depth is shown.
- E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 6 inches, unless otherwise indicated.
- F. Finish subgrade in a condition acceptable to the COR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.
- G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 0.25 inches of indicated grades.

3.5 LAWN AREAS

- A. General: Harrow and till to a depth of 4 inches, new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by COR before seeding or sodding operation begins.
- B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 4 inches. Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 4 inches of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits

indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL

- A. Disposal: Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.
- B. Place excess excavated topsoil only on Medical Center property where directed.
- C. Remove from the construction site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- D. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 6 mil polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN-UP

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Medical Center property.

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SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies performance of dewatering required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

1.2 SUMMARY

- A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:
 - 1. Implementation of the erosion and sedimentation control.
 - 2. Dewater excavations, including seepage and precipitation.
- B. The Contractor shall be responsible for providing all materials, equipment, labor, and services necessary for care of water and erosion control. Excavation work shall not begin before the Erosion and Sedimentation Control Plan is in place.

1.3 REQUIREMENT

- A. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least 1 foot below lowest foundation subgrade or bottom of pipe trench and to allow material to be excavated in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.
- B. Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of 1 foot below prevailing excavation surface.
- C. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.
- D. Maintain stability of sides and bottom of excavation.
- E. Construction operations are performed in the dry.
- F. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:
 - 1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.

2. Erosion is controlled.
 3. Flooding of excavations or damage to structures does not occur.
 4. Surface water drains away from excavations.
 5. Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.
- G. Permitting Requirements: The contractor shall comply with and obtain the required State and County permits where the work is performed.

1.4 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- C. Submittal requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- D. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- E. Excavation, backfilling, site grade and utilities: Section 31 20 11, EARTH MOVING.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Drawings and Design Data:
 1. When requested, submit drawings or data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation.
 2. Material may include location, depth and size of wellpoints, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water from site to adequate disposal.
 3. If requested, include a written report outlining control procedures to be adopted if dewatering problem arises.
 4. Materials submitted shall be in a format acceptable for inclusion in required permit applications to any and all regulatory agencies for which permits for discharge water from the dewatering system are required due to the discharge reaching regulated bodies of water.
- C. Inspection Reports.
- D. All required permits.

PART 2 - PRODUCTS (NOT USED)**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Install a dewatering system to lower and control ground surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to predrain the waterbearing strata above and below the bottom of structure foundations, utilities and other excavations.
- B. In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of 1 foot below prevailing excavation surface at all times.

3.2 OPERATION

- A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.
- B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

3.3 WATER DISPOSAL

- A. Dispose of water removed from the excavations in such a manner as will:
 - 1. Not endanger portions of work under construction or completed.
 - 2. Cause no inconvenience to Government or others working near site.
 - 3. Comply with stipulations of required permits for disposal of water.
 - 4. Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.
- B. Excavation Dewatering:
 - 1. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
 - 2. Drainage features shall have sufficient capacity to avoid flooding of work areas.

3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
 4. The Contractor shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.
 5. The Contractor shall plan for and make arrangements to divert either surface runoff or groundwater for the purpose of irrigating adjacent grassed or turf areas rather than allow water disposal to water courses or navigable waters via storm sewers or drainage ditches.
- C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

3.4 STANDBY EQUIPMENT

Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain dewatering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

3.5 CORRECTIVE ACTION

If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system loosening of the foundation strata, or instability of slopes, or damage to foundations or structures, perform work necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by Contractor, at no additional cost to Government.

3.6 DAMAGES

Immediately repair damages to adjacent facilities caused by dewatering operations.

3.7 REMOVAL

Insure compliance with all conditions of regulating permits and provide such information to the COR. Obtain written approval from COR before discontinuing operation of dewatering system.

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SECTION 31 23 23.33
FLOWABLE FILL

PART 1 - GENERAL

1.1 INTRODUCTION:

- A. Flowable fill refers to a cementitious slurry consisting of a mixture of fine aggregate or filler, water, and cementitious material(s), which is used as a fill or backfill in lieu of compacted earth. This mixture is capable of filling all voids in irregular excavations and hard to reach places (such as under undercuts of existing slabs), is self-leveling, and hardens in a matter of a few hours without the need for compaction in layers. Flowable fill is sometimes referred to as controlled density fill (CDF), controlled low strength material (CLSM), lean concrete slurry, and unshrinkable fill.
- B. Flowable fill materials will be used as only as a structural fill replacement on VA projects. The materials and mix design for the flowable fill should be designed to produce a comparable compressive strength to the surrounding soil after hardening, making excavation at a later time possible to produce the compressive strength indicated for the placed location, as determined by the COR.

1.2 DESCRIPTION:

Furnish and place flowable fill in a fluid condition that sets within the required time and, after curing, obtains the desired strength properties as evidenced by the laboratory testing of the specific mix design, at locations shown on the plans or as directed by the COR, verbally or in writing. This section specifies flowable fill for use as structural fill to remain easily excavatable using a backhoe as would be utilized for adjoining earth.

1.3 RELATED WORK:

- A. Earthwork, excavation and backfill and compaction requirements: Section 31 20 11, EARTH MOVING (short form).

1.4 DEFINITIONS:

- A. Flowable fill - Ready-mix Controlled Low Strength Material used as an alternative to compacted soil, and is also known as controlled density fill, and several other names, some of which are trademark names of material suppliers. Flowable fill (Controlled Low Strength Material) differs from portland cement concrete as it contains a low cementitious content to reduce strength development for possible future removal. Chemical admixtures may also be used in flowable fill to modify performance properties of strength, flow, set and permeability.

- B. Excavatable Flowable fill - flowable fill designed with a compressive strength that will allow excavation as either machine tool excavatable at compressive strength of 1.5 MPa (200 psi) maximum at 1 year, or hand tool excavatable at compressive strength of 0.7 MPa (100 psi) maximum at 1 year.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Flowable Fill Mix Design: Provide flowable fill mix design containing cement and water. At the contractor's option, it may also contain fly ash, aggregate, or chemical admixtures in any proportions such that the final product meets the strength and flow consistency, and shrinkage requirements included in this specifications.
 - 1. Test and Performance - Submit the following data:
 - a. Flowable fill shall have a minimum strength of 200 psi according to ASTM C 39 at 28 days after placement.
 - b. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per ft.) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
 - c. Flowable fill shall have a unit weight of 115 - 145 lb/feet³ measured at the point of placement after a 60 minute ready-mix truck ride.
 - C. Provide documentation that the admixture supplier has experience of at least one year, with the products being provided and any equipment required to obtain desired performance of the product.
 - D. Manufacturer's Certificates: Provide COR with a certification that the materials incorporated in the flowable fill, following achievement of the required strength, do not represent a threat to groundwater quality.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

- B. American Society for Testing and Materials (ASTM):

- D4832-02.....Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
- C618-03.....Standard Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as Mineral Admixture in Concrete. (Use Fly Ash conforming to the chemical and physical requirements for mineral admixture, Class F listed, including Table 2 (except for Footnote A). Waive the loss on ignition requirement.)
- C403/C403M-05.....Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
- C150-99 Rev.A-04.....Standard Specification for Portland Cement
- C33-03.....Standard Specification for Concrete Aggregates
- C494/C494M-04.....Standard Specification for Chemical Admixtures for Concrete
- C940 RevA-98.....Standard Specification for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced - Aggregate Concrete in the Laboratory
- C. American Concrete Institute (ACI):
- SP-150-94.....Controlled Low-Strength Materials

1.7 QUALITY ASSURANCE:

- A. Manufacturer: Flowable fill shall be manufactured by a ready-mix concrete producer with a minimum of 1 year experience in the production of similar products.
- B. Materials: For each type of material required for the work of this Section, provide primary materials that are the products of one manufacturer. If not otherwise specified here, materials shall comply with recommendations of ACI 229, "Controlled Low Strength Materials."
- C. Pre-Approval Procedures: The use of flowable fill during any part of the project shall be restricted to those incidences where, due to field conditions, the Contractor has made the COR aware of the conditions for which he recommends the use of the flowable, and the COR has confirmed those conditions and approved the use of the flowable fill, in advance. During the submittal process, the contractor shall prepare and submit various flowable fill mix designs corresponding to required conditions or if the contractor desires to use flowable fill due to economics. Approval for the strength of the flowable fill shall be obtained from the COR when the contractor desires, or is required, to use flowable fill at specific location(s) within the project. Prior to commencement of field operations the contractor shall establish procedures to

maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.8 DELIVERY, STORAGE, AND HANDLING:

Deliver and handle all products and equipment required, in strict compliance with manufacturer's recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.

1.9 PROJECT CONDITIONS:

Perform installation of flowable fill only when approved by the COR, and when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

PART 2 - PRODUCTS

2.1 MATERIALS:

Provide flowable fill containing, at a minimum, cementitious materials, sand and water. Cementitious materials shall be portland cement, pozzolanic materials, or other self-cementing materials, or combinations thereof, at the contractor's option, and following approval by the COR. The flowable fill mix design may also contain, fine aggregate or filler, and/or chemical admixtures in any proportions such that the final product meets the strength, flow consistency and shrinkage requirements included in this specification, as approved by the COR.

- A. Portland Cement: ASTM C150, Type 1 or Type 2. Meeting South Dakota State DOT standards.
- B. Mixing Water: Fresh, clean, and potable. Meeting THE South Dakota State Department of Transportation Standards for use as mix-water for cast-in-place concrete.
- C. Air-Entraining Admixture: ASTM C260.
- D. Chemical Admixtures: ASTM C494.
- E. Aggregate: ASTM C33.

2.2 FLOWABLE FILL MIXTURE:

- A. Mix design shall produce a consistency that will result in a flowable product at the time of placement which does not require manual means to move it into place.
- B. Flowable fill shall have a minimum strength of 200 psi according to ASTM C39 at 28 days after placement.
- C. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8-inch per foot) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for

Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

- D. Flowable fill shall have a unit weight of 115 - 145 lbs/feet³ measured at the point of placement after a 60 minute ready-mix truck ride. In the absence of strength data the cementitious content shall be a maximum of 90 kg/m³ (150 lbs/cy).
- E. Flowable fill shall have an in-place yield of a maximum of 110% of design yield for removable types at 1 year.
- F. Provide equipment as recommended by the Manufacturer and comply with manufacturer's recommendations for the addition of additives, whether at the production plant or prior to placement at the site.

PART 3 - EXECUTION

3.1 EXAMINATION:

Examine conditions of substrates and other conditions under which work is to be performed and notify COR, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 APPLICATION OF FLOWABLE FILL:

Secure tanks, pipes and other members to be encased in flowable fill. Ensure that there are no exposed metallic pipes, conduits, or other items that will be in contact with the flowable fill after placement. If so, replace with non-metallic materials or apply manufacturers recommended coating to protect metallic objects before placing the flowable fill. Replacement or protection of metallic objects is subject to the approval of the COR.

3.3 PROTECTION AND CURING:

Protect exposed surfaces of flowable fill from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by COR.

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SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.2 RELATED WORK

- A. Laboratory and field testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Paragraph 3.3 and Section 31 20 11, EARTH MOVING (short form).

1.3 INSPECTION OF PLANT AND EQUIPMENT

- A. The COR shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

1.4 ALIGNMENT AND GRADE CONTROL

- A. The Contractor's Registered Professional Land Surveyor shall establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Data and Test Reports:
 - 1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear.
 - 2. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear.
 - 3. Job-mix formula.
- C. Certifications:
 - 1. Asphalt tack coat material certificate of conformance to State of South Dakota Department of Transportation Standards.
 - 2. Asphalt cement certificate of conformance to State of South Dakota Department of Transportation Standards requirements.

- 3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the State of South Dakota Department of Transportation Standards.
- D. One copy of the current State of South Dakota Department of Transportation "Standard Specifications for Roads and Bridge Design".
- E. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with State of South Dakota Department of Transportation standards, except as stated in the project specifications.
- B. Mixing Plant: Conform to State of South Dakota Department of Transportation standards.
- C. Obtain materials from same source throughout.
- D. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Aggregate base, asphaltic base, and asphalt concrete materials shall conform to the requirements of the sections of the latest version of the South Dakota Department of Transportation Standard Specifications, including amendments, addenda and errata. Where the term "Engineer" is referenced in the South Dakota Department of Transportation Standard Specifications, it shall mean the VA COR or VA Contracting Officer.

2.2 AGGREGATE BASE COURSE

- A. Aggregate Base Course - Under asphalt, sidewalk and curb and/or gutter shall be crushed limestone that meets all of the requirements of Limestone Ledge Rock Base Course as specified in the South Dakota Department of Transportation's Standard Specifications for Road and Bridge Design.

2.3 ASPHALT

- A. Asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the State of South Dakota Department of Transportation Standards, including amendments, addenda and errata.
- B. Asphalt Cement: ASTM D946 and ASTM D3381, in accordance with State of South Dakota Department of Transportation standards.
- C. Aggregate for Binder Course Mix: In accordance with State of South Dakota Department of Transportation standards.
- D. Aggregate for Wearing Course Mix: In accordance with State of South Dakota Department of Transportation standards.

- E. Fine Aggregate: In accordance with State of South Dakota Department of Transportation standards.
- F. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
- G. Tack Coat: Homogeneous, medium curing, liquid asphalt. In accordance with the State of South Dakota Department of Transportation Standards.
- H. Oil: In accordance with the State of South Dakota Department of Transportation Standards.
- I. Asphalt Paving Mix:
 - 1. Use dry material to avoid foaming. Mix uniformly.
 - 2. The asphalt paving mix Class G, Type I shall be in accordance with the State of South Dakota Department of Transportation Standards.
 - 3. Mix Temperature: In accordance with the State of South Dakota Department of Transportation Standards.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the State of South Dakota Department of Transportation Standards for the type of material specified.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

- A. Provide hot plant-mixed asphaltic concrete paving materials.
 - 1. Temperature leaving the plant: 290 degrees F minimum, 320 degrees F maximum.
 - 2. Temperature at time of placing: 280 degrees F minimum.

3.3 SUBGRADE

- A. Shape to line and grade and compact with self-propelled rollers.
- B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.
- C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.
- D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.
- E. Proof-roll the subgrade with maximum 50 ton gross weight dump truck as directed by VA COR or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

3.4 BASE COURSES

- A. Base (Aggregate Base Course):

1. Spread and compact to the thickness shown on the drawings.
 2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
 3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.
- B. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0-inch to plus 0.5-inch.
- C. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 3/16-inch in ten feet.
- D. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.5 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with the State of South Dakota Department of Transportation Standards.
- B. Apply tack coat to contact surfaces of curbs, gutters and catch basins.

3.6 PLACEMENT OF ASPHALTIC CONCRETE PAVING

- A. Remove all loose materials from the compacted base.
- B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.
- C. Receipt of asphaltic concrete materials:
1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees F.
 2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50 degrees F, not during fog, rain, or other unsuitable conditions.
- D. Spreading:
1. Spread material in a manner that requires the least handling.
 2. Where thickness of finished paving will be 3 inches or less, spread in one layer.

E. Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
 - a. No depressions which will retain standing water.
 - b. No deviation greater than 3mm in 1/8-inch in six feet.

3.7 PROTECTION

- A. Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

3.8 FINAL CLEAN-UP

- A. Remove all debris, rubbish, and excess material from the work area.

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**SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:
- B. Curb and valley gutter.
- C. Pedestrian Pavement: Walks.

1.2 RELATED WORK

- A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Subgrade Preparation: Section 31 20 11, EARTH MOVING (short form).

1.3 DESIGN REQUIREMENTS

- A. All work covered by this section shall be in accordance with the latest published version of the State of South Dakota Department of Transportation Specifications for Road and Bridge Design.

1.4 WEATHER LIMITATIONS

- A. Placement of concrete shall be as specified under Article 3.8, COLD WEATHER and Article 3.7, HOT WEATHER of Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
- B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.
 - 1. Expansion joint filler
 - 2. Hot poured sealing compound
 - 3. Reinforcement
 - 4. Curing materials
- C. Data and Test Reports: Select base material (aggregate base course).
 - 1. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.
- B. American Association of State Highway and Transportation Officials (AASHTO):

- M031MM031-07-UL.....Deformed and Plain Carbon-Steel Bars for
Concrete Reinforcement (ASTM A615/A615M-09)
- M147-65-UL.....Materials for Aggregate and Soil-Aggregate
Subbase, Base and Surface Courses (R 2004)
- M148-05-UL.....Liquid Membrane-Forming Compounds for Curing
Concrete (ASTM C309)
- M171-05-UL.....Sheet Materials for Curing Concrete (ASTM C171)
- M182-05-UL.....Burlap Cloth Made from Jute or Kenaf and Cotton
Mats
- M213-01-UL.....Preformed Expansion Joint Fillers for Concrete
Paving and Structural Construction
(Non-extruding and Resilient Bituminous Type)
(ASTM D1751)
- T180-09-UL.....Moisture-Density Relations of Soils Using a 10
lb. Rammer and a 18 in. Drop
- C. American Society for Testing and Materials (ASTM):
- C94/C94M-09.....Ready-Mixed Concrete
- C143/C143M-09.....Slump of Hydraulic Cement Concrete

PART 2 - PRODUCTS

2.1 GENERAL

- A. Concrete shall be South Dakota Department of Transportation Class M.

2.2 REINFORCEMENT

- A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.
- B. Tie bars shall be deformed steel bars conforming to AASHTO M31.

2.3 FORMS

- A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.
- B. Do not use forms if they vary from a straight line more than 1/8-inch in any ten foot long section, in either a horizontal or vertical direction.
- C. Wood forms should be at least 2 inches thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

2.4 CONCRETE CURING MATERIALS

- A. Concrete curing materials shall conform to one of the following:
1. Burlap conforming to AASHTO M182 having a weight of seven ounces or more per square yard when dry.
 2. Impervious Sheeting conforming to AASHTO M171.

3. Liquid Membrane Curing Compound conforming to AASHTO M148 ASTM C309, Type 2 and shall be free of paraffin or petroleum.

2.5 EXPANSION JOINT FILLERS

- A. Material shall conform to AASHTO M213.

2.6 AGGREGATE BASE COURSE

- A. See Section 32 12 16 ASPHALT PAVING.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

- A. Prepare, construct, and finish the subgrade as specified in Section 31 20 11, EARTH MOVING (short form).
- B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 BASE (AGGREGATE BASE COURSE)

- A. Placing:
 1. Place the material on the prepared subgrade in a uniform layer to the required contour and grades, and to a loose depth not to exceed 6 inches, and that when compacted, will produce a layer of the designated thickness.
 2. When the designated compacted thickness exceeds 6 inches, place the material in layers of equal thickness. Remove unsatisfactory areas and replace with satisfactory mixture, or mix the material in the area.
 3. In no case will the addition of thin layers of material be added to the top layer in order to meet grade.
 4. If the elevation of the top layer is 1/2-inch or more below the grade, excavate the top layer and replace with new material to a depth of at least 3 inches in compacted thickness.
- B. Compaction:
 1. Perform compaction with approved equipment (hand or mechanical) well suited to the material being compacted.
 2. Moisten or aerate the material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.
 3. Compact each layer to at least 95 percent of maximum dry density as determined by ASTM D 698.
- C. Smoothness Test and Thickness Control:

Test the completed base for grade and cross section with a straight edge.

1. The surface of each layer shall not show any deviations in excess of 3/8-inch.
2. The completed thickness shall be within 1/2-inch of the thickness as shown.

D. Protection:

1. Maintain the finished base in a smooth and compacted condition until the concrete has been placed.
2. When Contractor's subsequent operations or adverse weather disturbs the approved compacted base, excavate, and reconstruct it with new material meeting the requirements herein specified, at no additional cost to the VA.

3.3 SETTING FORMS

A. Base Support:

1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.

B. Form Setting:

1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
3. Forms shall conform to line and grade with an allowable tolerance of 1/8-inch when checked with a straightedge and shall not deviate from true line by more than 1/4-inch at any point.
4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
5. Clean and oil forms each time they are used.

C. The Contractor's Registered Professional Land Surveyor, specified in Section 00 72 00, GENERAL CONDITIONS, shall establish and control the alignment and the grade elevations of the forms or concrete slipforming machine operations.

1. Make necessary corrections to forms immediately before placing concrete.
2. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.

3.4 EQUIPMENT

- A. The COR shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.
- B. Maintain equipment and tools in satisfactory working condition at all times.

3.5 PLACING REINFORCEMENT

- A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.
- B. Before the concrete is placed, the COR shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

3.6 PLACING CONCRETE - GENERAL

- A. Obtain approval of the COR before placing concrete.
- B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the COR before placing concrete.
- C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.
- D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.
- E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.
- F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.
- G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

3.7 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

- A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
- B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.

- C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.
- D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
- E. Finish the surface to grade with a wood or metal float.
- F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

3.8 PLACING CONCRETE FOR VEHICULAR PAVEMENT

- A. Deposit concrete into the forms as close as possible to its final position.
- B. Place concrete rapidly and continuously between construction joints.
- C. Strike off concrete and thoroughly consolidate by a finishing machine, vibrating screed, or by hand-finishing.
- D. Finish the surface to the elevation and crown as shown.
- E. Deposit concrete as near the joints as possible without disturbing them but do not dump onto a joint assembly. Do not place adjacent lanes without approval by the COR.

3.9 CONCRETE FINISHING - GENERAL

- A. The sequence of operations, unless otherwise indicated, shall be as follows:
 - 1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
 - 2. Maintain finishing equipment and tools in a clean and approved condition.

3.10 CONCRETE FINISHING CURB AND VALLEY GUTTER

- A. Round the edges of the gutter and top of the curb with an edging tool to a radius of 1/4-inch or as otherwise detailed.
- B. Float the surfaces and finish with a smooth wood or metal float until true to grade and section and uniform in textures.
- C. Finish the surfaces, while still wet, with a bristle type brush with longitudinal strokes.
- D. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the surface, while still wet, in the same manner as the gutter and curb top.
- E. Except at grade changes or curves, finished surfaces shall not vary more than 1/8-inch for gutter and 1/4-inch for top and face of curb, when tested with a 10 foot straightedge.
- F. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

- G. Correct any depressions which will not drain.
- H. Visible surfaces and edges of finished curb and valley gutter shall be free of blemishes, form marks, and tool marks, and shall be uniform in color, shape, and appearance.

3.11 CONCRETE FINISHING PEDESTRIAN PAVEMENT

- A. Walks and Wheelchair Curb Ramps:
 - 1. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.
 - 2. Brooming shall be transverse to the line of traffic.
 - 3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
 - 4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 1/16-inch in depth.
 - 5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 3/16-inch when tested with a 10 foot straightedge.
 - 6. The thickness of the pavement shall not vary more than 1/4-inch.
 - 7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

3.12 CONCRETE FINISHING FOR VEHICULAR PAVEMENT

- A. Accomplish longitudinal floating with a longitudinal float not less than 10 feet long and 6 inches wide, properly stiffened to prevent flexing and warping. Operate the float from foot bridges in a sawing motion parallel to the direction in which the pavement is being laid from one side of the pavement to the other, and advancing not more than half the length of the float.
- B. After the longitudinal floating is completed, but while the concrete is still plastic, eliminate minor irregularities in the pavement surfaces by means of metal floats, 5 feet in length, and straightedges, 10 feet in length. Make the final finish with the straightedges, which shall be used to float the entire pavement surface.
- C. Test the surface for trueness with a 10 foot straightedge held in successive positions parallel and at right angles to the direction in which the pavement is being laid and the entire area covered as necessary to detect variations. Advance the straightedge along the pavement in successive stages of not more than one half the length of the straightedge. Correct all irregularities and refinish the surface.

- D. The finished surface of the pavement shall not vary more than 1/4-inch in both longitudinal and transverse directions when tested with a 10 foot straightedge.
- E. The thickness of the pavement shall not vary more than 1/4-inch.
- F. When most of the water glaze or sheen has disappeared and before the concrete becomes nonplastic, give the surface of the pavement a broomed finish with an approved fiber broom not less than 18 inches wide. Pull the broom gently over the surface of the pavement from edge to edge. Brooming shall be transverse to the line of traffic and so executed that the corrugations thus produced will be uniform in character and width, and not more than 1/8-inch in depth. Carefully finish the edge of the pavement along forms and at the joints with an edging tool. The brooming shall eliminate the flat surface left by the surface face of the edger.
- G. The finish surfaces of new and existing abutting pavements shall coincide at their juncture.

3.13 CONCRETE FINISHING EQUIPMENT PADS

- A. After the surface has been struck off and screeded to the proper elevation, give it a smooth dense float finish, free from depressions or irregularities.
- B. Carefully finish all slab edges with an edger having a radius of 1/4-inch or as shown in the Drawings.
- C. After removing the forms, rub the faces of the pad with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The finish surface of the pad shall not vary more than 1/8-inch when tested with a 10 foot straightedge.
- D. Correct irregularities exceeding the above.

3.14 JOINTS - GENERAL

- A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.
- B. Joints shall be straight and continuous from edge to edge of the pavement.

3.15 CONTRACTION JOINTS

- A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.
- B. Construct joints in curbs and valley gutters by inserting 1/8-inch steel plates conforming to the cross sections of the curb and gutter or saw cutting as shown in the drawings.
- C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.

- D. Finish edges of all joints with an edging tool having the radius as shown.
- E. Score pedestrian pavement with a standard grooving tool or jointer.

3.16 EXPANSION JOINTS

- A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.
- B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.
- C. Anchor with approved devices to prevent displacing during placing and finishing operations.
- D. Round the edges of joints with an edging tool.
- E. Form expansion joints as follows:
 - 1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.
 - 2. Using joint filler of the type, thickness, and width as shown.
 - 3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

3.17 CONSTRUCTION JOINTS

- A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown.
- B. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.
- C. Use a butt-type joint with dowels in curb and valley gutter if the joint occurs at the location of a planned joint.

3.18 FORM REMOVAL

- A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.
- B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

3.19 CURING OF CONCRETE

- A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing

period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the COR.

- B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 6 inches.
- C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at least 4 mils in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 12 inches. Securely anchor sheeting.
- D. Liquid Membrane Curing:
 1. Apply pigmented membrane-forming curing compound in two coats at right angles to each other at a rate of 200 square feet per gallon for both coats.
 2. Do not allow the concrete to dry before the application of the membrane.
 3. Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.
 4. Immediately re-spray any area covered with curing compound and damaged during the curing period.

3.20 CLEANING

- A. After completion of the curing period:
 1. Remove the curing material (other than liquid membrane).
 2. Sweep the concrete clean.
 3. After removal of all foreign matter from the joints, seal joints as herein specified.
 4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

3.21 PROTECTION

- A. The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the COR, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the COR.

3.22 FINAL CLEAN-UP

- A. Remove all debris, rubbish and excess material from the Station.

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**SECTION 32 90 00
PLANTING**

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this section consists of furnishing and installing plant, soils, edging turf, grasses and landscape materials required as specified in locations shown.

1.2 RELATED WORK

- A. Topsoil Testing: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Stripping Topsoil, Stock Piling and Topsoil Materials: Section 31 20 00, EARTH MOVING.

1.3 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- E. Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, turf and grasses, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
- F. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Notify the Contracting Officer's Representative of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant and landscape materials from the job site immediately.
- B. Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable. Keep seed and other packaged materials in dry storage away from contaminants.
- C. Bulk Materials:
 - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants. Keep bulk materials in dry storage away from contaminants.
 - 2. Provide erosion control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 - 3. Accompany each delivery of bulk fertilizers with appropriate certificates.
- D. The use of equipment such as "tree spades" is permitted provided the plant balls are sized in accordance with ANSI Z60.1 and tops are protected from damage.
- E. Harvest, deliver, store, and handle sod according to requirements in TPI's "Guideline Specifications to Turfgrass Sodding". Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage, seed contamination and drying.
- F. All pesticides and herbicides shall be properly labeled and registered with the U.S. Department of Agriculture. Deliver materials in original, unopened containers showing, certified analysis, name and address of manufacturer, product label, manufacturer's application instructions specific to the project and indication of conformance with state and federal laws, as applicable.

1.5 PROJECT CONDITIONS

- A. Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

- B. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion. Plant during one of the following periods:
1. Spring Planting: April 1 - May 30.
 2. Fall Planting: September 1 - October 15.
- C. Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.
- D. Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.
- E. Plant trees, shrubs, and other plants after finish grades and irrigation system components are established but not before irrigation system components are installed, tested and approved.
1. When planting trees, shrubs, and other plants, protect irrigation system components and promptly repair damage caused by planting operations.

1.6 QUALITY ASSURANCE:

- A. Products Criteria:
1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
1. Certified Landscape Technician (CLT) - Exterior, with installation, maintenance, irrigation and specialty area(s) designated CLT-Exterior.
 - a. Certified Landscape Technician (CLT) - Interior, designated CLT-Interior.

b. Certified Ornamental Landscape Professional, designated COLP.

2. Pesticide Applicator: Licensed in state of project, commercial.

1.7 SUBMITTALS

A. Submit product data for each type of product indicated, including soils:

1. Include quantities, sizes, quality, and sources for plant materials.

B. Prior to delivery, provide notarized certificates attesting that each type of manufactured product, from the manufacturer, meet the requirements specified and shall be submitted to the Contracting Officer's Representative for approval.

1. Seed and Turf Materials notarized certificate of product analysis.

2. Manufacturer's certified analysis of standard products.

1.8 PLANT AND TURF ESTABLISHMENT PERIOD

A. The establishment period for plants and turf shall begin immediately after installation, with the approval of the Contracting Officer's Representative, and continue until the date that the Government accepts the project or phase for beneficial use and occupancy. During the Establishment Period the Contractor shall maintain the plants and turf as required in Part 3.

1.9 PLANT AND TURF MAINTENANCE SERVICE

A. Provide initial maintenance service for trees, shrubs, ground cover and other plants by skilled employees of landscape Installer. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below.

1. Maintenance Period: Substantial Completion Insert starting time.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below, form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. American National Standards Institute (ANSI):

Z60.1-04.....Nursery Stock

C. Association of Official Seed Analysts (AOSA): Rules for Testing Seed.

D. American Society For Testing And Materials (ASTM):

D977-05.....Emulsified Asphalt (AASHTO M140)

E. Hortus Third: A Concise Dictionary of Plants Cultivated in the United States and Canada.

F. Turfgrass Producers International (TPI): Guideline Specifications to Turfgrass Sodding.

- G. United States Department of Agriculture (USDA): Handbook No. 60
Diagnosis and Improvement of Saline and Alkali Soils; Federal Seed Act
Regulations.
- H. National Cemetery Administration (NCA):
Handbook 3420-08.....Turfgrass Maintenance
Appendix TL-08.....Cemetery Construction Requirements for
Turfgrass and Landscape Plant Material
Installation

1.11 WARRANTY

- A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance, unless noted otherwise below. Further, the Contractor will provide all manufacturer's and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.
1. Plant and Turf Warranty Periods will begin from the date of Substantial Completion of the project or phase for beneficial use and occupancy.
 - a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
 - b. Ground Covers, Biennials, Perennials, Turf, and Other Plants: 12 months.
 2. The Contractor shall have completed, located, and installed all plants and turf according to the plans and specifications. All plants and turf are expected to be living and in a healthy condition at the time of final inspection.
 3. The Contractor will replace any dead plant material and any areas void of turf immediately, unless required to plant in the succeeding planting season. Provide extended warranty for period equal to original warranty period for replacement plant materials. Replacement plant and turf warranty will begin on the day the work is completed.
 4. Replacement of relocated plants, that the Contractor did not supply, is not required unless plant failure is due to improper handling and care during transplanting. Loss through Contractor negligence requires replacement in plant type and size.
 5. The Government will reinspect all plants and turf at the end of the Warranty Period. The Contractor will replace any dead, missing, or defective plant material and turf immediately. The Warranty Period will end on the date of this inspection provided the Contractor has

complied with the warranty work required by this specification. The Contractor shall also comply with the following requirements:

- a. Complete remedial measures directed by the Contracting Officer's Representative to ensure plant and turf survival.
 - b. Repair damage caused while making plant or turf replacements.
- B. Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
- 1. Failures include, but are not limited to, the following:
 - a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

- A. Turf materials: ANSI Z60.1; will conform to the varieties specified and be true to botanical name as listed in Hortus Third; nursery-grown turf material true to genus, species, variety, and cultivar, free of disease, pests, eggs, larvae, and defects such as sun scald, windburn, injuries, abrasions, and disfigurement.

2.2 TURF FERTILIZERS

- A. Fertilizer: 18-46-0 delivered to site in unopened containers that clearly display the manufacturer's warranted statement of analysis. Granular fertilizer shall be added per recommendations in soil laboratory testing results.

2.3 PLANTING SOILS

- A. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process and stockpiled on-site. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
 - 1. Supplement with another specified planting soil when quantities are insufficient.
- B. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources can be used if sufficient topsoil is not available on site to meet the depth as specified herein. The Contractor shall furnish

imported topsoil. At least 10 days prior to topsoil delivery, notify the Contracting Officer's Representative of the source(s) from which topsoil is to be furnished. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from bogs, or marshes.

2.4 MULCH

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Salt hay or threshed straw.

a. Straw for lawn seed bed mulch: Stalks from oats, wheat, rye, barley, or rice that are free from noxious weeds, mold or other objectionable material. Straw shall be in an air dry condition and suitable for placing with blower equipment.

2.5 TACKIFIERS AND ADHESIVES

A. Asphalt emulsion: ASTM D977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.6 EROSION CONTROL

A. See plans for requirements.

2.7 WATER

A. Water shall not contain elements toxic to plant life. Water may be obtained on the VA Medical campus at no cost to the Contractor. Contact the COR for location.

2.8 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with "AOSA, Rules for Testing Seed" for purity and germination tolerances. Seed shall be labeled in conformance with U. S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will not be acceptable. Onsite seed mixing shall be done only in the presence of the COR.

B. Seed Species: Not less than 85 percent germination, not less than 85 percent pure seed, and not more than 2 percent weed seed.

1. Full Sun: A minimum of 3 cultivars.

2. Non-irrigated Seed Mix: Proportioned by weight as follows:

(Common Name)	Percent by Weight
Crested Wheatgrass	40%
Perennial Ryegrass	30%
Hard Fescue	20%
Annual Ryegrass	10%

2.9 SOD

- A. Sod: Approved, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding".
Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Sod Species: Grass species as follows, with a minimum of 3 cultivars.
 - 1. Proportioned by weight as follows:
 - a. Kentucky Bluegrass (Poa Pratensis) 100% (3 cultivars).

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
 - 5. Special conditions may exist that warrant a variance in the specified planting dates or conditions. Submit a written request to the Contracting Officer's Representative stating the special conditions and proposal variance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Contracting Officer's Representative and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

- B. Install 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.

3.3 MECHANIZED TREE SPADE PLANTING

- A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.
- B. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.
- C. Cut exposed roots cleanly during transplanting operations.
- D. Use the same tree spade to excavate the planting hole as was used to extract and transport the tree.
- E. Where possible, orient the tree in the same direction as in its original location.

3.4 TREE WRAP

- A. Wrap the trunks of deciduous trees immediately after planting. Wrap the trunks of deciduous trees, 1-1/2 inches or greater in caliber with the specified material beginning at the base and extending to the first branches. Remove wrapping after one year. When using crinkled paper wrap, securely tie wrapping at the top and bottom and at 18 inch maximum intervals with twine.

3.5 TURF AREA PREPARATION AND GRADING

- A. For newly graded subgrades loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 1. Apply fertilizer directly to subgrade before loosening, at rates recommended by the soils analysis.
 2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
 3. Spread planting soil to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

- a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
 - b. Reduce elevation of planting soil to allow for soil thickness of sod.
- B. Finish grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

3.6 SEEDING

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
 - 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 2 lb/1000 sq. ft.
- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
 - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
 - 2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.
- E. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch or planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.7 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
1. Lay sod across angle of slopes exceeding 1:3.
 2. Anchor sod on slopes exceeding 1:6 with biodegradable staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently until sod is established.

3.8 TURF RENOVATION

- A. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.
1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
 2. Install new planting soil as required.
- B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.
- C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.
- D. Mow, dethatch, core aerate, and rake existing turf.
- E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.
- G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.
- H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.
- I. Apply seed and protect with straw mulch or sod as required for new turf.
- J. Water newly planted areas and keep moist until new turf is established.

3.9 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use IPM (Integrated Pest Management) practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow 2 to 3 inches.

3.10 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Contracting Officer's Representative:
1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and

surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

3.11 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Contracting Officer's Representative before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Non-Selective): Applied to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Non-Selective): Applied only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.12 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- D. Erect temporary fencing or barricades and warning signs, as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- E. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

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SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies construction of outside, underground storm sewer systems. The storm sewer systems shall be complete and ready for operation, including all drainage structures, frames, grate and covers, connections to new buildings, structure service lines, existing storm sewer lines and existing drainage structures and all required incidentals.

1.2 RELATED WORK:

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 11, EARTH MOVING (short form).
- C. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 53, MISCELLANEOUS CAST-IN-PLACE CONCRETE.

1.3 QUALITY ASSURANCE:

- A. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
 - 2. Nameplates: Nameplate bearing manufacturer's name, or identifiable trademark, securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- B. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to public storm sewer lines and the extension, and/or modifications to Public Utility systems including the Wyoming Department of Environmental Quality (WYDEQ).

1.4 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data: Submit the following as one package:
 - 1. Piping.
 - 2. Jointing material (fittings).
 - 3. Manhole, inlet and catch basin material.
 - 4. Frames and covers.
 - 5. Steps.
 - 6. Resilient connectors and downspout boots.

7. Grout.

1.5 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
- A536-84(2004).....Ductile Iron Castings
- A615-05/A615M-05.....Deformed and Plain-Billet Steel Bars for
Concrete Reinforcement
- C150-04ae1.....Portland Cement
- C443-05/C443M-05.....Joints for Concrete Pipe and Manholes, Using
Rubber Gaskets
- C478-03a/C478M-03a.....Precast Reinforced Concrete Manhole Sections
- C923-02/C923M-02.....Resilient Connectors between Reinforced Concrete
Manhole Structures, Pipes and Materials
- D698-00ae1.....Laboratory Compaction Characteristics of Soil
Using Standard Effort (12,400 ft-lbf/ft³ (600
kN-m/m³))
- D1056-00.....Flexible Cellular Materials-Sponge or Expanded
Rubber
- D3212-96a(2003)e1.....Joints for Drain and Sewer Plastic Pipes Using
Flexible Elastomeric Seals
- D3350-04.....Polyethylene Plastics Pipe and Fittings
Materials
- F477-02e1.....Elastomeric Seals (Gaskets) for Joining Plastic
Pipe
- F714-05.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based on
Outside Diameter
- F894-98a.....Polyethylene (PE) Large Diameter Profile Wall
Sewer and Drain Pipe
- NOTE: ASTM test methods shall be the current version as of the date of advertisement of the project.
- C. American Association of State Highway and Transportation Officials (AASHTO):
- M294-04.....Corrugated Polyethylene Pipe, 300-1500 mm (12 to
60 inches) Diameter

PART 2 - PRODUCTS

2.1 PIPING:

- A. Gravity Lines (Pipe and Appurtenances):
1. High Density Polyethylene (HDPE):

- a. Corrugated PE Plastic Pipe: Shall have a smooth interior and annular exterior corrugations.
- 1) Shall comply with AASHTO M252, Type S for pipes 100 to 250 mm (4 to 10 inches). Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 424420C.
 - 2) Shall comply with AASHTO M294, Type S for pipes 300 to 1500 mm (12 to 60 inches). Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 435400C.

2.2 JOINTING MATERIAL:

A. PE Plastic Pipe:

1. Corrugated PE Plastic Pipe: Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F477. Water tight joints shall conform to requirements in AASHTO M252, AASHTO M294 or ASTM F2306 and shall be watertight according to ASTM D 3212.

2.3 MANHOLES, JUNCTION BOXES AND CURB INLETS:

A. Manholes, junction boxes and curb inlets shall be constructed of precast reinforced sections or cast-in-place concrete. Inlets shall be in accordance with the State of South Dakota Department of Transportation Standard and specifications, and the following VA requirements. In case of variance, VA requirements supersede.

1. Precast Reinforced Concrete Rings: Rings or sections shall have an inside diameter as indicated on the drawings, and shall be not less than 48 inches in diameter. Wall thickness shall conform to requirements of ASTM C76, except that lengths of the sections may be shorter as conditions require. Tops shall conform to ASTM C478. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
2. Precast Reinforced Concrete Manhole Risers and Tops: Design, material and installation shall conform to requirements of ASTM C478. Top sections shall be eccentric. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
3. Flat top manhole tops shall be reinforced concrete as detailed on the drawings.
4. Precast Catch Basins: Concrete for precast sections shall have a minimum compressive strength of 4,000 psi at 28 days, ASTM A615, Grade 60 reinforcing steel, rated for AASHTO HS20-44 loading with 30 percent impact, and conform to ASTM C-857.

5. Mortar:
 - a. Precast Reinforced Concrete Ring and Riser Structures: By volume, 1 part of Portland cement and 2 parts sand. Water in mixture shall produce a stiff, workable mortar, but shall not exceed 5-1/2 gallons per sack of cement.
6. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet AASHTO M-198B.
7. Frames and covers shall be gray cast iron conforming to ASTM A48. The frame and cover shall be rated for HS20-44 loading, have a studded pattern on the cover. The studs and the lettering shall be raised 5/16-inch. The cover shall be a minimum of 24 inches in diameter and shall have four 3/4-inch vent holes and two lifting slots. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.
8. Frame and Cover for Gratings: Frame and cover for gratings shall be cast gray iron conforming to ASTM A48. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the drawings.
9. Manhole steps shall be polypropylene plastic coated on a No. 4 deformed rebar conforming to ASTM C478. Polypropylene shall conform to ASTM D4101. Steps shall be a minimum of 10 inches wide and project a minimum of 5 inches away from the wall. The top surface of the step shall have a studded non-slip surface. Steps shall be placed at 12-inch centers.

2.4 CONCRETE:

Concrete shall be in accordance with South Dakota Department of Transportation Standards specifications. For concrete not specified in above standards, concrete shall have a minimum compressive strength of 4000 psi at 28 days. The cement shall be Type III conforming to ASTM C150. Concrete shall conform to the provisions of Section 03 of these specifications.

2.5 REINFORCING STEEL:

Reinforcing steel shall be deformed bars, ASTM A615, Grade 40 unless otherwise noted.

2.6 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS:

- A. Resilient Connectors: Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923.
- B. Downspout Adapters: See Section 077723.13.

2.7 WARNING TAPE:

Standard, 4-Mil polyethylene 76 mm (3-inch) wide tape detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

PART 3 - EXECUTION**3.1 EXCAVATION FOR STORM DRAINS AND DRAINAGE STRUCTURES:**

Excavation of trenches and for appurtenances and backfilling for storm drains, shall be in accordance with the applicable portions of Section 31 20 11, EARTH MOVING (short form).

3.2 PIPE BEDDING:

The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. High Density Polyethylene (HDPE) pipe bedding requirements shall be Type 1 Bedding Material or sand, see plans.

3.3 GENERAL PIPING INSTALLATION:

- A. Lay pipes true to line and grade. Gravity flow sewer shall be laid with bells facing upgrade.
- B. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
- E. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not lay sewer pipe in same trench with another pipe or other utility.
- H. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches over the crown of the pipe.

- I. Install gravity sewer line in accordance with the provisions of these specifications and the following standards:
 - 1. High Density Polyethylene (HDPE) Piping: Comply with ASTM D 2321 and manufacturer's recommendations with gasketed joints
- J. Warning tape shall be continuously placed 12 inches above storm sewer piping.

3.4 REGRADING:

- A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.
- B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.
- C. The Contractor shall comply with all OSHA confined space requirements when working within existing structures.

3.5 CONNECTIONS TO EXISTING VA-OWNED MANHOLES:

Make pipe connections and alterations to existing manholes so that finished work will conform as nearly as practicable to the applicable requirements specified for new manholes, including concrete and masonry work, cutting, and shaping. See details on the drawings.

3.6 MANHOLES, INLETS AND CATCH BASINS:

- A. General:
 - 1. Circular Structures:
 - a. Precast reinforced concrete rings shall be installed true and plumb. The joints between rings and between rings and the base and top shall be sealed with a preform flexible gasket material specifically manufactured for this type of application.
 - b. Precast reinforced concrete manhole risers and tops. Install as specified for precast reinforced concrete rings.
 - 2. Rectangular Structures:
 - a. Reinforced concrete structures shall be installed in accordance with Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE of these specifications.
 - b. Precast concrete structures shall be placed on an 8-inch reinforced concrete pad, or be provided with a precast concrete

base section. Structures provided with a base section shall be set on 4-inch thick aggregate base course compacted to a minimum of 95 percent of the maximum density as determined by ASTM D 698. Set precast section true and plumb. Seal all joints with preform flexible gasket material.

3. Do not build structures when air temperature is 0 degrees C (32 degrees F), or below.
4. Invert channels shall be smooth and level.
5. Install manhole frames and covers on a mortar bed, and flush with the finish pavement. Frames and covers shall not move when subject to vehicular traffic. Install a concrete collar around the frame to protect the frame from moving until the adjacent pavement is placed. In unpaved areas, the rim elevation shall be 50 mm (2 inches) above the adjacent finish grade. Install a 200 mm (8 inches) thick, by 300 mm (12 inches) concrete collar around the perimeter of the frame. Slope the top of the collar away from the frame.

3.7 CURB INLETS, CATCH BASINS, AND AREA DRAINS:

Reinforced concrete as shown, or precast concrete.

3.8 INSPECTION OF SEWERS:

Inspect and obtain the COR's approval. Thoroughly flush out before inspection. Lamp between structures and show full bore indicating sewer is true to line and grade. Lip at joints on inside of sewer is prohibited.

3.9 TESTING OF STORM SEWERS:

- A. Gravity Sewers (Select one of the following):
 1. Air Test: Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, corrugated HDPE conform to ASTM F2487. All other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.

2. Exfiltration Test:

- a. Subject pipe to hydrostatic pressure produced by head of water at depth of 900 mm (3 feet) above invert of sewer at upper manhole under test. In areas where ground water exists, head of water shall be 900 mm (3 feet) above existing water table. Maintain head of water for one hour for full absorption by pipe body before testing. During 1 hour test period, measured maximum allowable rate of exfiltration for any section of sewer shall be 11L (3.0 gallons) per hour per 30 m (100 feet).
- b. If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.

- - - E N D - - -

APPENDIX A

Geotechnical Engineering Report

River Street Hillside Watershed and Stabilization Project

Hot Springs VA Medical Center

Hot Springs, South Dakota

August 29, 2012

Terracon Project No. B4125029



Prepared for:

FourFront Design
Rapid City, South Dakota

Prepared by:

Terracon Consultants, Inc.
Rapid City, South Dakota

Offices Nationwide
Employee-Owned

Established in 1965
terracon.com

Terracon

Geotechnical ■ Environmental ■ Construction Materials ■ Facilities



August 29, 2012

Mr. Shane Matt, PE
FourFront Design, Inc.
517 Seventh Street
Rapid City, South Dakota 57701

**Subject: Geotechnical Engineering Report
River Street Hillside Watershed and Stabilization Project
Hot Springs VA Medical Center
Hot Springs, South Dakota
Terracon Project No. B4125029**

Dear Mr. Matt,

Terracon Consultants, Inc. (Terracon) has completed the geotechnical services for the proposed hillside watershed collection system to be constructed on the hillside above as well as along River Street, at the VA Medical Center, in Hot Springs, South Dakota. This study was performed in general accordance with Terracon's Proposal No. GB412094R1, dated June 25, 2012. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and utilities for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Teresa Serie, EIT
Staff Professional

Walt Feeger, PE
Office Manager

Copies: Client (3)
File (1)



Geotechnical Engineering Report

River Street Hillside Watershed & Stabilization Project ■ Hot Springs, SD
August 29, 2012 ■ Terracon Project No. B4125029



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**GEOTECHNICAL ENGINEERING REPORT
RIVER STREET HILLSIDE WATERSHED 7 STABILIZATION PROJECT
HOT SPRINGS VA MEDICAL CENTER
HOT SPRINGS, SOUTH DAKOTA**

Terracon Project No. B4125029

August 29, 2012

1.0 INTRODUCTION

A geotechnical report has been completed for the proposed watershed collection system on the hillside above River Street, as well as along the east side of the roadway alignment at the Hot Springs VA Medical Center in Hot Springs, South Dakota. Four (4) soil borings, designated B-1 through B-4, were advanced to depths of approximately 10½ feet below existing grades along the top of the hillside as well as along the existing River Street alignment. This report specifically addresses the recommendations for utility placement and backfill recommendations. Logs of the borings along with a boring location diagram are included in Appendix A of this report.

2.0 PROJECT INFORMATION

2.1 Project Description

There is ongoing concern with respect to stability and erosion of the west facing slope along the approximate 1,200 lineal feet of the River Street entrance into the VA Medical Center in Hot Springs. The VA is concerned that falling debris from the hillside will present a significant hazard to vehicles and pedestrians travelling along the roadway. It has been determined through a previous study that a contributing factor to the slope stability issue is due to the existing watershed currently being directed across and down the slope.

A system has been proposed to collect the surface runoff at the top of the hillside and direct it through an underground piping system to the south and then downward along River Street to the storm sewer inlets at the base of the street near the intersection of Main Street.

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	The project site is located at the top of the hillside above River Street as well as along the River Street roadway alignment from the VA Medical Center downward to the intersection with Main Street.

ITEM	DESCRIPTION
Existing improvements	The area is generally comprised of housing and medical/administrative support buildings and infrastructure associated with the VA Medical Center. The area along the proposed watershed collection system is comprised of landscaped areas vegetated with domesticated grasses and trees as well as native grasses and brush.
Existing topography	The overall topography generally slopes downward to the west with an approximate elevation drop of 71 feet noted between borings B-1 and B-2.

3.0 SUBSURFACE CONDITIONS

3.1 Typical Profile

In general, the subsurface soils encountered within the borings consisted of reddish brown, medium stiff clays and reddish brown, loose to medium dense clayey sand to depths of about 2½ to 9 feet below grade. The clay and sand soils are underlain by weathered and competent sandstone/limestone bedrock which extended to the total depths explored in each of the borings.

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report.

3.2 Groundwater

The boreholes were observed while drilling and after completion for the presence and level of groundwater. Measurable groundwater was not encountered during our site exploration. Borings were backfilled with auger cuttings once groundwater measurements were made.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, local irrigation practices, and other factors not evident at the time the borings were performed. Due to the relatively low permeability of the clay soils encountered at the site, a relatively long period of time may be needed for a groundwater level to stabilize in the boring. The presence of groundwater and potential groundwater level fluctuations should be considered when developing the design and construction plans for the project. Evaluation of the factors that affect groundwater fluctuations is beyond the scope of this report.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Utility Trench Excavations and Construction

In general, the excavations into the site soils will mainly encounter fine grained clay and sand soils. However, depending on the depth required for placement of the watershed collection piping system, sandstone/limestone bedrock may be encountered. It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment such as large tracked excavators. Removal of bedrock material will likely require the use of pneumatic hammers or minor blasting to facilitate excavation.

Although groundwater was not encountered during our field work, depending on the time of year construction takes place groundwater or surface runoff accumulation may be encountered within utility excavations. Contractors working on the project should anticipate dewatering the excavations and have equipment on-site that will lower and maintain the groundwater level below the base of the excavations if encountered.

The soil classifications shown on the logs are based solely on the materials encountered in the borings. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered during construction, the actual conditions should be evaluated by the contractor's competent person to determine any excavation modifications necessary to maintain safe conditions.

The individual contractor's competent person should be made responsible for designing and constructing stable, temporary excavations, as required, to maintain stability of both the excavation sides and bottom. Excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards. In our opinion, the soils and weathered bedrock encountered at the site can be classified as Type B with maximum allowable slopes of 1H:1V for excavations less than 20 feet in depth.

Depending on the depths of excavations and subsurface soil and groundwater conditions, the use of temporary shoring and/or trench boxes may be required. As a safety measure, vehicles and stockpiles should be kept away from the excavation crest a distance at least equal to the slope height. Where practical, the exposed slope face should be protected against the elements.

4.2 Earthwork

The excavated site soils, cleaned of all organic/deleterious material, man-made debris, and rock or bedrock fragments greater than 3 inches in nominal size may be stockpiled on-site for re-use as trench backfill above the pipe bedding. If encountered, and to the practical extent possible, we recommend that the gypsum fragments, especially those greater than 3 inches in nominal size, be removed from the backfill material prior to re-use.

Earthwork contractors should anticipate processing and moisture conditioning the site soils prior to use as backfill material. If the amount of excavated on-site material is not sufficient for re-use as utility trench backfill, imported material will be required. The imported backfill material should be approved by the geotechnical engineer prior to use.

Prior to use, the backfill material should be moisture conditioned to within ± 3 percent of optimum as determined by ASTM D698 (standard proctor). Trench backfill should be placed and compacted in horizontal lifts not more than 8 inches thick, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. We recommend the material be compacted to at least 95 percent of the maximum dry density (ASTM D698). Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

Additionally, in areas where the utility trenches cross paved areas, we recommend the pavement subgrade areas be thoroughly proofrolled with a loaded water truck or tandem axle dump truck after final grading and recompaction are complete, and prior to paving.

If disturbance has occurred or unstable subgrade soils are observed, pavement subgrade areas should be reworked, moisture conditioned, or removed and replaced with properly compacted engineered fill to the recommendations in this report prior to paving. All pavement subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to paving. Geotextile material could also be used to help increase subgrade stability and help expedite construction.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during earthwork phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

Geotechnical Engineering Report

River Street Hillside Watershed & Stabilization Project ■ Hot Springs, SD

August 29, 2012 ■ Terracon Project No. B4125029



This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project, as outlined in this report, are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION



FIG No.
1

BORING LOCATION DIAGRAM
 River Steet Watershed & Stabilization
 Hot Springs VA Medical Center
 Hot Springs, South Dakota

Terracon
 Consulting Engineers and Scientists
 2026 Samco Rd., Suite 101 Rapid City, SD 57702
 P (605) 716 2924 F (605) 716 2926

Project No. B4125029
 Scale: nts
 File No. Boring Location Engineering
 Date: August 2012

Project Mgr:	WF
Drawn By:	TS
Checked By:	WF
Approved By:	WF

APPROXIMATE LOCATION OF BORING
 Not a Legal Survey
 All Boring Locations Approximate

LOG OF BORING NO. B- 1

OWNER Department of Veterans Affairs	ENGINEER FourFront Design, Inc.
--	---

SITE Hot Springs VA Medical Center Hot Springs, South Dakota	PROJECT River Street Slope Watershed and Stabilization
--	--

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, ft.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	Approx. Surface Elev.: 3558 ft								
0.3	TOPSOIL/VEGETATIVE LAYER 3557.7								
1	LEAN CLAY with SAND , reddish brown, medium stiff (CL)			1.1	5	9			
2				1.5	7	6			
7	WEATHERED SANDSTONE/LIMESTONE BEDROCK 3551								
3				1.5	33	2			
10.5	End of Boring 3547.5								

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER DEPTH OBSERVATIONS, ft

WD	▼	None 7/26/2012	▼
WD	▼		▼
WD			



BORING STARTED		7-26-12	
BORING COMPLETED		7-26-12	
RIG	CME-55	FOREMAN	BC
LOGGED	TS	JOB #	B4125029

BOREHOLE 99_B4125029.GPJ_TERRACON.GDT 8/29/12

LOG OF BORING NO. B-2

OWNER Department of Veterans Affairs	ENGINEER FourFront Design, Inc.
--	---

SITE Hot Springs VA Medical Center Hot Springs, South Dakota	PROJECT River Street Slope Watershed and Stabilization
--	--

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, ft.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	Approx. Surface Elev.: 3487 ft								
2.5	CLAYEY SAND with GRAVEL , brown/red, medium dense (SC)	3484.5		1	SS	0.5	19	7	
9	LEAN CLAY , reddish brown, very stiff (CL)			2	SS	1.5	19	3	
9	WEATHERED SANDSTONE/LIMESTONE BEDROCK	3478		3	SS	1.5	30	8	
10.5	End of Boring	3476.5							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER DEPTH OBSERVATIONS, ft	
WD	None 7/26/2012
WD	
WD	



BORING STARTED	7-26-12
BORING COMPLETED	7-26-12
RIG	CME-55
FOREMAN	BC
LOGGED	TS
JOB #	B4125029

BOREHOLE 99 B4125029.GPJ TERRACON.GDT 8/29/12

LOG OF BORING NO. B-3

OWNER Department of Veterans Affairs	ENGINEER FourFront Design, Inc.
--	---

SITE Hot Springs VA Medical Center Hot Springs, South Dakota	PROJECT River Street Slope Watershed and Stabilization
--	--

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES			TESTS		
				NUMBER	TYPE	RECOVERY, ft.	SPT - N BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf
	Approx. Surface Elev.: 3553 ft								
0.4	TOPSOIL/VEGETATIVE LAYER	3552.6		1	SS	1.4	6	12	
	LEAN CLAY , reddish brown, medium stiff (CL)								
				2	SS	1.5	6	14	
7	WEATHERED SANDSTONE/LIMESTONE BEDROCK	3546							
				3	SS	1.5	33	4	
10.5	End of Boring	3542.5							

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER DEPTH OBSERVATIONS, ft

WD	▼	None 7/26/2012	▼
WD	▼		▼
WD			



BORING STARTED		7-26-12	
BORING COMPLETED		7-26-12	
RIG	CME-55	FOREMAN	BC
LOGGED	TS	JOB #	B4125029

BOREHOLE 99 B4125029.GPJ TERRACON.GDT 8/29/12

Geotechnical Engineering Report

River Street Hillside Watershed & Stabilization Project ■ Hot Springs, SD
August 29, 2012 ■ Terracon Project No. B4125029



Field Exploration Description

The boring locations were selected by Terracon and FourFront Design, Inc. and staked in the field by Terracon personnel. The approximate boring locations are indicated on the attached Boring Location Diagram. The ground surface elevations indicated on the boring logs was interpolated from topographic maps of the area. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a CME-55 rotary drill rig using solid-stem augers to advance the boreholes. Samples of the soil encountered in the borings were obtained using split spoon (SS) samplers. Bulk samples of the auger cuttings were also obtained from the borings.

In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound C.M.E. auto-hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

A CME automatic SPT hammer was used to advance the split-spoon samplers in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings once follow-up groundwater measurements were recorded.

A field log of each boring was prepared by the field engineer. These logs included visual classifications of the materials encountered during drilling as well as the engineer's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

APPENDIX B
LABORATORY TESTING

Geotechnical Engineering Report

River Street Hillside Watershed & Stabilization Project ■ Hot Springs, SD
August 29, 2012 ■ Terracon Project No. B4125029

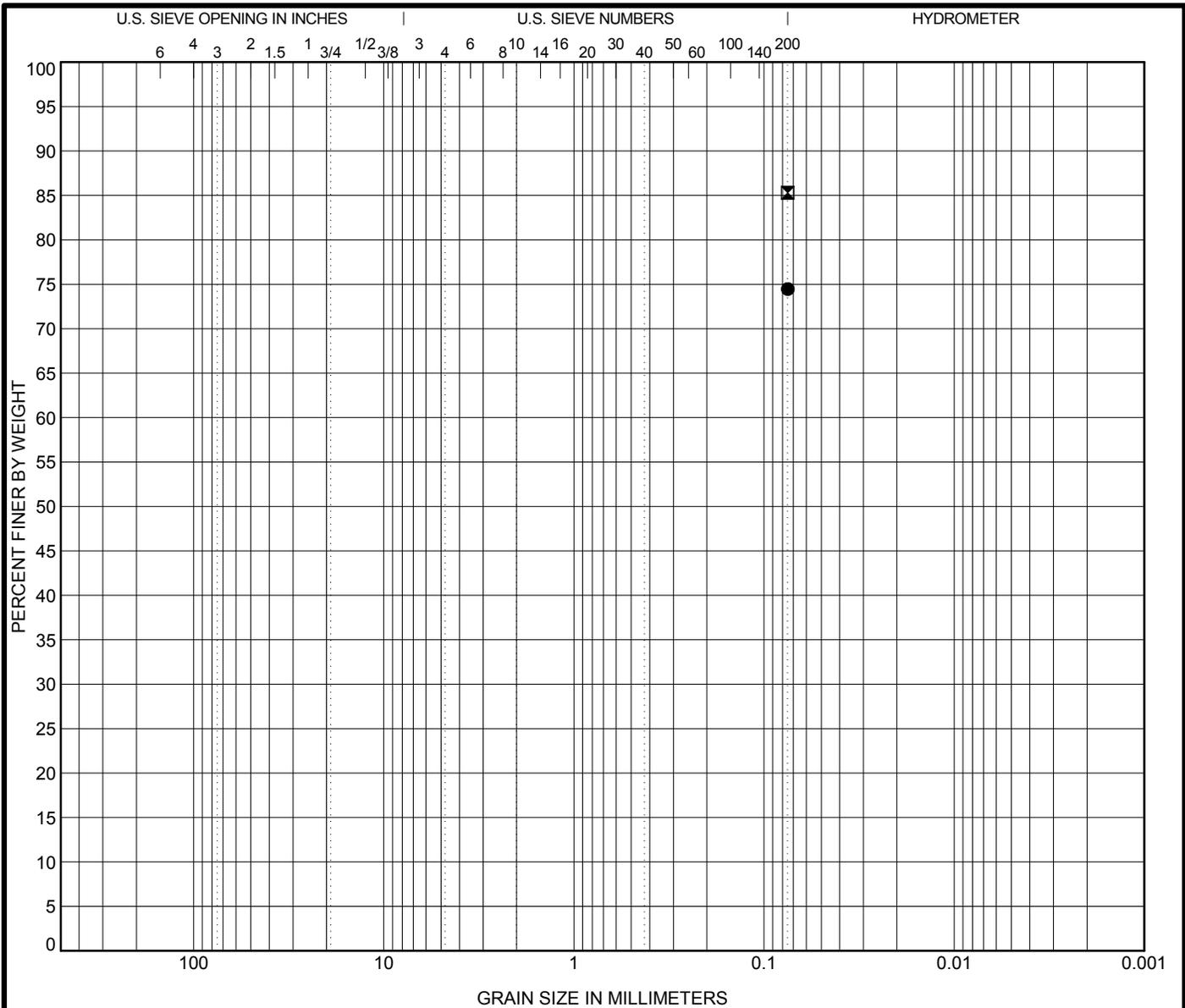


Laboratory Testing

As a part of the laboratory testing program, the soil samples were classified in the laboratory based on visual observation, texture, plasticity, and the laboratory testing performed as noted below. The soil descriptions presented on the boring logs for native soils are in accordance with our enclosed General Notes and Unified Soil Classification System (USCS). The estimated group symbol for the USCS is also shown on the boring logs, and a brief description of the Unified System is included in this report. Results of the laboratory tests are presented on the boring logs and/or included herein.

Selected soil samples were tested for the following properties:

- Water Content
- Grain Size Distribution
- Atterberg Limits



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● B-1 4ft	LEAN CLAY with SAND(CL)	33	17	16		
☒ B-2 4ft	LEAN CLAY(CL)	31	14	17		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● B-1 4ft	0.075				0	26	74	
☒ B-2 4ft	0.075				0	15	85	



GRAIN SIZE DISTRIBUTION

Project: River Street Slope Watershed and Stabilization
 Site: Hot Springs VA Medical Center Hot Springs, South Dakota
 Job #: B4125029
 Date: 8-28-12

TC_GRAIN_SIZE_B4125029.GPJ_TERRACON.GDT 8/28/12

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-3/8" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2" O.D., unless otherwise noted	PA:	Power Auger
CS:	Ring Sampler - 2" I.D., 2½" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling
WCI:	Wet Cave in	WD:	While Drilling
DCI:	Dry Cave in	BCR:	Before Casing Removal
AB:	After Boring	ACR:	After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

FINE-GRAINED SOILS

COARSE-GRAINED SOILS

BEDROCK

<u>(RS)</u> <u>Blows/Ft.</u>	<u>(SS)</u> <u>Blows/Ft.</u>	<u>Consistency</u>	<u>(RS)</u> <u>Blows/Ft.</u>	<u>(SS)</u> <u>Blows/Ft.</u>	<u>Relative</u> <u>Density</u>	<u>(RS)</u> <u>Blows/Ft.</u>	<u>(SS)</u> <u>Blows/Ft.</u>	<u>Consistency</u>
< 3	0-2	Very Soft	0-6	< 3	Very Loose	< 30	< 20	Weathered
3-4	3-4	Soft	7-18	4-9	Loose	30-49	20-29	Firm
5-9	5-8	Medium Stiff	19-58	10-29	Medium Dense	50-89	30-49	Medium Hard
10-18	9-15	Stiff	59-98	30-50	Dense	90-119	50-79	Hard
19-42	16-30	Very Stiff	> 98	> 50	Very Dense	> 119	> 79	Very Hard
> 42	> 30	Hard						

RELATIVE PROPORTIONS OF SAND AND GRAVEL

GRAIN SIZE TERMINOLOGY

<u>Descriptive Terms of</u> <u>Other Constituents</u>	<u>Percent of</u> <u>Dry Weight</u>	<u>Major Component</u> <u>of Sample</u>	<u>Particle Size</u>
Trace	< 15	Boulders	Over 12 in. (300mm)
With	15 – 29	Cobbles	12 in. to 3 in. (300mm to 75 mm)
Modifier	> 30	Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
		Sand	#4 to #200 sieve (4.75mm to 0.075mm)
		Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

PLASTICITY DESCRIPTION

<u>Descriptive Terms of</u> <u>Other Constituents</u>	<u>Percent of</u> <u>Dry Weight</u>	<u>Term</u>	<u>Plasticity Index</u>
Trace	< 5	Non-plastic	0
With	5 – 12	Low	1-10
Modifiers	> 12	Medium	11-30
		High	30+

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests

				Soil Classification		
				Group Symbol	Group Name ^B	
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well graded gravel ^F	
		Gravels with Fines More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F,G,H}	
			Fines classify as CL or CH	GC	Clayey gravel ^{F,G,H}	
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well graded sand ^I	
		Sands with Fines More than 12% fines ^D	$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand ^I	
			Fines classify as ML or MH	SM	Silty sand ^{G,H,I}	
		Fines classify as CL or CH	SC	Clayey sand ^{G,H,I}		
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K,L,M}	
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K,L,M}	
		Organic	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}
			Liquid limit - not dried		OH	Organic silt ^{K,L,M,O}
	Silts and Clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay ^{K,L,M}	
			PI plots below "A" line	MH	Elastic silt ^{K,L,M}	
		Organic	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K,L,M,P}
			Liquid limit - not dried		OH	Organic silt ^{K,L,M,Q}
Highly organic soils	Primarily organic matter, dark in color, and organic odor		PT	Peat		

^A Based on the material passing the 3-in. (75-mm) sieve

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well graded gravel with silt, GW-GC well graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well graded sand with silt, SW-SC well graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

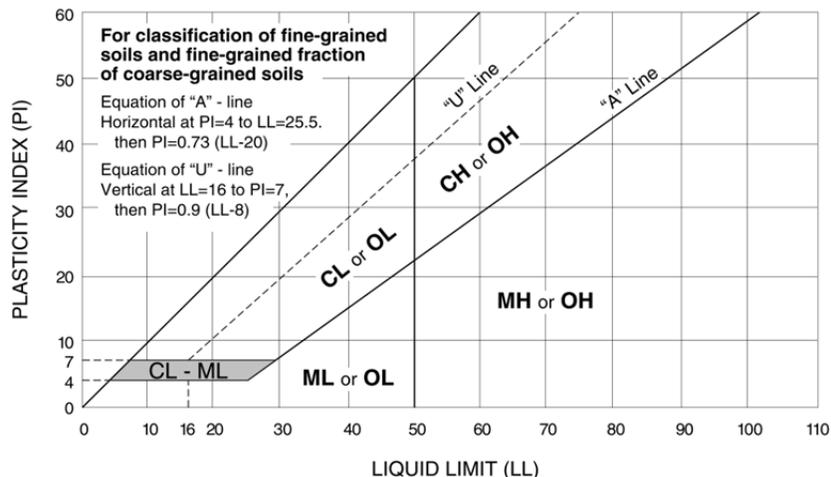
^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



**LABORATORY TEST
SIGNIFICANCE AND PURPOSE**

TEST	SIGNIFICANCE	PURPOSE
California Bearing Ratio	Used to evaluate the potential strength of subgrade soil, subbase, and base course material, including recycled materials for use in road and airfield pavements.	Pavement Thickness Design
Consolidation	Used to develop an estimate of both the rate and amount of both differential and total settlement of a structure.	Foundation Design
Direct Shear	Used to determine the consolidated drained shear strength of soil or rock.	Bearing Capacity, Foundation Design, and Slope Stability
Dry Density	Used to determine the in-place density of natural, inorganic, fine-grained soils.	Index Property Soil Behavior
Expansion	Used to measure the expansive potential of fine-grained soil and to provide a basis for swell potential classification.	Foundation and Slab Design
Gradation	Used for the quantitative determination of the distribution of particle sizes in soil.	Soil Classification
Liquid & Plastic Limit, Plasticity Index	Used as an integral part of engineering classification systems to characterize the fine-grained fraction of soils, and to specify the fine-grained fraction of construction materials.	Soil Classification
Permeability	Used to determine the capacity of soil or rock to conduct a liquid or gas.	Groundwater Flow Analysis
pH	Used to determine the degree of acidity or alkalinity of a soil.	Corrosion Potential
Resistivity	Used to indicate the relative ability of a soil medium to carry electrical currents.	Corrosion Potential
R-Value	Used to evaluate the potential strength of subgrade soil, subbase, and base course material, including recycled materials for use in road and airfield pavements.	Pavement Thickness Design
Soluble Sulphate	Used to determine the quantitative amount of soluble sulfates within a soil mass.	Corrosion Potential
Unconfined Compression	To obtain the approximate compressive strength of soils that possess sufficient cohesion to permit testing in the unconfined state.	Bearing Capacity Analysis for Foundations
Water Content	Used to determine the quantitative amount of water in a soil mass.	Index Property Soil Behavior

REPORT TERMINOLOGY
(Based on ASTM D653)

<i>Allowable Soil Bearing Capacity</i>	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
<i>Alluvium</i>	Soil, the constituents of which have been transported in suspension by flowing water and subsequently deposited by sedimentation.
<i>Aggregate Base Course</i>	A layer of specified material placed on a subgrade or subbase usually beneath slabs or pavements.
<i>Backfill</i>	A specified material placed and compacted in a confined area.
<i>Bedrock</i>	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.
<i>Bench</i>	A horizontal surface in a sloped deposit.
<i>Caisson (Drilled Pier or Shaft)</i>	A concrete foundation element cast in a circular excavation which may have an enlarged base. Sometimes referred to as a cast-in-place pier or drilled shaft.
<i>Coefficient of Friction</i>	A constant proportionality factor relating normal stress and the corresponding shear stress at which sliding starts between the two surfaces.
<i>Colluvium</i>	Soil, the constituents of which have been deposited chiefly by gravity such as at the foot of a slope or cliff.
<i>Compaction</i>	The densification of a soil by means of mechanical manipulation
<i>Concrete Slab-on-Grade</i>	A concrete surface layer cast directly upon a base, subbase or subgrade, and typically used as a floor system.
<i>Differential Movement</i>	Unequal settlement or heave between, or within foundation elements of structure.
<i>Earth Pressure</i>	The pressure exerted by soil on any boundary such as a foundation wall.
<i>ESAL</i>	Equivalent Single Axle Load, a criteria used to convert traffic to a uniform standard, (18,000 pound axle loads).
<i>Engineered Fill</i>	Specified material placed and compacted to specified density and/or moisture conditions under observations of a representative of a geotechnical engineer.
<i>Equivalent Fluid</i>	A hypothetical fluid having a unit weight such that it will produce a pressure against a lateral support presumed to be equivalent to that produced by the actual soil. This simplified approach is valid only when deformation conditions are such that the pressure increases linearly with depth and the wall friction is neglected.
<i>Existing Fill (or Man-Made Fill)</i>	Materials deposited throughout the action of man prior to exploration of the site.
<i>Existing Grade</i>	The ground surface at the time of field exploration.

REPORT TERMINOLOGY
(Based on ASTM D653)

<i>Expansive Potential</i>	The potential of a soil to expand (increase in volume) due to absorption of moisture.
<i>Finished Grade</i>	The final grade created as a part of the project.
<i>Footing</i>	A portion of the foundation of a structure that transmits loads directly to the soil.
<i>Foundation</i>	The lower part of a structure that transmits the loads to the soil or bedrock.
<i>Frost Depth</i>	The depth at which the ground becomes frozen during the winter season.
<i>Grade Beam</i>	A foundation element or wall, typically constructed of reinforced concrete, used to span between other foundation elements such as drilled piers.
<i>Groundwater</i>	Subsurface water found in the zone of saturation of soils or within fractures in bedrock.
<i>Heave</i>	Upward movement.
<i>Lithologic</i>	The characteristics which describe the composition and texture of soil and rock by observation.
<i>Native Grade</i>	The naturally occurring ground surface.
<i>Native Soil</i>	Naturally occurring on-site soil, sometimes referred to as natural soil.
<i>Optimum Moisture Content</i>	The water content at which a soil can be compacted to a maximum dry unit weight by a given compactive effort.
<i>Perched Water</i>	Groundwater, usually of limited area maintained above a normal water elevation by the presence of an intervening relatively impervious continuous stratum.
<i>Scarify</i>	To mechanically loosen soil or break down existing soil structure.
<i>Settlement</i>	Downward movement.
<i>Skin Friction (Side Shear)</i>	The frictional resistance developed between soil and an element of the structure such as a drilled pier.
<i>Soil (Earth)</i>	Sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks, and which may or may not contain organic matter.
<i>Strain</i>	The change in length per unit of length in a given direction.
<i>Stress</i>	The force per unit area acting within a soil mass.
<i>Strip</i>	To remove from present location.
<i>Subbase</i>	A layer of specified material in a pavement system between the subgrade and base course.
<i>Subgrade</i>	The soil prepared and compacted to support a structure, slab or pavement system.