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## DIVISION 02 - SITE WORK

## SECTION 02090

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## SECTION 02090

## LEAD-BASED PAINT (LBP) ABATEMENT AND DISPOSAL

## PART 1 GENERAL

## 1.1 REFERENCES

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.

## CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 148	Hazardous Waste Injection Restrictions
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packagings

## DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD-01	(1996) Lead-Based Paint: Guidelines for the Availability and Control of Lead-Based Paint Hazards in Housing
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## ENGINEERING MANUALS (EM)

EM 385-1-1 (1992) U.S. Army Corps of Engineers Safety and Health Requirements Manual

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 701 (1996) Methods of Fire Test for Flame-Resistant Textiles and Films

## NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH OSHA Booklet 3142 Lead in Construction

## UNDERWRITERS LABORATORIES (UL)

UL 586 (1996) High-Efficiency, Particulate, Air Filter Units

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-01 Data

Equipment List; GA.

A list of equipment items to be used in the work, including brand names, model, capacity, performance characteristics, quantities and other pertinent information.

## SD-08 Statements

Lead-Based Paint (LBP) Inventory; GA.

A space-by-space inspection shall be conducted with the Contracting Officer. A written inventory shall be prepared that identifies the LBP containing surfaces. The Government's LBP Management Plan will be the basis of the inventory. Areas and materials identified as containing LBP shall be treated unless the Contractor provides analytical evidence stating that the materials are not contaminated with LBP. If the inventory identifies additional LBP contamination, the Contractor shall make an amendment to the inventory. Costs of sampling and analysis to verify or add to the Contractor's LBP Inventory shall be borne by the Contractor.

Lead-Based Paint (LBP) Management Plan; GA.

The Contractor shall review the specified abatement work tasks and abatement methods and shall prepare a detailed LBP Management Plan that identifies the work procedures, health, and safety measures to be used in LBP abatement. The plan shall address the various sources of lead and the methods to be undertaken to abate the lead hazards to include the following key elements:

- a. Location of LBP containing components keyed to project drawings.
- b. Abatement methods for each LBP containing component.
- c. Means for notifying occupants of proposed work schedules.
- d. Training requirements as required by Federal, state, and local regulations.
- e. Unique problems associated with the LBP abatement project.
- f. Sketch of LBP control areas and decontamination areas.
- g. Eating, drinking, smoking, and rest room procedures.
- h. Sequencing of LBP related work.
- i. Personnel protective equipment; respiratory protection program and controls.
- j. Engineering controls, containment structures and safety measures.
- k. Worker exposure assessment procedures.
- l. Work Practice controls.
- m. Housekeeping.
- n. Hygiene facilities and practice.
- o. Medical surveillance, including medical removal protection.
- p. Sampling, testing and analytical methods to include personal air sampling requirements of 29 CFR 1926 Section .62 and when specified or where required, environmental air sampling, dust wipe sampling (preabatement, during abatement, post abatement), soil sampling (preabatement, post abatement, final clearance), toxicity characteristic leaching procedure (TCLP) of the waste material in accordance with 40 CFR 261. Procedures must include frequency, locations, and sampling and analytical methods to be used.

#### Emergency Contingency Plan; GA

An emergency contingency plan shall be prepared in accordance with 40 CFR 261. Procedure must address the following LBP abatement hazards as appropriate to the project:

- a. Negative air pressure system failure.
- b. Major breach of containment barriers.
- c. Detection of unexpected lead levels on adjacent grounds.
- d. Spilling of lead debris bags or containers.
- e. Phone numbers for project manager, local fire, police and medical personnel.

#### Hazardous Waste Management Plan; GA.

A Hazardous Waste Management Plan shall be prepared that complies with applicable requirements of Federal, state, and local hazardous waste regulations and addresses:

- a. Identification or documentation of potential hazardous wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes; the facility location, phone number, and name of a 24-hour point of contact shall be included. Two copies of EPA, state, and local hazardous waste permit applications, permits, and EPA identification numbers.
- d. Names and qualifications (experience and training) of personnel who will be working onsite with hazardous waste.
- e. List of waste handling equipment to be used in performing the work to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and clean-up contingency measures to be implemented.
- g. Work plan and schedule for waste containment, removal, and disposal. Waste shall be cleaned up and containerized daily.
- h. Cost for hazardous waste disposal according to this plan.

Waste Handling and Site Storage Plan; GA.

A Handling and Site Storage Plan shall be prepared that addresses the handling and storage of LBP debris in accordance with the requirement of 40 CFR 262 and 40 CFR 265. The Contractor shall confirm that an EPA identification number has been obtained so that proper manifesting of the waste will be addressed, and that site storage limitations, including the time of storage, container requirements, contingency plan, and personnel training have been complied with.

Waste Disposal Plan; GA.

A Waste Disposal Plan shall be prepared that will include but not be limited to the following:

- a. A written confirmation that the debris will be treated and disposed of in accordance with the requirements of 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 264 and 40 CFR 268.
- b. A written confirmation that transportation of the debris will be in accordance with 40 CFR 263.
- c. Waste subcontractor's name, address, telephone number, and landfill location, including copies of licenses and signed agreements.
- d. Landfill name, address, and telephone number. A copy of the landfill's state and locally issued license, and a signed

agreement that the landfill will accept the LBP wastes.

- e. Detailed delivery tickets prepared, signed, and dated by an agent of the landfill, certifying the amount of LBP containing materials delivered to the landfill, within 3 days after delivery.

#### SD-09 Reports

Sampling Result; GA.

A daily log of the personal and environmental air sampling test results shall be reviewed by the Certified Industrial Hygienist (CIH) and submitted, in written form, no more than 48 hours after completion of the sampling cycle. The log shall list each sample result, sampling time and date, sample type, identification of personnel monitored, flow rate and duration, air volume sampled, yield of lead, cassette size, analytical method used, analyst's name and company, and interpretation of results. Results shall be reported in micrograms of lead per cubic meter of air. In addition, the daily log shall include the results of dust wipe samples, soil samples and TCLP sampling including each phase of preabatement, during abatement and final clearance. Documentation of results that exceed specified limits (personal air samples that exceed 30 micrograms per cubic meter) or as required by Federal, state or local requirements shall be highlighted in the log in such a manner to make them easily distinguishable from monitoring results that do not exceed specified or regulatory limits.

#### SD-13 Certificates

Quality Assurance; GA.

Certificates shall meet the requirements of paragraph QUALITY ASSURANCE. The statements shall be signed and dated by a certifying officer after the award of this contract and contain the following:

- a. Contractor's name and address.
- b. Project name and location.
- c. The specified requirements that are being certified.

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Qualifications

- a. Contractor: Certification that the Contractor has prior experience on LBP abatement projects similar in nature and extent to ensure the capability to perform the abatement in a satisfactory manner.
- b. Competent Person: Certification that the Contractor's full-time onsite Competent Person meets the competent person requirements of 29 CFR 1926 Section .62 and is experienced in administration and supervision of LBP abatement projects, including work practices, protective measures for building and personnel, disposal procedures, etc. This person shall have completed a Contractor Supervisor LBP abatement course by an EPA Training Center or an equivalent certification course, and have had a minimum of 2 years on-the-job experience.

- c. Certified Industrial Hygienist (CIH): Certification that the CIH has 2 years prior experience on similar LBP abatement projects and is certified by the American Board of Industrial Hygiene (ABIH). The certification shall include a copy of the ABIH certificate showing certification number, and date of certification or recertification.
- d. Industrial Hygienist: Certification that the Industrial Hygienist meets the Office of Personnel Management Standard for the Industrial Hygiene Series GS-690, and has a minimum of two years experience in LBP abatement.
- e. Testing Laboratory: The name, address, and telephone number of the independent testing laboratory selected to perform sampling and analysis for personal and environmental air samples, lead dust wipes, bulk sample analyses, and TCLP analysis. Documentation that the laboratory performing the analysis is an EPA National Lead Laboratory Accreditation Program (NLLAP) accredited laboratory and that it is rated proficient in the NIOSH/EPA Environmental Lead Proficiency Analytical Testing Program (ELPAT). Certification shall include accreditation for heavy metal analysis, list of experience relevant to analysis of lead in air, and a Quality Assurance and Quality Control Program. Currently, the American Association for Laboratory Accreditation (ASLA) and the American Industrial Hygiene Association (AIHA) are the EPA recognized laboratory accreditors. Documentation shall include the date of accreditation or reaccreditation.
- f. Blood Lead Testing Laboratory. The name, address and telephone number of the blood lead testing laboratory; the laboratory's listing by OSHA and the U.S. Public Health Service Center for Disease Control (CDC); and documentation that the laboratory certified in the state where the work site is located.

#### 1.3.2 Respiratory Protection Devices

Manufacturer's certification of NIOSH or the Mine Safety and Health Administration (MSHA) approval for respiratory protection devices utilized on the site.

#### 1.3.3 Cartridges, Filters, and Vacuum Systems

Manufacturer's certification of NIOSH approval of respirator cartridges (organic vapor, acid gas, mist, dust, high efficiency particulate); High Efficiency Particulate Air (HEPA) filtration capabilities for all cartridges, filters, and HEPA vacuum systems.

#### 1.3.4 Medical Records

Certification that employees who are involved in LBP abatement work have received medical examinations and will receive continued medical surveillance, including biological monitoring, as required by 29 CFR 1926 Section .62 and by the state and local regulations pertaining to such work. Records shall be retained, at Contractor expense, in accordance with 29 CFR 1910 Section .20.

#### 1.3.5 Training

Training certification shall be provided prior to the start of work

involving LBP abatement, for all of the Contractors' workers, supervisors and Competent Person. Training shall meet the requirements of 29 CFR 1926 Section .62, 29 CFR 1926 Section .59 and 49 CFR 172, and that required by EPA or the state LBP course for the work to be performed. Training shall be provided prior to the time of job assignment and, at least, annually. Training may cover all abatement methods or focus only on those methods specified in the LBP Management Plan. The project specific training shall, as a minimum, include the following:

- a. Specific nature of the operation which could result in exposure to lead.
- b. Purpose, proper selection, fitting, use, and limitations of respirators.
- c. Purpose and description of the medical surveillance program and the medical removal protection program, including information concerning the adverse health effects associated with excessive exposure to lead (with particular attention to the adverse reproductive effects on both males and females and hazards to the fetus and additional precautions for employees who are pregnant).
- d. Relevant engineering controls and good work practices.
- e. The contents of any compliance plan in effect.
- f. Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician.
- g. The employee's right of access to records under 29 CFR 1910Section .20.

#### 1.3.6 Licenses and Permits

Copies of licenses and permits as required by applicable Federal, state, and local regulations shall be obtained at least 20 days before the start of the LBP abatement project.

#### 1.4 DESCRIPTION OF WORK

LBP is to be removed, encapsulated or enclosed according to the Government LBP Management Plan, appended herein.

#### 1.5 SITE VISIT

Contractor shall visit and investigate the site, review the drawings and specifications, assess the amount of LBP, and become familiar with conditions which will affect the work.

#### 1.6 LIABILITY INSURANCE FOR LBP

LBP abatement liability insurance shall be obtained without additional expense to the Government. The Contractor shall assume full responsibility and liability for the compliance with Federal, state, and local regulations pertaining to training, work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site.

## 1.7 PROTECTION OF EXISTING WORK TO REMAIN

Abatement, storage, transportation, and disposal work shall be performed without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, the Contractor shall restore work and areas to the original condition.

## 1.8 COORDINATION WITH OTHER WORK

Abatement and disposal work shall be coordinated with existing work and/or concurrent work being performed in adjacent areas.

## 1.9 SAFETY AND HEALTH REGULATORY REQUIREMENTS

Work shall be performed in accordance with requirements of EM 385-1-land applicable regulations including, but not limited to 29 CFR 1910, 29 CFR 1926, especially Section .62. Matters of interpretation of the standards shall be submitted to the appropriate agency for resolution before starting work. Where these requirements vary, the most stringent shall apply.

## 1.10 PRECONSTRUCTION SAFETY MEETING

The Contractor and CIH shall attend a preconstruction safety meeting prior to starting any work involving LBP abatement. Items required to be submitted will be reviewed for completeness, and where specified, for acceptance.

## 1.11 ACCIDENT PREVENTION PLAN

### 1.11.1 Preparation and Implementation

The Accident Preparation Plan (APP) shall be prepared in accordance with EM 385-1-1, Table 1-1. Where topic in table 1-1 is not applicable, the APP shall justify its omission or reduced level of detail, and establish that adequate consideration was given to the topic. The APP shall cover onsite work by the Contractor or subcontractors. The Competent Person shall be responsible for development, implementation, and quality control of the content and actions required in the APP. For each anticipated work task, the APP shall establish hazards and control measures. The APP shall be easily readable and understandable by the Contractor's work force.

### 1.11.2 Acceptance and Modifications

The APP shall be prepared, signed and dated by the Contractors Competent Person and submitted 30 days prior to the preconstruction safety conference. Deficiencies in the APP shall be discussed at the Preconstruction Safety Conference and the APP shall be revised to correct the deficiencies, and resubmitted for acceptance. Onsite work shall not begin until the APP has been accepted unless otherwise authorized by the Contracting Officer. One copy of the APP shall be maintained in the Contractor's jobsite file, and a second copy shall be posted where it will be accessible to personnel on the site. As work proceeds, the APP shall be adapted to new situations and conditions. Changes to the APP shall be made with concurrence of the Competent Person and Site Superintendent, and acceptance of the Contracting Officer. Should an unforeseen hazard become evident during performance of the work, the Competent Person shall bring such hazard to the attention of the Superintendent and the Contracting Officer, both verbally and in writing, for resolution as soon as possible. In the interim, the Contractor shall take necessary action to re-establish

and maintain safe working conditions; and to safeguard onsite personnel, visitors, the public, and the environment. Disregard for provisions of this specification, or the accepted APP shall be cause for stopping of work until the matter is rectified.

#### 1.11.3 Activity Hazard Analyses

An Activity Hazard Analysis (AHA) shall be prepared prior to beginning each major phase of the work and submitted for review and acceptance. Format shall be in accordance with EM 385-1-1, figure 1-1. A major phase of work is defined as an operation involving hazards not experienced in previous operations, or where a new work crew is to perform. The analysis shall define the activities and the sequence in which they are to be performed, specific hazards anticipated, and control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the Activity Hazard Analysis has been accepted and a preparatory meeting has been conducted by the Contractor to discuss content of the AHA with everyone engaged in the activity, including the Government's onsite representative. The AHA shall be continuously reviewed and modified when appropriate to address changing conditions or operations. The accepted AHA shall be appended to and become part of the APP.

#### 1.12 RESPIRATORY PROTECTION PROGRAM

A respiratory protection program shall be established as required by 29 CFR 1926 Section .103 and .62 and in accordance with 29 CFR 1910Section .134. An approved respirator shall be furnished to each employee and visitor required to enter a LBP work control area. A fit test shall be conducted in accordance with 29 CFR 1926 Section .62, Appendix D.

#### 1.13 HAZARD COMMUNICATION PROGRAM

A Hazard Communication Program shall be implemented in accordance with 29 CFR 1926 Section .59.

#### 1.14 SAFETY AND HEALTH OVERSIGHT

The Competent Person shall be the onsite person responsible for coordination, safety, security and execution of the work. The Competent Person shall be able to identify existing and predictable lead hazards and shall have the authority to take corrective measures to eliminate them. The CIH shall be responsible for dust wipe, personal and environmental sampling.

#### 1.15 PREPARATORY INSPECTION MEETING

The Contractor and CIH shall arrange and hold a preparatory inspection meeting immediately prior to beginning any LBP abatement. The APP, Activity Hazard Analyses, and the Contractor's LBP Management Plan, including containment, engineering controls, worker protection, training, and monitoring, will be reviewed for completeness.

#### 1.16 TRAINED AND COMPETENT PERSONNEL

Work shall be performed by Competent Persons, qualified and trained in the abatement, enclosure, encapsulation, monitoring, testing, storage, treatment, hauling, and disposal of contaminated LBP debris material, and in subsequent cleanup of the affected environment. Workers shall comply with the appropriate Federal, state, and local regulations which mandate

training requirements and work practices and shall be capable of performing the work under this contract.

#### 1.17 POSTED WARNINGS AND NOTICES

The following regulations, warnings, and notices shall be posted at the work site in accordance with 29 CFR 1926 Section .62.

##### 1.17.1 Regulations

Two copies of applicable Federal, state, and local regulations and NIOSH OSHA Booklet 3142 shall be maintained. One copy shall be posted at the work site and one copy shall be on file in the project office.

##### 1.17.2 Warning Signs and Labels

Warning signs shall be provided at building entrances and approaches to LBP control areas containing airborne LBP debris. Signs shall be located at a distance from the LBP control areas that will allow personnel to read the sign and take the necessary protective actions required before entering the LBP control area.

###### 1.17.2.1 Warning Signs

Warning signs shall be in English and be of sufficient size to be clearly legible and display the following:

WARNING  
LEAD WORK AREA  
POISON  
NO SMOKING OR EATING  
AUTHORIZED PERSONNEL ONLY  
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

###### 1.17.2.2 Warning Labels

Warning labels shall be in English and be of sufficient size to be clearly legible and display the following:

CAUTION: CLOTHING CONTAMINATED WITH LEAD. DO NOT REMOVE DUST BY BLOWING OR SHAKING. DISPOSE OF LEAD CONTAMINATED WASH WATER IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE OR LOCAL REGULATIONS.

##### 1.17.3 Worker Information

Right-to-know notices shall be placed in clearly visible areas of the work site in compliance with Federal, state, and local regulations.

##### 1.17.4 Air Monitoring Results

Daily air monitoring results shall be prepared so as to be easily understood by the workers, and shall be placed in a clearly visible area of the work site.

##### 1.17.5 Emergency Telephone Numbers

A list of telephone numbers shall be posted at the site. The list shall include numbers of the local hospital, emergency squad, police and fire departments, Government and Contractor representatives who can be reached

24 hours per day, and professional consultants directly involved in the project.

#### 1.18 EQUIPMENT AND MATERIALS

Sufficient quantities of health and safety materials required by 29 CFR 1926 Section .62, and other materials and equipment needed to complete the project, shall be available and kept on the site.

##### 1.18.1 Respirators

Air-purifying respirators shall be approved by NIOSH for use with dust, fumes, and mists having permissible exposure limits less than 0.05 milligrams per cubic meter (i.e., have high-efficiency particulate air (HEPA) filters) and for other hazardous airborne contaminants that may be encountered, as determined by the Competent Person. Respirators shall comply with the requirements of 29 CFR 1926 Section .62 and shall be used in accordance with 29 CFR 1926 Section .103 and 29 CFR 1910Section .134.

##### 1.18.2 Respirator Cartridges

A sufficient supply of respirator cartridges shall be maintained at the work site to provide new cartridges to employees, authorized visitors, and Government personnel throughout the duration of the project. Cartridges shall be replaced according to the manufacturer's recommendations, when breathing becomes difficult, or if the cartridge becomes wet.

##### 1.18.3 Protective Clothing

The Contractor shall furnish, at no cost to personnel, equipment/clothing for protection from airborne and waterborne LBP debris. An adequate supply of these items shall be available for worker, authorized visitor, and Government personnel use. Workers and visitors shall not take protective clothing and equipment off the work site at any time. Protective clothing includes:

- a. Coveralls (Whole Body Protective Coverings): Full-body coveralls and head covers shall be worn by workers in the work area. Sleeves shall be secured at the wrist and pants legs at the ankle with tape. Permeable clothing shall be provided in heat-stress conditions. Where non-disposable coveralls are provided, these coveralls shall be cleaned after each wearing. Cleaning of coveralls and other non-disposable clothing shall be in accordance with the provisions for cleaning in 29 CFR 1926 Section .62.
- b. Boots: Work boots with nonskid soles or impermeable work boot covers shall be worn by workers. Where required by OSHA, safety boots (steel toe or steel toe and shank) shall be worn. Paint the uppers of boots red with waterproof enamel. Do not allow boots to be removed from the work area for any reason after being contaminated with LBP debris. Dispose of boots as LBP contaminated waste at the end of the work.
- c. Gloves: Inner gloves, appropriate for items and hazards encountered, and disposable outer work gloves shall be provided to each worker and shall be worn while the worker is in the work area. Glove material shall be appropriate for the specific chemical exposure. Gloves shall not be removed from the work area, and shall be disposed of as LBP contaminated waste at the

end of the work.

- d. **Hard Hats:** Head protection (hard hats) shall be provided as required by OSHA and EM 385-1-1 for workers and authorized visitors. Protective plastic strap suspension hats shall be used. Hard hats shall be worn at all times that work is in progress. Hats shall remain in the work area until the project is completed. Hats shall be thoroughly cleaned, decontaminated, and bagged before being removed from the work area at the end of the project.
- e. **Eye Protection:** Fog-proof goggles for personnel engaged in LBP abatement operations shall be worn when the use of a full face piece respirator is not required.
- f. **Work Clothing:** Cloth work clothes shall be provided for wearing under the disposable protective coveralls and foot coverings.

#### 1.18.4 Negative Air Pressure System

When a LBP control area requires the use of an airtight containment barrier, a negative air pressure system shall be used, and pressure differential recordings taken. LBP shall not be removed from the LBP control area until the proper engineer controls and HEPA filtration systems are in place.

##### 1.18.4.1 HEPA Filter Requirements

The negative air pressure system shall be equipped with approved HEPA filters per UL 586. Negative air pressure equipment shall be equipped with new HEPA filters, and shall be sufficient to maintain a minimum pressure differential of minus 5 Pa (0.02 inch) 0.02 inch of water column relative to adjacent, unsealed areas. Negative air pressure system minimum requirements are listed below.

- a. The unit shall be capable of delivering its rated volume of air with a clean first stage filter, an intermediate filter and a primary HEPA filter in place.
- b. The HEPA filter shall be certified as being capable of removing particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.
- c. The unit shall be capable of continuing to deliver no less than 70 percent of rated capacity when the HEPA filter is 70 percent full or measures 620 Pa (2.5 inches of water) 2.5 inches of water static pressure differential on a magnehelic gage.
- d. The unit shall be equipped with a manometer-type negative pressure differential monitor with minor scale division of 0.02 inch of water and accuracy within plus or minus 1.0 percent. The manometer shall be calibrated daily as recommended by the manufacturer. Record manually manometer readings of the pressure differential between the LBP control area and adjacent unsealed areas at the beginning of each workday and every 2 working hours thereafter.
- e. The unit shall be equipped with a means for the operator to easily interpret the readings in terms of the volumetric flow rate of air per minute moving through the machine at any given moment.

- f. The unit shall be equipped with an electronic mechanism that automatically shuts the machine off in the event of a filter breach or absence of a filter.
- g. The unit shall be equipped with an audible horn that sounds an alarm when the machine has shut itself off.
- h. The unit shall be equipped with an automatic safety mechanism that prevents a worker from improperly inserting the main HEPA filter.
- i. The unit shall be ducted through the containment barrier wall to the outside of the building or work area as required by the Task Order. The unit shall not be exhausted into any work area.

#### 1.18.4.2 Number of Units Required

The air within the containment barrier shall be changed at least once every 15 minutes by a continuously operating negative air pressure system, until the LBP control area barrier is removed. Filters shall be replaced as necessary to maintain the efficiency of the system. A back-up unit shall be maintained onsite.

#### 1.18.4.3 Auxiliary Generator

An auxiliary generator shall be provided with a capacity adequate to power a minimum of 50 percent of the negative air machines at any time during the work. When power fails, the generator controls shall automatically start the generator and switch the negative air pressure system machines to generator power. The generator shall not present a carbon monoxide hazard to workers.

#### 1.18.4.4 Local HVAC Systems

The building heating, ventilating, and air conditioning (HVAC) system shall not be used as the negative air pressure system for the LBP control area.

#### 1.18.4.5 Discontinuing Negative Air Pressure System

The negative air pressure system shall not be shut down during LBP abatement work unless authorized by the Contracting Officer. At the completion of the LBP abatement and disposal project, units shall be run until full cleanup has been completed and wipe clearance samples have been collected, analyzed, and have passed final clearance testing requirements. Dismantling of the negative air pressure systems shall conform to the written decontamination procedures. Prefilters shall be removed and properly disposed of, and the intake to the machines shall be sealed with polyethylene to prevent environmental contamination.

#### 1.18.5 Expendable Supplies

##### 1.18.5.1 Polyethylene Sheet and Bags - General

Polyethylene sheet and bags shall be minimum 0.15 mm (6 mils) 6 mils thick. Bags shall have pre-printed labels, and 125 mm (5 inch) 5 inch (minimum) long plastic ties, pointed and looped to secure the filled bags. Polyethylene sheets shall be in roll sizes to minimize seams.

##### 1.18.5.2 Polyethylene Sheet - Flame Resistant

Where a potential for fire exists, flame-resistant polyethylene sheets shall be provided. Polyethylene film shall be frosted or black and shall conform to the requirements of NFPA 701.

#### 1.18.5.3 Polyethylene Sheet - Reinforced

Reinforced polyethylene sheet shall be provided where high skin strength is required such as where it constitutes the only barrier between the LBP control area and the outdoor environment. The sheet stock shall consist of translucent, nylon-reinforced or woven-polyethylene thread laminated between two layers of polyethylene film. Film shall meet flame resistant standards of NFPA 701.

#### 1.18.5.4 Tape and Adhesive Spray

Tape and adhesive shall be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive shall retain adhesion when exposed to wet conditions, including amended water. Tape shall be minimum 50 mm (2 inches) 2 inches wide, industrial strength.

#### 1.18.5.5 Containers

Impermeable containers shall be used to receive and retain lead contaminated material until disposal. Containers shall be labeled in accordance with EPA, DOT and OSHA standards.

#### 1.18.5.6 Chemicals

Chemicals, including caustics and paint strippers, shall be properly labeled and stored in leak-tight containers.

#### 1.18.6 Vacuum Systems

HEPA filtered vacuum systems shall be used during abatement operations which generate dust. The systems shall be suitably sized for the project, and filters shall be capable of removing particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.

#### 1.18.7 Heat Blower Guns

Heat blower guns shall be flameless, electrical, paint-softener type with controls to limit temperature to 590 degrees C (1,100 degrees F). 1,100 degrees F. Heat blower shall be DI (non-grounded) 120 Vac, and shall be equipped with cone, fan, glass protector and spoon reflector nozzles.

#### 1.18.8 Chemical Paint Strippers

Chemical paint strippers shall contain no methylene chloride and shall be formulated to prevent stain, discoloration, or raising of the substrate materials.

#### 1.18.9 Chemical Paint Stripper Neutralizer

Neutralizers for paint strippers shall be used on exteriors only and shall be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

### 1.19 STORAGE OF MATERIALS

Materials shall be stored in a place and manner which protects them from damage and contamination. During periods of cold weather, plastic materials shall be protected from the cold. No flammable or hazardous materials shall be stored inside any building. Regularly inspect materials to identify damaged or deteriorating items. Damaged or deteriorated items shall not be used and shall be removed from the site as soon as they are discovered. Any materials which become contaminated with LBP waste shall be disposed of consistent with the requirements of 40 CFR 148 and these specifications. Stored materials shall not present a hazard or an inconvenience to workers, visitors, and/or other occupants and employees of the building.

### PART 2 PRODUCTS (NOT APPLICABLE)

### PART 3 EXECUTION

#### 3.1 PILOT ABATEMENT PROJECT

Prior to beginning full-scale abatement, a pilot abatement project shall demonstrate the specified abatement procedure on the indicated facility. Preabatement lead dust samples shall be collected from each type of surface in the pilot facility as specified in paragraphs Wipe Sampling, and Preabatement Lead-Dust Wipe Samples. The Contracting Officer shall evaluate the following during the pilot abatement project:

- a. Lead dust wipe samples shall be collected and analyzed during abatement and for final clearance as specified in paragraph Wipe Sampling. If results of analysis indicate that lead levels are above clearance levels, the Contractor shall evaluate his/her abatement cleanup procedures. If clearance levels are low and continue to be low, less restrictive engineering controls may be proposed by the Contractor.
- b. If personal air sample analyses indicate that action levels or permissible exposure limits specified in 29 CFR 1926 Section .62 have not been exceeded, then respirator protection may become less restrictive. Half-face respirators shall be the minimum respiratory protection employed.
- c. During cleanup a final dust wipe clearance shall be performed after a single cleanup iteration. If the samples are below acceptable levels the Contractor may request approval for one cleanup pass instead of two cleanup passes.
- d. Adequate samples of waste generated (water, solid components, caustic paste, filters, paint chips, etc.) shall be collected for Toxicity Characteristic Leaching Procedure (TCLP) testing. The TCLP test shall be performed by an accredited laboratory.
- e. Waste generated throughout the abatement project shall be properly containerized, according to applicable regulations, and disposed of as per the results of the TCLP analysis.

#### 3.2 WORK PROCEDURES

LBP abatement and related work shall be performed in accordance with the accepted Contractor's LBP Management Plan as modified and approved,

following the pilot abatement project. Procedures and equipment required to limit occupational and environmental exposures to lead during LBP removal shall be in accordance with 29 CFR 1926 Section .62, and as specified herein. Paint chips and associated waste shall be disposed of in compliance with Federal, state, and local regulations.

### 3.2.1 Personnel Protection Procedures

Personnel shall wear and use protective clothing and equipment as specified. Eating, smoking, drinking, chewing tobacco and chewing gum, and applying makeup shall not be permitted in the LBP control area. Personnel of trades not engaged in the abatement and disposal of LBP shall not be exposed at any time to airborne concentrations of lead equal to or in excess of 30 micrograms per cubic meter of air. Electrical service shall be disconnected when wet removal is performed, and temporary electrical service protected by a ground fault circuit interrupter shall be provided.

### 3.2.2 Safety and Health Procedures

The Competent Person shall be present on the work site throughout the abatement project to supervise, monitor, and document the project's health and safety provisions. A daily log shall be maintained showing the results of sampling tests throughout the project area. LBP abatement work being conducted within a LBP Control area where an airtight barrier is required shall be stopped if dust wipe concentration levels collected outside the containment area during abatement, equal or exceed the preabatement level or 200 micrograms per square foot, whichever is greater.

### 3.2.3 Safety and Health Responsibilities

The Competent Person shall:

- a. Verify that training meets applicable requirements.
- b. Review and approve LBP Management Plan for conformance to the applicable referenced standards.
- c. Inspect LBP removal work for conformance with the accepted LBP Management Plan.
- d. Ensure that worker exposure air monitoring activities are in accordance with 29 CFR 1926 Section .62.
- e. Ensure work is performed in strict accordance with specifications.
- f. Ensure hazardous exposure to personnel and to the environment are adequately controlled.

The CIH shall be responsible for directing personal and environmental air monitoring and lead dust wipe sampling.

### 3.2.4 Medical Surveillance Procedures

Medical surveillance shall be implemented in accordance with the approved Contractor's LBP Management Plan, and shall comply with the requirements of 29 CFR 1926 Section .62, including the provisions for biological monitoring, medical removal protection and a physician's written opinion, signed by the physician performing the employee examination. The Contractor shall provide a copy of the written opinion for Contractor's

employees 2 days prior to each employee's commencement of work.

### 3.2.5 Engineering Controls and Containment Structures

#### 3.2.5.1 LBP Control Area

The LBP control area is where LBP abatement work occurs and as such shall be considered contaminated, and shall be isolated to prevent LBP containing dust or debris from passing into adjacent building or open areas. The control area shall be decontaminated at the completion of the LBP abatement and disposal work.

#### 3.2.5.2 Boundary Requirements

Physical boundaries shall be provided around exterior LBP control areas by roping off the area indicated in the LBP Management Plan. Interior projects shall be isolated by curtains, portable partitions, or other enclosures to ensure that concentrations of lead dust outside the LBP control area will not equal or exceed the preabatement level or 200 micrograms per square foot, whichever is greater.

#### 3.2.5.3 Control Barriers

The LBP control area shall be separated from other portions of the building and the outside with control barriers. The polyethylene sheeting will have all openings masked and sealed, and shall be erected according to the Contractor's LBP Management Plan. Polyethylene sheeting shall be mechanically supported, independent of duct tape or spray adhesive.

#### 3.2.5.4 Preabatement Lead-Dust Wipe Samples

Preabatement lead-dust wipe samples shall be taken outside the LBP controlled area, in accordance with HUD-01. Samples shall be taken within 3 meters (10 feet) 10 feet of the abatement structure at 20 percent of the area planned for abatement.

#### 3.2.5.5 Masking and Sealing

- a. Interior LBP control area requirements: Openings shall be sealed where the release of airborne LBP dust is expected. A control area shall be established with the use of curtains, portable partitions, or other systems in order to prevent the escape of dust from the contaminated control area. The control area shall be provided with protective covering of two layers of polyethylene sheeting over floors. Penetrations of the floor, walls, and ceiling shall be sealed with polyethylene sheeting and duct tape. Polyethylene sheeting shall be firmly attached to the structure. Joints shall be sealed with spray adhesive and duct tape. Openings shall be provided for the supply and exhaust of air for the negative air pressure system. Personal monitoring during the work shift shall be in accordance with 29 CFR 1926 Section .62.
- b. Exterior LBP control area requirements: Where the construction of a contained LBP control area is impractical, a roped-off perimeter shall be installed 6 meters (20 feet) 20 feet from, and around, the area where the LBP handling procedures are performed and other requirements for LBP control areas shall be maintained. Personal monitoring of airborne concentrations shall be conducted in adjacent areas, during the work shift, in accordance with 29 CFR

1926 Section .62. Where wipe sampling is not practical, air monitoring outside of the roped-off perimeter shall be conducted as specified. Airborne concentrations shall not exceed specified levels.

#### 3.2.5.6 Personnel Decontamination Unit Procedures

Decontamination units shall be constructed when required for the abatement procedures. Materials fabricated or delivered to the site before the shop drawings have been returned to the Contractor will be subject to rejection by the Contracting Officer. Specifications and drawings of portable prefab units, such as a trailer unit, if utilized, must be submitted for review and approval before start of construction. Submittal shall include, but not be limited to, a floor plan layout showing dimensions, materials, sizes, thicknesses, plumbing, and electrical outlets. Access between contaminated and uncontaminated rooms or areas shall be through an airlock.

Access between any two rooms or room and trailer within the decontamination unit shall be through a plastic sheeting curtained doorway.

A separate equipment decontamination unit shall be provided. Each work area shall have an emergency exit. The personnel decontamination unit's clean room shall be the only means of entrance and exit, except for emergencies, from the LBP control area. Materials shall exit the LBP control area through the equipment decontamination area.

#### 3.2.5.7 Clean Room Procedures

The clean room shall have only one exit to non-contaminated areas of the building or site. An airtight seal shall be constructed of polyethylene between the clean room and the rest of the building. Surfaces of the clean room shall be protected with sheet polyethylene. A temporary unit with a separate equipment decontamination locker room and a clean locker room shall be provided for personnel who are required to wear whole body protective clothing. One locker shall be provided in each locker room for each LBP abatement worker, and each Contractor's representative. Lead-free personal clothing and shoes shall be kept in the clean locker. Hand wash station/showers shall be located between the equipment decontamination locker room and the clean locker room, and employees shall wash or shower before changing into personal clothes. An adequate supply of clean disposable towels shall be provided. LBP contaminated work clothing shall be cleaned. Clean rooms shall be physically attached to the LBP control area for areas inside the building but may be directly adjacent to the LBP control area outside of the building. Joint use of this space for other functions, such as offices, equipment storage, etc., is prohibited.

#### 3.2.5.8 Hand Wash Station/Shower Room Procedures

An operational shower and hand washing station shall be provided between the work area and the clean changing room. Workers shall wash and/or shower before entering the clean changing room. Shower room shall be separated from other rooms by air tight walls fabricated from polyethylene sheeting. Water shall be hot and cold or warm. Shower heads and controls, soap dish, continuing supply of soap, and clean towels shall be provided. The shower shall be maintained in a sanitary condition. Waste water shall be pumped to drain and through waste water filters that meet state and/or local requirements. These filters shall be located inside the shower unit and filters shall be changed regularly. Spent filters shall be discarded as LBP contaminated waste.

#### 3.2.5.9 Equipment Decontamination Unit Procedures

The Equipment Decontamination Unit shall be used for removal of equipment and materials from the LBP control area, and shall include a wash room, holding room, and an enclosed walkway. The unit shall be constructed from wood framing material and polyethylene sheeting. Workers shall not enter or exit the LBP control area through the Equipment Decontamination Unit. A washdown station, consisting of an enclosed shower unit, shall be located in the work area outside the Wash Room. The washdown station shall be used to clean equipment, bags and containers. Bagged or containerized LBP wastes shall be passed from the work area and cleaned in the Wash Room. The Wash Room shall be separated from the work area by a polyethylene sheeting flap. Wastewater shall be filtered and filters shall be changed as required for the shower unit and the Wash Room. Filters shall be disposed of as LBP contaminated wastes. The Holding Room shall be used as a drop location for bagged LBP passed from the Wash Room. This room shall be constructed so that bagged materials cannot be passed from the Wash Room through the Holding Room to the enclosed walkway. The walkway shall be separated from adjacent rooms by double flaps of 1.6 mm (1/16 inch) 1/16 inch thick single ply rubber roofing materials of EPDM or Neoprene. The enclosed walkway shall isolate the Holding Room from the building exterior and shall be constructed of wood framing and polyethylene sheeting. The walkway shall provide access to the Holding Room from the building exterior. The enclosed walkway shall be separated from the exterior by a single flap of polyethylene sheeting.

#### 3.2.5.10 Maintenance of Decontamination Units

Barriers and polyethylene sheeting shall be effectively sealed and taped. Containment barriers shall be visually inspected at the beginning of each work period. Damaged barriers and defects shall be immediately repaired upon discovery. Smoke methods shall be used to test effectiveness of barriers when directed by the Contracting Officer.

#### 3.2.5.11 LBP Control Area Exiting Procedures

Personnel exiting a LBP control area shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:

- a. Vacuum all protective clothing before removing.
- b. Remove protective clothing in the decontamination room, and place this clothing in an approved impermeable disposal bag.
- c. Wash or shower.
- d. Change to clean clothes prior to leaving the physical boundary designated around the lead-contaminated work site.

#### 3.2.6 Furnishings

The Contractor shall remove furniture and equipment from the work area before LBP removal work begins.

#### 3.2.7 Building Ventilating Systems

Any building ventilating system or any other system bringing air into or out of the LBP control work area shall be shut down and isolated by lockable switch; disconnecting wires; removing circuit breakers; isolated

by airtight seals, or other positive means that will prevent spread of contamination through the system and accidental premature restarting of the equipment. Airtight seals shall consist of rigid covers for supply and exhaust grills and 2 layers of polyethylene. Individual seals shall be applied to ventilation openings (supply and exhaust), lighting fixtures, clocks, windows, doorways, elevator doors, stairs, ramps, speakers, and other openings into the work area. Seals shall be maintained until project decontamination is completed. After decontamination work has been completed and final air sample testing proves that the area is decontaminated, seals shall be removed and the ventilating systems may be operated again.

### 3.2.8 Temporary Utilities

Temporary equipment to provide adequate power, light, heat, and water shall be installed to accomplish the abatement operations properly and safely. The Contractor shall maintain the security and maintenance of the utility system in the LBP control areas. In the event of a failure of any utility system, the Government will not be responsible for any loss of time or other expense incurred by the Contractor. Wiring and electrical service shall be as specified in NFPA 70, National Electrical Code. In addition, the Contractor shall provide:

- a. Backflow protection on all water connections. Fittings installed by the Contractor shall be removed after completion of work with no damage or alteration to existing water piping and equipment.
- b. Heavy-duty abrasion-resistant hoses to provide water to each work area and decontamination area.
- c. A hot water heater, if hot water is not supplied through the building's existing water supply to the decontamination showers.
- d. Electrical service to work areas. Electrical service shall comply with NEMA, NECA, and UL standards. Warning signs shall be posted at power outlets which are other than 110-120 volt power. Only grounded extension cords shall be used. Incandescent lamps and light fixtures shall be of adequate wattage to provide good illumination in LBP control areas.
- e. Temporary heating units, when needed, that have been tested and labeled by UL, FM, or another recognized trade association related to the fuel being consumed. Forced air or fan type units shall not be utilized inside a work area. Units shall have tip-over protection.
- f. Sufficient quantity of single-occupant, self-contained chemical toilets, properly vented and fully enclosed, if permanent toilets are not available.

## 3.3 LBP ABATEMENT METHODS

### 3.3.1 Encapsulation with Surface Coatings

Peeling and deteriorated surfaces shall be wet scraped prior to application of the approved encapsulant. Debris shall be handled in accordance with the Hazardous Waste Management Plan. Surfaces shall be prepared according to the manufacturer's specifications. Surface coatings shall not be applied to friction surfaces such as window tracks or door jams.

### 3.3.2 Encapsulation with Flexible Wall Covering Systems

Peeling and deteriorated surfaces shall be wet scraped prior to application of the approved flexible wall covering material. Debris shall be handled in accordance with the Hazardous Waste Management Plan. Surfaces shall be prepared according to the manufacturer's specifications.

### 3.3.3 Enclosure with Gypsum Board

Peeling and deteriorated surfaces shall be wet scraped prior to application of the enclosure. Gypsum board shall be used to create an enclosure over, in front of, or around the existing. The gypsum board shall be attached using drywall screws and construction adhesive. Electrical outlets, switches, telephone jacks and ventilating and heating registers shall be repositioned to be flush with the new gypsum board surface. Seams shall be taped and plastered according to local building codes and specifications. The complete enclosure shall be painted and finished molding, baseboard added.

### 3.3.4 Enclosure with Paneling

Peeling and deteriorated surfaces shall be wet scraped prior to application of the enclosure. Paneling shall be attached using nails, screws and construction adhesive. Electrical outlets, switches, telephone jacks and ventilating and heating registers shall be repositioned to be flush with the new gypsum board surface. Seams shall be sealed according to local building codes and specifications and finished molding, baseboard added.

### 3.3.5 Exterior Enclosure

Peeling and deteriorating surfaces shall be wet scraped prior to application of the approved vinyl, aluminum or wood siding. All debris shall be handled in accordance with the Hazardous Waste Management Plan. Siding and moisture barriers shall be installed according to manufacturer's specifications and local building codes.

- a. Doors and windows on the side of the building upon which a dust-generating method is being used, and on the same floor and all floors below, must be closed and covered with polyethylene sheeting.
- b. The ground and any plants or shrubs in the area in which exterior abatement is occurring shall be covered with a waterproof canvas tarp and weighted at all edges to prevent blowing. Such covering shall cover from the side of the structure to a point eight feet away from the structure. The covering shall be taped or otherwise attached to the structure. The tarp shall be placed in a manner that traps all debris and water. This is best accomplished by elevating the edges. The tarp shall be properly disposed of and not re-used.

### 3.3.6 Component Replacement

All doors and windows shall be removed from buildings and replaced as required in the Task Order. All debris shall be handled in accordance with the Hazardous Waste Management Plan. Replacement components shall be installed according to local building codes.

### 3.3.7 Chemical Stripping

LBP shall be removed by using approved chemical strippers. Chemical strippers containing methylene chloride are prohibited. Chemical stripping shall take place onsite or offsite as required in the Task Order. Stripping shall be done according to manufacturer's recommendations. Substrates shall be thoroughly washed and neutralized before applying a primer or sealing coat. Waste generated by the stripping process shall be handled in accordance with the Hazardous Waste Management Plan. Adjacent walls and floors shall be protected to prevent contamination.

### 3.3.8 Hand-Scraping with a Heat Gun

LBP shall be removed by hand-scraping with a heat gun. Paint residue shall be handled in accordance with the Hazardous Waste Management Plan. Heat guns shall be operated below 590 degrees C (1,100 degrees F) 1,100 degrees F to prevent possible release of toxic fumes or starting a fire.

### 3.3.9 Vacuum Blasting

LBP shall be removed by vacuum blasting techniques with the device fitted to HEPA vacuum systems. Work shall be performed in a LBP control area using negative pressure full containment with HEPA filtered exhaust. Paint residue shall be handled in accordance with the Hazardous Waste Management Plan.

### 3.3.10 Needle Gun

LBP shall be removed by needle gun with the device fitted to HEPA vacuum systems. Work shall be performed in a LBP control area using negative pressure full containment with HEPA filtered exhaust. Paint residue shall be handled in accordance with the Hazardous Waste Management Plan.

## 3.4 MONITORING

During the entire LBP removal and disposal operations, a CIH shall be onsite directing the monitoring/sampling and inspecting the work to ensure that the health and safety requirements of this contract are satisfied.

### 3.4.1 Personal Air Monitoring

Airborne concentrations of lead shall be collected and analyzed in accordance with 29 CFR 1926 Section .62. Results shall be reported in micrograms per cubic meter of air. The Competent Person shall use personal air monitoring results to determine the effectiveness of engineering controls, the adequacy of PPE and to determine if proper work practices are being employed. The Contracting Officer shall be notified if any personal air monitoring result equals or exceeds 30 micrograms per cubic meter of air. The Contractor shall take steps to reduce the concentration of lead in the air.

### 3.4.2 Wipe Sampling

Wipe sampling for lead dust concentrations shall be conducted:

- a. Preabatement to establish a baseline.
- b. During abatement to monitor activities and ensure containment integrity.

- c. Post abatement to determine if specified clearance criteria has been met.

#### 3.4.2.1 Preabatement

Preabatement wipe samples shall be collected outside the LBP control area in accordance with paragraph Preabatement Lead-Dust Wipe Samples. Samples outside the LBP control work area shall be collected at critical barriers, in the clean room of the decontamination unit and in traffic control areas such as personal and equipment entrances.

#### 3.4.2.2 Abatement

The CIH shall collect wipe samples during all LBP abatement activities on a daily basis. The samples shall be collected outside the LBP control area in accordance with paragraph Preabatement Lead-Dust Wipe Samples. Samples shall be collected outside the LBP control work area at critical barriers, in the clean room of the decontamination unit and in traffic control areas such as personal and equipment entrances.

#### 3.4.2.3 Results

The Contractor shall have the results of the wipe sampling within 48 hours after the completion of the sampling. Results shall be reported in micrograms per square foot.

#### 3.4.2.4 Excessive Levels

LBP abatement work being conducted within a LBP control area shall be stopped if measured dust wipe concentration levels collected outside the containment area, during abatement, equal or exceed the preabatement levels or 200 micrograms per square foot, whichever is greater. The Contractor shall immediately notify the Contracting Officer. At the direction of the Contracting Officer, the Contractor shall clean outside areas which equal or exceed the levels stated above, at no additional cost to the Government. The cleaning shall be in accordance with paragraph CLEANUP AND DISPOSAL, prior to clearance. The Contractor shall collect and have analyzed additional wipe samples at no charge to the Government to ensure the areas are clean. Cleaning and resampling shall continue until levels as stated above are achieved. The Contractor shall correct containment and/or work practices to mitigate the problem. Removal work shall resume when approval is given by the Contracting Officer.

#### 3.4.2.5 Post Abatement

Post abatement samples shall be collected in accordance with paragraph Final Clearance Testing.

#### 3.4.3 Area Air Monitoring

Airborne concentrations of lead shall be collected and analyzed in accordance with 29 CFR 1926 Section .62. Results shall be reported in micrograms per cubic meter of air.

##### 3.4.3.1 Preabatement

Preabatement samples shall be collected in the following locations outside the work area; one upwind of the abatement and two downwind of the

abatement activities.

#### 3.4.3.2 Abatement

The CIH shall collect area air samples on a daily basis. The samples shall be collected in the same location as the preabatement samples.

#### 3.4.3.3 Results

The Contractor shall have the results of the area air monitoring within 48 hours after completion of the sampling. Results shall be reported in micrograms per cubic meter of air.

#### 3.4.3.4 Excessive Levels

Outdoor LBP abatement shall cease and the Contracting Officer notified if measured airborne lead concentrations, collected during abatement, exceed the preabatement airborne concentration levels. The Contractor may be required to clean and resample the effected area, at no additional cost to the Government, if directed by the Contracting Officer. The Contractor shall correct the work practices and/or engineering controls and shall resume abatement at the direction of the Contracting Officer.

#### 3.4.4 Waste Sampling and Testing

Sampling and testing of all waste shall be in accordance with 40 CFR 261.

#### 3.4.5 Soil Sampling

##### 3.4.5.1 Preabatement

In order to establish baseline lead-in-soil conditions on the site prior to the initiation of exterior lead abatement, composite soil samples shall be collected. Eight to ten small portions of surface soil shall be scooped with a fresh 50 mL plastic centrifuge tube and composited in the tube. This will represent a single sample. If excessive paint chips are present in the soil they shall be included in the sample. The 8 - 10 samples shall be collected such that they represent the area where abatement occurred. One shall be taken at the dripline extending out a distance of 3 m.10 feet.

Sampling shall be on bare soil. The laboratory shall utilize procedures in EPA SOP Publication No. 600/2-91-231 or other procedures required by the state where work is being performed.

##### 3.4.5.2 Post Abatement

Post abatement soil samples shall be collected in the same locations as the preabatement samples utilizing the same procedures. If post abatement soil samples exceed the preabatement levels, the Contractor will be required to perform soil excavation to a depth of 50 mm two inches in the area specified by the Contracting Officer at no additional cost to the Government. The soil shall be tested as specified in paragraph CLEANUP AND DISPOSAL. Analysis that exceed TCLP limits shall be treated as LBP contaminated waste and disposed accordingly.

#### 3.5 ADJACENT AREAS

Damage to adjacent areas shall be repaired to the approval of the Contracting Officer.

### 3.6 CLEANUP AND DISPOSAL

#### 3.6.1 Cleanup

##### 3.6.1.1 Daily

Surfaces in the LBP control area shall be maintained free of accumulations of paint chips and dust. Spread of dust and debris shall be restricted; waste shall not be distributed over the work area. Dry sweep or compressed air shall not be used for cleanup. At the end of each shift, the area shall be cleaned of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner and wet mopping the area. LBP abatement work shall cease during the cleanup.

##### 3.6.1.2 Prior to Clearance

Upon completion of the lead paint abatement and a satisfactory visual inspection by the Contracting Officer in a given work area, a preliminary clean-up shall be performed by the Contractor. This clean-up includes removal of any contaminated material, equipment or debris including polyethylene sheeting from the work area, except for critical barriers. The polyethylene sheeting shall be sprayed or misted with water for dust control, abatement debris removed and then the sheeting removed by folding it in upon itself. Polyethylene sheeting used for critical barriers shall remain in place until final clearance criteria. The following methodology shall be utilized during the cleanup prior to clearance.

- a. Lead-contaminated debris shall be containerized in accordance with paragraph Contaminated Waste. Waste bags shall not be overloaded, shall be securely sealed and stored in the designated area until disposal.
- b. Non-contaminated debris shall be containerized; removed from the work area and stored in the designated area until disposal in accordance with paragraph Non-Contaminated Waste.
- c. Removal of surface polyethylene sheeting shall begin from upper levels such as cabinets and shelves. Removal of floor polyethylene sheeting shall begin at the corners and folded in the middle to contain the dust. Polyethylene shall be disposed of as specified for debris.
- d. Cleaning. Once the polyethylene sheeting, except critical barriers is removed from the work area, cleaning shall begin. It shall be done in the following sequence: HEPA Vacuum; Tri-Sodium Phosphate (TSP) wash (or equivalent cleaner); and HEPA Vacuum.
- e. HEPA Vacuum. Vacuum all surfaces. Begin with ceilings and proceed down the walls, including window, doors, door trim and ending with floors. Begin vacuuming at the furthest corner from the entrance to the work area.
- f. Wet Wash. Wash or mop the surfaces vacuumed in the same sequence. Contractor shall utilize a tri-sodium phosphate (TSP) detergent solution or other equally effective cleaning agent and allow surface to dry.
- g. Cleaning Equipment. The Contractor shall prepare and use detergents containing five to ten percent TSP or other equally

effective cleaning agent which shall be used in accordance with the manufacturers instructions. The waste water from cleaning shall be contained and disposed of according to applicable Federal, state, county and local regulations and guidelines. The waste water shall not be disposed of in storm sewers or sanitary sewers without specific and written Government approval.

### 3.6.2 Visual Inspection

Upon completion of the final cleaning, the Contractor shall notify the Contracting Officer and request a final visual inspection with the Contracting Officer's representative with the criteria in the final cleaning/visual inspection example format sheet located at the end of this section. If the area does not pass the visual inspection, the Contractor shall reclean the area as required by paragraph CLEANUP AND DISPOSAL, at no additional expense to the Government. Final clearance testing shall not proceed until the Contracting Officer has accepted the final cleaning by the Contractor.

### 3.6.3 Final Clearance Testing

Final clearance surface dust sampling in accordance with HUD-01 shall be conducted after a thorough cleanup has been completed in accordance with the following:

- a. Onsite paint removal throughout the unit. Three samples shall be taken (one from a window sill, one from a window well, and one from the floor) in each area. An area is defined as a room, closet, pantry, hall, portion of a room, etc.
- b. Onsite paint removal in limited areas. Three samples shall be taken (one from a window sill, one from a window well, and one from the floor) in each area abated and one sample outside the containment area (within ten feet in 20 percent of the abated units). Pre-abatement wipe samples shall be compared to determine if dust from the abatement process has contaminated non-abated areas. The Contractor shall cleanup these areas if contamination from the abatement process occurs.
- c. Replacement and/or encapsulation only throughout the unit. One wipe sample shall be taken in each area divided equally between window wells, window sills, and floors.
- d. Replacement and/or encapsulation only in limited areas. One wipe sample shall be taken in each abated area divided equally between window wells, window sills, and floors, and one wipe sample outside the containment area within ten feet in 20 percent of the abated units.
- e. Exterior abatement. At least one wipe sample shall be taken on a horizontal surface in part of the living area such as a front porch.

Retests. Should laboratory results indicate that the wipe test clearance level is exceeded, the Contractor shall reclean the affected area, at no additional cost to the Government. The Contractor shall utilize specified cleaning methods. Retesting will then be performed to determine if specified clearance criteria was met. The Contractor shall pay for additional testing and shall provide, at no additional cost, a recleaning

of an affected area until the clearance level is achieved.

#### 3.6.4 Certification

The Competent Person shall certify in writing that inside the LBP control area and the area external to the LBP control area met final clearance requirements.

#### 3.6.5 Removal of Control Area

After approval of the final clearance certification, and when authorized by the Contracting Officer, the LBP control area, containment barriers, and control structures roped-off boundary and warning signs shall be removed.

#### 3.6.6 Disposal

##### 3.6.6.1 Toxicity Characteristic Leaching Procedure (TCLP) Results

The results of the TCLP analysis performed during abatement shall be used to determine disposal procedures.

##### 3.6.6.2 Contaminated Waste

Lead-contaminated waste, scrap, and debris shall be disposed of as follows:

- a. Lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing, which may produce airborne concentrations of lead particles shall be stored in U.S. Department of Transportation 49 CFR 178 approved 200 liter (55 gallon) 55 gallon drums. Each drum shall be labeled to identify the type of waste as defined in 49 CFR 172 and the date lead-contaminated wastes were first put into the drum. The Uniform Hazardous Waste Manifest forms from Federal and state agencies shall be obtained and completed. Land disposal restriction notifications shall be as required by 40 CFR 268. The Contracting Officer shall be notified at least 14 days prior to delivery to arrange for job site inspection of the drums and manifests. Lot deliveries of hazardous wastes shall be made as needed to ensure that drums do not remain on the work site longer than 90 calendar days from the date affixed to each drum. The Contracting Officer will assign an area for interim storage of waste-containing drums.
- b. Lead-contaminated waste shall be handled, stored, transported, and disposed of in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Land disposal restriction notification shall be as required by 40 CFR 268.

##### 3.6.6.3 Non-Contaminated Waste

Non-contaminated waste, scrap, and debris shall be disposed of off-site.

#### 3.6.7 Disposal Documentation

Written evidence shall be provided that the hazardous waste treatment, storage, or disposal facility is approved for lead disposal by the EPA and state or local regulatory agencies. One copy shall be submitted of the completed manifest; signed, and dated by the initial transporter in accordance with 40 CFR 262.

3.6.8 Title to Materials

Materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor, and shall be disposed of in accordance with Section 02220 DEMOLITION, except as specified herein.

3.6.9 Payment for Hazardous Waste

Payment for disposal of hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Government.

CERTIFICATION OF FINAL CLEANING AND VISUAL INSPECTION

Individual abatement task as identified in paragraph,  
Description of Work\_\_\_\_\_

In accordance with the clearing and decontamination procedures specified in the Contractor's lead hazard abatement plan and this contract, the Contractor hereby certifies that he/she has thoroughly visually inspected the decontaminated regulated work area (all surfaces, including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) and has found no dust, debris, or lead containing material residue.

BY: (Contractor's signature)\_\_\_\_\_  
Date\_\_\_\_\_  
Print name and  
title\_\_\_\_\_

(Contractor's Onsite Supervisor signature)\_\_\_\_\_  
Date\_\_\_\_\_  
Print name and  
title\_\_\_\_\_

(Contractor's CIH signature)\_\_\_\_\_ Date\_\_\_\_\_  
Print name and  
title\_\_\_\_\_

CONTRACTING OFFICER ACCEPTANCE OR REJECTION

The Contracting Officer hereby determines that the Contractor has performed final cleaning and visual inspection of the decontaminated regulated work area (all surfaces including pipes, beams, ledges, walls, ceiling, floor, decontamination unit, etc.) and by quality assurance inspection, finds the Contractor's final cleaning to be:

\_\_\_\_\_ Acceptable

\_\_\_\_\_ Unacceptable, Contractor instructed to reclean the LBP control work area

BY: Contracting Officer's Representative

Signature\_\_\_\_\_  
Date\_\_\_\_\_  
Print name and  
title\_\_\_\_\_

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## SECTION 02111

## EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 698	(1991) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1995a) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 5434	(1993) Guide for Field Logging of Subsurface Explorations of Soil and Rock

## CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 302	Designation, Reportable Quantities, and Notification
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## 1.2 SURVEYS

Surveys shall be performed immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. The Contractor shall provide cross-sections on 7.6 meter 25 foot intervals and at obvious break points for all excavated areas. Locations of confirmation samples shall also be surveyed. Surveys shall be performed as required in the Task Order.

### 1.3 MEASUREMENT AND PAYMENT

#### 1.3.1 Measurement

Measurement for excavation shall be based on the actual number of cubic meters yards of contaminated material in-place, prior to excavation. Determination of the volume of contaminated material excavated shall be based on cross-sectional volume determination reflecting the differential between the original elevations of the top of the contaminated material and the final elevations after removal of the contaminated material. Measurement for backfilling of excavated areas shall be based on in-place cubic meters yards of compacted fill. Measurement for construction of stockpile areas shall be based on the number of square meters yards of stockpile liner constructed.

#### 1.3.2 Payment

##### 1.3.2.1 Excavation and Transportation

Compensation for excavation and onsite transportation of contaminated material will be paid as a unit cost. This unit cost shall include any other items incidental to excavation and handling not defined as having a specific unit cost.

##### 1.3.2.2 Backfilling

Compensation for backfill soils, backfilling, and geotechnical testing to verify soil type and compaction will be paid as a single unit cost.

##### 1.3.2.3 Stockpiling

Compensation for construction of stockpile areas will be paid for as a unit cost. This unit cost shall include grading required to construct the stockpile, cover materials, liner materials, construction of berms, and any other items incidental to construction of stockpiles.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation, submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Excavation and Handling Work Plan; GA.

Work Plan within 30 calendar days after notice to proceed. No work at the site, with the exception of site inspections and surveys, shall be performed until the Work Plan is approved. The Contractor shall allow 30 calendar days in the schedule for the Government's review. No adjustment for time or money will be made if resubmittals of the Work Plan are

required due to deficiencies in the plan. At a minimum, the Work Plan shall include:

- a. Schedule of activities.
- b. Method of excavation and equipment to be used.
- c. Shoring or side-wall slopes proposed.
- d. Dewatering plan.
- e. Storage methods and locations for liquid and solid contaminated material.
- f. Borrow sources and haul routes.
- g. Decontamination procedures.
- h. Spill contingency plan.

SD-09 Reports

Surveys; GA.

Cross-sections and areas of excavation.

Backfill Material; GA. Confirmation Sampling and Analysis; GA. Sampling of Stored Material; GA. Sampling Liquid; GA. Compaction; GA. Chemical Testing; GA.

Test results.

Closure Report; GA.

Six copies of Closure Report within 14 calendar days of work completion at the site.

1.5 REGULATORY REQUIREMENTS

1.5.1 Permits and Licenses

The Contractor shall obtain required federal, state, and local permits for excavation and storage of contaminated material. Permits shall be obtained at no additional cost to the Government.

1.5.2 Air Emissions

Air emissions shall be monitored and controlled in accordance as required by the Task Order.

1.6 DESCRIPTION OF WORK

The work shall consist of excavation and temporary storage of contaminated material. Approximate locations of contaminated material are shown on the drawings. Chemical analysis of contaminated material may or may not have been performed by the Government and if done will be shown in the Task Order. Subsurface conditions are shown in the Task Order. The Contractor shall perform an independent evaluation of the site characterization data. The Contracting Officer shall be notified within 48 hours if contaminated

material is discovered which has not been previously identified or if other discrepancies between data provided and actual field conditions are discovered. Backfill material is not available onsite. Ground water is as shown by the Task Order below pre-excitation ground surface and may or may not be expected to be encountered during excavation activities as shown by the Task Order.

1.7 CHEMICAL TESTING

Required sampling and chemical analysis shall be conducted in accordance with applicable specifications.

1.8 SCHEDULING

The Contractor shall notify the Contracting Officer 15 calendar days prior to the start of excavation of contaminated material. The Contractor shall be responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.

PART 2 PRODUCTS

2.1 BACKFILL MATERIAL

Backfill material shall be obtained from offsite. Backfill shall be classified in accordance with ASTM D 2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, MH, CL, or CH and shall be free from roots and other organic matter, trash, debris, snow, ice or frozen materials. Backfill material shall be tested for Atterberg limits (ASTM D 4318), grain-size distribution (ASTM D 422), and compaction characteristics (ASTM D 698 or ASTM D 1557 as required by the Task Order) at a frequency of once per 3000 cubic meters yards. A minimum of one set of classification tests shall be performed per borrow source and 1 backfill sample shall be collected and tested for the following list of contaminants:

Chemical Parameter	Test Frequency	Regulatory Limit
--------------------	----------------	------------------

(as required by the Task Order)

Backfill shall not be used until borrow source chemical and physical test results have been submitted and approved.

2.2 SPILL RESPONSE MATERIALS

The Contractor shall provide spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times in which hazardous materials/wastes are being handled or transported.

Spill response materials shall be compatible with the type of materials and contaminants being handled.

PART 3 EXECUTION

3.1 EXISTING STRUCTURES AND UTILITIES

No excavation shall be performed until site utilities have been field located. The Contractor shall take the necessary precautions to ensure no damage occurs to existing structures and utilities. Damage to existing structures and utilities resulting from the Contractor's operations shall be repaired at no additional cost to the Government. Utilities encountered

that were not previously shown or otherwise located shall not be disturbed without written approval from the Contracting Officer.

3.2 CONTAMINATED MATERIAL REMOVAL

3.2.1 Stripping

The upper non-contaminated layers of soil in the area of contamination shall be considered clean and shall be stripped and stockpiled separately from contaminated material, at the location shown on the drawings. The upper 0.152 meters 0.5 feet of stripped soil shall be defined as topsoil and shall be stockpiled separately from the remainder of the stripped soil. No liner system will be required beneath stripped material.

3.2.2 Excavation

Areas of contamination shall be excavated to within 60 mm 0.2 feet of the depth and extent shown on the drawings or as directed by the Contracting Officer. Excavation shall be performed in a manner that will limit the potential for contaminated material to be mixed with uncontaminated material. The Contractor shall maintain an excavation of sufficient size to allow workers ample room to complete the work. A log of the materials and any visible signs of contamination encountered during excavation shall be maintained for each area of excavation. Excavation logs shall be prepared in accordance with ASTM D 5434.

3.2.3 Shoring

Sheeting, bracing, or shoring shall be installed in the absence of adequate side slopes if there is a need for workers to enter the excavated area.

3.2.4 Dewatering

Surface water shall be diverted to prevent entry into the excavation. Dewatering shall be limited to that necessary to assure adequate access, a safe excavation, and to ensure that compaction requirements can be met.

3.3 CONFIRMATION SAMPLING AND ANALYSIS

The Contracting Officer shall be present to inspect the removal of contaminated material from each site. After all material suspected of being contaminated has been removed, the excavation shall be examined for evidence of contamination and, if appropriate, field analysis used to determine the presence of volatile and/or semi-volatile contamination using a real time vapor monitoring instrument or immunoassay field kits as required by the Task Order. Excavation of additional material shall be as directed by the Contracting Officer. After all suspected contaminated material is removed, confirmation samples shall be collected and analyzed for the following contaminants:

Chemical Parameter	Action Level
--------------------	--------------

(as required by the Task Order)

Samples shall be collected at a frequency of one per 100 square meters 119 .6 square yards from the bottom and each of the side walls or as directed by the Contracting Officer. A minimum of one sample shall be collected from the bottom and each side wall of the excavation. Based on test results, the Contractor shall propose any additional excavation which may

be required to remove material which is contaminated above action levels. Additional excavation shall be subject to approval by the Contracting Officer. Locations of samples shall be marked in the field and documented on the as-built drawings.

### 3.4 CONTAMINATED MATERIAL STORAGE

Material shall be placed in temporary storage immediately after excavation or after treatment while awaiting test results as required by the Task Order. The following paragraphs describe acceptable methods of material storage. Storage units shall be in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, each unit shall be clearly labeled with an identification number and a written log shall be kept to track the source of contaminated material in each temporary storage unit.

#### 3.4.1 Stockpiles

Stockpiles shall be constructed to isolate stored contaminated material from the environment. The maximum stockpile size shall be 300 cubic meters. 392.66 cubic yards. Stockpiles shall be constructed to include:

- a. A chemically resistant geomembrane liner. Non-reinforced geomembrane liners shall have a minimum thickness of 0.5 mm. 20 mils. Scrim reinforced geomembrane liners shall have a minimum weight of 20 kg/100 square meters. 40 lbs. per 1000 square feet. The ground surface on which the geomembrane is to be placed shall be free of rocks greater than 12 mm 0.5 inches in diameter and any other object which could damage the membrane.
- b. Geomembrane cover to prevent precipitation from entering the stockpile. Non-reinforced geomembrane covers shall have a minimum thickness of 0.25 mm. 10 mils. Scrim reinforced geomembrane covers shall have a minimum weight of 13 kg/100 square meters 26 lbs. per 1000 square feet. The cover material shall be anchored to prevent it from being removed by wind.
- c. Berms surrounding the stockpile, a minimum of 300 mm 12 inches in height. Vehicle access points shall also be bermed.
- d. Storage and removal of liquid which collects in the stockpile, in accordance with paragraph Liquid Storage.

#### 3.4.2 Roll-Off Units

Water-tight roll-off units shall be used to temporarily store contaminated material. An impermeable cover shall be placed over the units to prevent precipitation from contacting the stored material. The units shall be located as required by the Task Order. Liquid which collects inside the units shall be removed and stored in accordance with paragraph Liquid Storage.

#### 3.4.3 Liquid Storage

Liquid collected from excavations and stockpiles shall be temporarily stored in 220 L barrels. 55 gallon barrels. Liquid storage containers shall be water-tight and shall be located as required by the Task Order.

### 3.5 SAMPLING

3.5.1 Sampling of Stored Material

Samples of stored material shall be collected at a frequency of once per 300 cubic meters. 392.66 cubic yards. Samples shall be tested for the following:

Chemical Parameter	Action Level
--------------------	--------------

(as required by the Task Order)

Stored material with contaminant levels that exceed the action levels shall be treated offsite. Analyses for contaminated material to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analyses to the extent required by the approved offsite treatment, storage or disposal (TSD) facility shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government and subject to approval by the Contracting Officer.

3.5.2 Sampling Liquid

Liquid collected from excavations, storage areas and decontamination facilities shall be sampled at a frequency of once for every 2,000 L 500 gallons of liquid collected. Samples shall be tested for the following:

Chemical Parameter	Action Level
--------------------	--------------

(as required by the Task Order)

Liquid with contaminant levels that exceed action levels shall be treated offsite. Analyses for contaminated liquid to be taken to an offsite treatment facility shall conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analysis to the extent required by the approved offsite treatment, storage or disposal (TSD) facility receiving the material shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government and subject to approval by the Contracting Officer.

3.5.3 Sampling Beneath Storage Units

Samples from beneath and 1 m 3 feet outside of each storage unit shall be collected prior to construction of and after removal of the storage unit. Samples shall be collected at a frequency of one per each 100 square meters 119.68 square yards from a depth interval of 0 to 0.15 m 0 to 0.5 feet and shall be tested for the following:

Chemical Parameter	Action Level
--------------------	--------------

(as required by the Task Order)

Based on test results, soil which has become contaminated above action levels shall be removed at no additional cost to the Government. Contaminated material which is removed from beneath the storage unit shall be handled in accordance with paragraph Sampling of Stored Material. As

directed by the Contracting Officer and at no additional cost to the Government, additional sampling and testing shall be performed to verify spills have been cleaned up.

### 3.6 SPILLS

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify the Contracting Officer immediately. If the spill exceeds the reporting threshold, the Contractor shall follow the pre-established procedures as described in the RCRA Contingency Plan or Base Wide Contingency Plan as required by the Task Order for immediate reporting and containment. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, state, and local regulations. As directed by the Contracting Officer, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Government.

### 3.7 BACKFILL

#### 3.7.1 Confirmation Test Results

Excavations shall be backfilled immediately after all contaminated materials have been removed and confirmation test results have been approved. After completion of backfilling, a 0.15 meter 6 inch layer of top soil shall be placed in a single lift to the lines and grades shown on the drawings.

#### 3.7.2 Compaction

Approved backfill shall be placed in lifts with a maximum loose thickness of 200 mm. 8 inches. Soil shall be compacted to 90 percent of ASTM D 1557 maximum dry density for cohesive soils and 95 percent of ASTM D 1557 maximum dry density for cohesionless soils. Density tests shall be performed at a frequency of once per 930 square meters 10,000 square feet per lift. A minimum of one density test shall be performed on each lift of backfill placed. Field in-place dry density shall be determined in accordance with ASTM D 1556.

### 3.8 DISPOSAL REQUIREMENTS

Offsite disposal of contaminated material shall be in accordance with Section 02120 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS.

### 3.9 CLOSURE REPORT

Six copies of a Closure Report shall be prepared and submitted within 21 calendar days of completing work at the site. The report shall be labeled with the contract number, project name, location, date, name of general contractor, and the Corps of Engineers District contracting for the work. The Closure Report shall include the following information as a minimum:

- a. A cover letter signed by a responsible company official certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents.
- b. A narrative report including, but not limited to, the

following:

(1) site conditions, ground water elevation, and cleanup criteria;

(2) excavation logs;

(3) field screening readings;

(4) quantity of materials removed from each area of contamination;

(5) quantities of water/product removed during dewatering;

(6) sampling locations and sampling methods;

(7) collection data such as time of collection and method of preservation;

(8) sample chain-of-custody forms; and

(9) source of backfill.

c. Copies of all chemical and physical test results.

d. Copies of all manifests and land disposal restriction notifications.

e. Copies of all certifications of final disposal signed by the responsible disposal facility official.

f. Waste profile sheets.

g. Scaled drawings showing limits of each excavation, limits of contamination, known underground utilities within 15 m 50 feet of excavation, sample locations, and sample identification numbers.

h. Progress Photographs. Color photographs shall be used to document progress of the work. A minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions shall be taken before work begins. After work has been started, activities at each work location shall be photographically recorded daily or weekly as required by the Task Order. Photographs shall be a minimum of 76.2 x 127.0 mm 3 x 5 inches and shall include:

(1) Soil removal, handling, and sampling.

(2) Unanticipated events such as discovery of additional contaminated material.

(3) Contaminated material storage.

(4) Site or task-specific employee respiratory and personal protection.

(5) Fill placement and grading.

(6) Post-construction photographs. After completion of work

at each site, the Contractor shall take a minimum of four views of each excavation site.

Photographs shall be mounted back-to-back in double face plastic sleeves punched to fit standard three ring binders. Each print shall have an information box attached. The box shall be typewritten and arranged as follows:

Project Name:	Direction of View:
Location:	Date/Time:
Photograph No.:	Description of View:

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SECTION 02120  
TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS

## PART 1 GENERAL

## 1.1 REFERENCES

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.

## CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 302	Designation, Reportable Quantities, and Notification
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

49 CFR 107	Hazardous Materials Program Procedures
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-1 Data

On-site Hazardous Waste Management; GA.  
Off-site Hazardous Waste Management; GA.

Prior to start of work, a plan detailing the manner in which hazardous wastes shall be managed.

### SD-09 Reports

Recordkeeping; GA.

Information necessary to file state annual or EPA biennial reports for all hazardous waste transported, treated, stored, or disposed of under this contract. The Contractor shall not forward these data directly to the regulatory agency but to the Contracting Officer at the specified time. The submittal shall contain all the information necessary for filing of the formal reports in the form and format required by the governing Federal or state regulatory agency. A cover letter shall accompany the data to include the contract number, Contractor name, and project location.

Spill Response; FIO.

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), or pollutant or contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify the Contracting Officer immediately. If the spill exceeds a reporting threshold, the Contractor shall follow the pre-established procedures for immediate reporting to the Contracting Officer.

Exception Reports; GA.

In the event that a manifest copy documenting receipt of hazardous waste at the treatment, storage, and disposal facility is not received within 35 days of shipment initiation, the Contractor shall prepare and submit an exception report to the Contracting Officer within 37 days of shipment initiation.

### SD-13 Certificates

Qualifications; FIO.

Copies of the current certificates of registration issued to the Contractor and/or subcontractors or written statements certifying exemption from these requirements.

Off-Site Policy Compliance Certification; FIO.

A letter certifying that EPA considers the facilities to be used for all off-site disposal to be acceptable in accordance with the Off-Site policy in 40 CFR 300, Section .440. This certification shall be provided for wastes from Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6901 et seq., sites as well as from Comprehensive Environmental Response Compensation and Liability Act (CERCLA), 42 U.S.C. 9601 et seq., responses. See Attachment A, sample certification, at the end of this section.

Certificates of Disposal; FIO.

Certificates documenting the ultimate disposal of hazardous wastes, polychlorinated biphenyls (PCBs), and/or asbestos within 30 days of initial shipment. Receipt of these certificates will be required for final payment.

Shipping Documents and Packagings Certification; GA.

All transportation related shipping documents to the Contracting Officer, including draft hazardous waste manifests draft asbestos waste shipment records draft manifests for PCBs for review a minimum of 14 days prior to anticipated pickup. Packaging assurances shall be furnished prior to transporting hazardous material; "generator copies" of hazardous waste manifests, asbestos waste shipment records, "generator copies" of manifests used for initiating shipments of PCBs, supporting waste analysis documents shall be furnished when shipments are originated; and "receipt copies" of asbestos waste shipment records at the designated disposal facility shall be furnished not later than 35 days after acceptance of the shipment.

#### SD-18 Records

Notices of Non-Compliance and Notices of Violation; FIO.

Notices of non-compliance or notices of violation by a Federal, state, or local regulatory agency issued to the Contractor in relation to any work performed under this contract. The Contractor shall immediately provide copies of such notices to the Contracting Officer. The Contractor shall also furnish all relevant documents regarding the incident and any information requested by the Contracting Officer, and shall coordinate its response to the notice with the Contracting Officer or his designated representative prior to submission to the notifying authority. The Contractor shall also furnish a copy to the Contracting Officer of all documents submitted to the regulatory authority, including the final reply to the notice, and all other materials, until the matter is resolved.

### 1.3 QUALIFICATIONS

#### 1.3.1 Transportation and Disposal Coordinator

The Contractor shall designate, by position and title, one person to act as the Transportation and Disposal Coordinator (TDC) for this contract. The TDC shall serve as the single point of contact for all environmental regulatory matters and shall have overall responsibility for total

environmental compliance at the site including, but not limited to, accurate identification and classification of hazardous waste and hazardous materials; determination of proper shipping names; identification of marking, labeling, packaging and placarding requirements; completion of waste profiles, hazardous waste manifests, asbestos waste shipment records, PCB manifests, bill of ladings, exception and discrepancy reports; and all other environmental documentation. The TDC shall have, at a minimum, one year of specialized experience in the management and transportation of hazardous waste.

#### 1.3.2 Training

The Contractor's hazardous materials employees shall be trained, tested, and certified to safely and effectively carry out their assigned duties in accordance with Section 01351 SAFETY, HEALTH, AND EMERGENCY RESPONSE (HTRW/UST). The Contractor's employees transporting hazardous materials or preparing hazardous materials for transportation shall be trained, tested, and certified in accordance with 49 CFR 172.

#### 1.3.3 Certification

The Contractor and/or subcontractors transporting hazardous materials shall possess a current certificate of registration issued by the Research and Special Programs Administration (RSPA), U.S. Department of Transportation, when required by 49 CFR 107, Subpart G.

#### 1.4 LAWS AND REGULATIONS REQUIREMENTS

Work shall meet or exceed the minimum requirements established by Federal, state, and local laws and regulations which are applicable. These requirements are amended frequently and the Contractor shall be responsible for complying with amendments as they become effective. In the event that compliance exceeds the scope of work or conflicts with specific requirements of the contract, the Contractor shall notify the Contracting Officer immediately.

#### 1.5 DEFINITIONS

- a. Hazardous Material. A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated pursuant to the Hazardous Materials Transportation Act, 49 U.S.C. Appendix Section 1801 et seq. The term includes materials designated as hazardous materials under the provisions of 49 CFR 172, Sections .101 and .102 and materials which meet the defining criteria for hazard classes and divisions in 49 CFR 173. EPA designated hazardous wastes are also hazardous materials.
- b. Hazardous Waste. A waste which meets criteria established in RCRA or specified by the EPA in 40 CFR 261 or which has been designated as hazardous by a RCRA authorized state program.

#### PART 2 PRODUCTS

##### 2.1 MATERIALS

The Contractor shall provide all of the materials required for the packaging, labeling, marking, placarding and transportation of hazardous

wastes and hazardous materials in conformance with Department of Transportation standards. Details in this specification shall not be construed as establishing the limits of the Contractor's responsibility.

#### 2.1.1 Packagings

The Contractor shall provide bulk and non-bulk containers for packaging hazardous materials/wastes consistent with the authorizations referenced in the Hazardous Materials Table in 49 CFR 172, Section .101, Column 8. Bulk and non-bulk packaging shall meet the corresponding specifications in 49 CFR 173 referenced in the Hazardous Materials Table, 49 CFR 172, Section .101. Each packaging shall conform to the general packaging requirements of Subpart B of 49 CFR 173, to the requirements of 49 CFR 178 at the specified packing group performance level, to the requirements of special provisions of column 7 of the Hazardous Materials Table in 49 CFR 172, Section .101, and shall be compatible with the material to be packaged as required by 40 CFR 262. The Contractor shall also provide other packaging related materials such as materials used to cushion or fill voids in overpacked containers, etc. Sorbent materials shall not be capable of reacting dangerously with, being decomposed by, or being ignited by the hazardous materials being packaged. Additionally, sorbents used to treat free liquids to be disposed of in landfills shall be non-biodegradable as specified in 40 CFR 264, Section .314.

#### 2.1.2 Markings

The Contractor shall provide markings for each hazardous material/waste package, freight container, and transport vehicle consistent with the requirements of 49 CFR 172, Subpart D and 40 CFR 262, Section .32 (for hazardous waste), 40 CFR 761, Section .45 (for PCBs), 40 CFR 61, Section .149(d) (for asbestos). Markings shall be capable of withstanding, without deterioration or substantial color change, a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation.

#### 2.1.3 Labeling

The Contractor shall provide primary and subsidiary labels for hazardous materials/wastes consistent with the requirements in the Hazardous Materials Table in 49 CFR 172, Section .101, Column 6. Labels shall meet design specifications required by 49 CFR 172, Subpart E including size, shape, color, printing, and symbol requirements. Labels shall be durable and weather resistant and capable of withstanding, without deterioration or substantial color change, a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation.

#### 2.1.4 Placards

For each off-site shipment of hazardous material/waste, the Contractor shall provide primary and subsidiary placards consistent with the requirements of 49 CFR 172, Subpart F. Placards shall be provided for each side and each end of bulk packaging, freight containers, transport vehicles, and rail cars requiring such placarding. Placards may be plastic, metal, or other material capable of withstanding, without deterioration, a 30 day exposure to open weather conditions and shall meet design requirements specified in 49 CFR 172, Subpart F.

#### 2.1.5 Spill Response Materials

The Contractor shall provide spill response materials including, but not limited to, containers, adsorbent, shovels, and personal protective equipment. Spill response materials shall be available at all times in which hazardous materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of material being handled.

## 2.2 EQUIPMENT AND TOOLS

The Contractor shall provide miscellaneous equipment and tools necessary to handle hazardous materials and hazardous wastes in a safe and environmentally sound manner.

## PART 3 EXECUTION

### 3.1 ON-SITE HAZARDOUS WASTE MANAGEMENT

These paragraphs apply to Government owned waste only. Contractors are prohibited by 10 U.S.C. 2692 from storing contractor owned waste on site for any length of time. The Contractor shall be responsible for ensuring compliance with all Federal, state, and local hazardous waste laws and regulations and shall verify those requirements when preparing reports, waste shipment records, hazardous waste manifests, or other documents. The Contractor shall identify hazardous wastes using criteria set forth in 40 CFR 261 or all applicable state and local laws, regulations, and ordinances. When accumulating hazardous waste on-site, the Contractor shall comply with generator requirements in 40 CFR 262 and any applicable state or local law or regulations. On-site accumulation times shall be restricted to applicable time frames referenced in 40 CFR 262, Section .34 and any applicable state or local law or regulation. Accumulation start dates shall commence when waste is first generated (i.e. containerized or otherwise collected for discard). The Contractor shall only use containers in good condition and compatible with the waste to be stored. The Contractor shall be responsible for ensuring containers are closed except when adding or removing waste. The Contractor shall be responsible for immediately marking all hazardous waste containers with the words "hazardous waste" and other information required by [40 CFR 262, Section .32] [and] [any applicable state or local law or regulation] as soon as the waste is containerized. An additional marking shall be placed on containers of "unknowns" designating the date sampled, and the suspected hazard. The Contractor shall be responsible for inspecting containers for signs of deterioration and shall be responsible for responding to any spills or leaks. The Contractor shall inspect all hazardous waste areas weekly and shall provide written documentation of the inspection. Inspection logs shall contain date and time of inspection, name of individual conducting the inspection, problems noted, and corrective actions taken.

#### 3.1.1 Hazardous Waste Classification

The Contractor, in consultation with the Contracting Officer and waste generator, shall identify all waste codes applicable to each hazardous waste stream based on requirements in 40 CFR 261 or any applicable state or local law or regulation. The Contractor shall also identify all applicable treatment standards in 40 CFR 268 and state land disposal restrictions and shall make a determination as to whether or not the waste meets or exceeds the standards. Waste profiles, analyses, classification and treatment standards information shall be submitted to Contracting Officer for review and approval.

### 3.1.2 Management Plan

The Contractor shall prepare a plan detailing the manner in which hazardous wastes will be managed and describing the types and volumes of hazardous wastes anticipated to be managed as well as the management practices to be utilized. The plan shall identify the method to be used to ensure accurate piece counts and/or weights of shipments; shall identify waste minimization methods; shall propose facilities to be utilized for treatment, storage, and/or disposal; shall identify areas on-site where hazardous wastes are to be handled; shall identify whether transfer facilities are to be utilized; and if so, how the wastes will be tracked to ultimate disposal.

### 3.2 OFF-SITE HAZARDOUS WASTE MANAGEMENT

The Contractor shall use RCRA Subtitle C permitted facilities which meet the requirements of 40 CFR 264 or facilities operating under interim status which meet the requirements of 40 CFR 265. Off-site treatment, storage, and/or disposal facilities with significant RCRA violations or compliance problems (such as facilities known to be releasing hazardous constituents into ground water, surface water, soil, or air) shall not be used.

#### 3.2.1 Description of TSD Facility and Transporter

The Contractor shall provide the Contracting Officer with EPA ID numbers, names, locations, and telephone numbers of TSD facilities and transporters. This information shall be contained in the Hazardous Waste Management Plan for approval prior to waste disposal.

#### 3.2.2 Status of the Facility

Facilities receiving hazardous waste must be permitted in accordance with 40 CFR 270 or operating under interim status in accordance with 40 CFR 265 requirements, or must be permitted by an authorized state program. Additionally, prior to using a TSD Facility, the Contractor shall contact the EPA Regional Off-site Coordinator specified in 40 CFR 300, Section .440, to determine the facility's status, and document all information necessary to satisfy the requirements of the EPA Off-Site policy and furnish this information to the Contracting Officer.

#### 3.2.3 Shipping Documents and Packagings Certification

Prior to shipment of any hazardous material off-site, the Contractor's TDC shall provide written certification to the Contracting Officer that hazardous materials have been properly packaged, labeled, and marked in accordance with Department of Transportation and EPA requirements.

#### 3.2.4 Transportation

The Contractor shall use manifests for transporting hazardous wastes as required by 40 CFR 263 or any applicable state or local law or regulation. Transportation shall comply with all requirements in the Department of Transportation referenced regulations in the 49 CFR series. The Contractor shall acquire manifests in accordance with the hierarchy established in 40 CFR 262, Section .21. The Contractor shall prepare hazardous waste manifests for each shipment of hazardous waste shipped off-site. Manifests shall be completed using instructions in 40 CFR 262, Subpart B and any applicable state or local law or regulation. Manifests and waste profiles shall be submitted to Contracting Officer for review and approval. The

Contractor shall prepare land disposal restriction notifications as required by 40 CFR 268 or any applicable state or local law or regulation for each shipment of hazardous waste. Notifications shall be submitted with the manifest to the Contracting Officer for review and approval. When the additional cost of sending a qualified USACE representative to a remote location for a small clean up project is unwarranted, the option of requiring the on-site Contractor to sign the manifests on behalf of the generator is permitted and should be considered. This option shall only be exercised on a project specific basis, if prior to the solicitation process, written authorization of the customer and approval of the Chief, Construction Division at the executing district has been obtained, and the technical provisions of the contract solicitation provide competing contractors notice of the requirement.

### 3.2.5 Treatment and Disposal of Hazardous Wastes

The hazardous waste shall be transported to an approved hazardous waste treatment, storage, or disposal facility within 30 days of the accumulation start date on each container. The Contractor shall ship hazardous wastes only to facilities which are properly permitted to accept the hazardous waste or operating under interim status. The Contractor shall ensure wastes are treated to meet land disposal treatment standards in 40 CFR 268 prior to land disposal. The Contractor shall propose TSD facilities via submission of the Hazardous Waste Management Plan, subject to the approval of the Contracting Officer.

### 3.3 HAZARDOUS MATERIALS MANAGEMENT

The Contractor, in consultation with the Contracting Officer and generator, shall evaluate, prior to shipment of any material off-site, whether the material is regulated as a hazardous waste in addition to being regulated as a hazardous material; this shall be done for the purpose of determining proper shipping descriptions, marking requirements, etc., as described below.

#### 3.3.1 Identification of Proper Shipping Names

The Contractor shall use 49 CFR 172, Section .101 to identify proper shipping names for each hazardous material (including hazardous wastes) to be shipped off-site. Proper shipping names shall be submitted to the Contracting Officer in the form of draft shipping documents for review and approval.

#### 3.3.2 Packaging, Labeling, and Marking

The Contractor shall package, label, and mark hazardous materials/wastes using the specified materials and in accordance with the referenced authorizations. The Contractor shall mark each container of hazardous waste of 418 L 104 gallons or less with the following:

"HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal.  
If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency.  
Generator's name \_\_\_\_\_  
Manifest Document Number \_\_\_\_\_".

#### 3.3.3 Shipping Documents

The Contractor shall ensure that each shipment of hazardous material sent

off-site is accompanied by properly completed shipping documents.

#### 3.3.3.1 PCB Waste Shipment Documents

The Contractor shall prepare hazardous waste manifests for each shipment of PCB waste shipped off-site. Manifests shall be completed using instructions in 40 CFR 761, Sections .207 and .208 and all other applicable requirements. Documents shall be submitted to Contracting Officer for review and approval.

#### 3.3.3.2 Asbestos Waste Shipment Documents

The Contractor shall prepare waste shipment records as required by 40 CFR 61 for shipments of asbestos. Waste shipment records shall be submitted to the Contracting Officer for review and approval. Waste shipment records shall be signed by the Contractor.

#### 3.3.3.3 Other Hazardous Material Shipment Documents

The Contractor shall prepare a bill of lading for each shipment of hazardous material which is not accompanied by a hazardous waste manifest or asbestos waste shipment record which fulfills the shipping paper requirements. The bill of lading shall satisfy the requirements of 49 CFR 172, Subpart C, and any applicable state or local law or regulation, and shall be submitted to the Contracting Officer for review and approval. For laboratory samples and treatability study samples, the Contractor shall prepare bills of lading and other documentation as necessary to satisfy conditions of the sample exclusions in 40 CFR 261, Section .4(d) and (e) and any applicable state or local law or regulation. Bill of ladings requiring shipper's certifications shall be signed by the Contractor.

#### 3.4 OBTAINING EPA ID NUMBERS

The Contractor shall complete EPA Form 8700-12, Notification of Hazardous Waste Activity, and submit to the Contracting Officer for review and approval. The Contractor shall allow a minimum of 30 days for processing the application and assigning the EPA ID number. Shipment shall be made not earlier than one week after receipt of the EPA ID number.

#### 3.5 SPECIAL REQUIREMENTS FOR ASBESTOS WASTES

If work involves asbestos containing wastes, the Contractor shall manage these wastes in accordance with specification Section 13280 ASBESTOS ABATEMENT.

#### 3.6 WASTE MINIMIZATION

The Contractor shall minimize the generation of hazardous waste to the maximum extent practicable. The Contractor shall take all necessary precautions to avoid mixing clean and contaminated wastes. The Contractor shall identify and evaluate recycling and reclamation options as alternatives to land disposal. Requirements of 40 CFR 266 shall apply to: hazardous wastes recycled in a manner constituting disposal; hazardous waste burned for energy recovery; lead-acid battery recycling; and hazardous wastes with economically recoverable precious metals.

#### 3.7 RECORDKEEPING

The Contractor shall be responsible for maintaining adequate records to

support information provided to the Contracting Officer regarding exception reports, annual reports, and biennial reports. The Contractor shall be responsible for maintaining asbestos waste shipment records for a minimum of 3 years from the date of shipment or any longer period required by any applicable law or regulation or any other provision of this contract.

### 3.8 SPILL RESPONSE

The Contractor shall respond to any spill of hazardous material or hazardous waste which are in the custody or care of the Contractor, pursuant to this contract. Any direction from the Contracting Officer concerning a spill or release shall not be considered a change under the contract. The Contractor shall comply with all applicable requirements of Federal, state, or local laws or regulations regarding any spill incident.

### 3.9 EMERGENCY CONTACTS

The Contractor shall be responsible for complying with the emergency contact provisions in 49 CFR 172, Section .604. Whenever the Contractor ships hazardous materials, the Contractor shall provide a 24 hr emergency response contact and phone number of a person knowledgeable about the hazardous materials being shipped and who has comprehensive emergency response and incident mitigation information for that material, or has immediate access to a person who possesses such knowledge and information. The phone must be monitored on a 24 hour basis at all times when the hazardous materials are in transportation, including during storage incidental to transportation. The Contractor shall ensure that information regarding this emergency contact and phone number are placed on all hazardous material shipping documents. The Contractor shall designate an emergency coordinator and post the following information at areas in which hazardous wastes are managed:

- a. The name of the emergency coordinator.
- b. Phone number through which the emergency coordinator can be contacted on a 24 hour basis.
- c. The telephone number of the local fire department.
- d. The location of fire extinguishers and spill control materials.

Attachment A  
 SAMPLE OFF-SITE POLICY CERTIFICATION MEMO

Project/Contract #: \_\_\_\_\_  
 Waste Stream: \_\_\_\_\_  
 Primary TSD Facility, EPA ID # and Location: \_\_\_\_\_  
 Alter. TSD Facility, EPA ID # and Location: \_\_\_\_\_

EPA Region -----	Primary Contact -----	Secondary Contact -----
I	(617) 565-9446	(617) 573-1754
II	(212) 637-4139	(212) 264-2638
III	(814) 566-3450	(215) 597-8338
IV	(404) 562-8589	(404) 347-7603
V	(312) 886-3587	(312) 886-4445
VI	(214) 665-2282	(214) 655-2281
VII	(913) 551-7883	(913) 551-7667
VIII	(303) 312-6419	(303) 293-1506
IX	(415) 744-2091	(415) 744-2114
X	(206) 553-1061	(206) 553-1061

EPA representative contacted: \_\_\_\_\_  
 EPA representative phone number: \_\_\_\_\_  
 Date contacted: \_\_\_\_\_

Comment: \_\_\_\_\_  
 The above EPA representative was contacted on \_\_\_\_\_. As of that date the above sites were considered acceptable in accordance with the Off-Site Policy in 40 CFR 300.440.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 Phone number: \_\_\_\_\_

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SECTION 02220

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## SECTION 02220

## DEMOLITION

## PART 1 GENERAL

## 1.1 REFERENCES

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.

## ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

## 1.2 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Work Plan; GA.

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, including procedures and methods to provide necessary supports, lateral bracing and shoring when required, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations in accordance with EM 385-1-1.

## 1.4 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent

the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

## 1.5 PROTECTION

### 1.5.1 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

### 1.5.2 Protection of Structures

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

### 1.5.3 Protection of Existing Property

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 damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. 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.

### 1.5.4 Protection From the Weather

The interior of buildings to remain; salvageable materials and equipment shall be protected from the weather at all times.

### 1.5.5 Protection of Trees

Trees within the project site which might be damaged during demolition, and which are indicated to be left in place, shall be protected by a 1.8 m (6 foot) 6 foot high fence. The fence shall be securely erected a minimum of 1.5 m 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the Contracting Officer.

#### 1.5.6 Environmental Protection

The work shall comply with the requirements of Section 01410 ENVIRONMENT PROTECTION.

#### 1.6 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

#### 1.7 USE OF EXPLOSIVES

Use of explosives will not be permitted.

#### 1.8 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the Task Order.

### PART 2 PRODUCTS (Not Applicable)

### PART 3 EXECUTION

#### 3.1 EXISTING STRUCTURES

Existing structures indicated shall be removed as required by the Task Order. Interior walls, other than retaining walls and partitions, shall be removed to top of concrete slab on ground. Basement slabs shall be broken up to permit drainage. Sidewalks, curbs, gutters and street light bases shall be removed as indicated.

#### 3.2 UTILITIES

Existing utilities shall be removed as indicated. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

#### 3.3 FILLING

Holes, open basements and other hazardous openings shall be filled as required by the Task Order.

#### 3.4 DISPOSITION OF MATERIAL

Title to material and equipment to be demolished, except Government salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed.

##### 3.4.1 Salvageable Items and Material

Contractor shall salvage items and material to the maximum extent possible.

##### 3.4.1.1 Material Salvaged for the Contractor

Material salvaged for the Contractor shall be stored as approved by the Contracting Officer and shall be removed from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

#### 3.4.1.2 Items Salvaged for the Government

Salvaged items to remain the property of the Government shall be removed in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents.

#### 3.4.1.3 Items Salvaged for the Using Service

Items reserved as property of the using service shall be removed prior to commencement of work under this contract.

#### 3.4.1.4 Historical Items

Historical items shall be removed in a manner to prevent damage. The following historical items shall be delivered to the Government for disposition: Corner stones, contents of corner stones, and document boxes wherever located on the site.

#### 3.4.2 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of offsite.

#### 3.5 CLEAN UP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

#### 3.6 PAVEMENTS

Existing pavements designated for removal shall be saw cut and removed in accordance with the details shown on the drawings and to the limits and depths indicated on the drawings.

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## SECTION 02226

## REMOVAL AND SALVAGE OF HISTORIC BUILDING MATERIALS

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

The work includes removal and salvage of identified historic items and materials, and removal of resulting rubbish and debris. General demolition of non-historic materials and removal of resulting rubbish and debris shall comply with the requirements of Section 02220 DEMOLITION. Materials to be salvaged or recycled shall be stored daily in areas and manner specified by the Contracting Officer. In the interest of conservation, salvage and recycling shall be pursued to the maximum extent possible.

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-18 Records

Work Plan; GA.

The procedures proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged or recycled, dust control, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

## 1.3 QUALIFICATIONS

The Contractor shall provide qualified workers trained and experienced in whole-building recycling, including removal and salvage of historic materials and shall submit documentation of five consecutive years of work of this type. A list of similar projects shall be provided identifying when, where, and for whom the work was done. A current point-of-contact for identified references shall be provided.

## 1.4 DUST CONTROL

The amount of dust resulting from removal, salvage and demolition operations shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water to control dust will not be permitted when it will result in, or create, damage to existing building materials and hazardous or objectionable conditions such as ice, flooding and pollution.

## 1.5 PROTECTION

### 1.5.1 Protection of Existing Historic Property

Before beginning any removal, salvage or 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 damage to existing historic items that are to remain in place, to be reused, or to remain the property of the Government. Items damaged by the Contractor shall be repaired and restored to original condition, or replaced, as approved by the Contracting Officer. 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 provide additional supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

### 1.5.2 Protection From the Weather

The interior of buildings to remain and salvageable materials shall be protected from the weather at all times. Salvaged historic materials shall be stored out of contact with the ground and under weathertight covering.

### 1.5.3 Environmental Protection

The work shall comply with the requirements of Section 13280 ASBESTOS ABATEMENT and Section 02090 LEAD-BASED PAINT (LBP) ABATEMENT AND DISPOSAL.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 SALVAGED ITEMS

Contractor shall salvage items to the maximum extent possible. Prior to any demolition work, historic items to be salvaged shall be removed from the structure. Removal of salvageable items shall be accomplished by hand labor to the maximum extent possible. Care shall be taken to not damage historic portions of the structure to remain or items identified for salvage. Furnishings, equipment, and materials not scheduled for salvage or recycling shall be removed prior to any salvaging procedures. Contractor shall keep a complete recording of all salvaged materials including the condition of such materials before, and after, salvage operations.

#### 3.1.1 Site Work

The following site items shall be removed intact and salvaged: fences and gates, site furnishings, fountains, sculpture, site ornaments, site lighting fixtures, items of historic value.

#### 3.1.2 Concrete

The following concrete items shall be removed intact and salvaged: precast architectural elements.

#### 3.1.3 Masonry

The following masonry items shall be removed intact and salvaged: brick,

stone, terra cotta, cast stone, clay tile trim elements, cornerstones, items of historic value.

#### 3.1.4 Metals

The following metal items shall be removed intact and salvaged: ladders, stairs and handrails, cast architectural ornament, architectural metalwork, ornamental ironwork, gratings and metal walkways, items of historic value.

#### 3.1.5 Wood

The following materials shall be removed intact and salvaged: wood decking, millwork, custom paneling, wood stairs and handrails, ladders, architectural woodwork, custom casework, wood timbers ( 125 x 125 mm 5 x 5 inch or larger), items of historic value.

#### 3.1.6 Thermal and Moisture Protection

The following materials shall be removed intact and salvaged: slate tiles, clay tiles, gutters, leaders, and downspouts, skylights, roof accessories, exterior siding, items of historic value.

#### 3.1.7 Doors and Windows

Doors and windows with associated hardware and operating mechanisms shall be removed intact (including glass) and salvaged per schedule.

#### 3.1.8 Finishes

The following special or historic finishes shall be protected or removed and remain intact as required by the Task Order: stencilling, decorative tile, molded ornament, decorative ceiling materials, wood flooring, textured wall coverings, murals, items of historic value.

#### 3.1.9 Equipment and Specialty Items

The following equipment and specialty items shall be removed intact and salvaged: chalkboards and tackboards, toilet partitions, louvers and vents, stoves, plaques, lockers, mirrors, bath accessories, partitions, contents of cornerstones, document boxes items of historic value.

#### 3.1.10 Mechanical Equipment

The following mechanical equipment shall be removed intact and salvaged: bathroom fixtures, radiators, registers and grilles, fans, items of historic value.

#### 3.1.11 Electrical Equipment

The following electrical fixtures and equipment shall be removed intact and salvaged: light fixtures, switches, switch plates, outlet covers, clocks, telecommunications equipment, items of historic value.

### 3.2 RECYCLED MATERIALS

Contractor shall recycle materials to the maximum extent possible. Removal of recyclable materials shall be accomplished by hand labor wherever possible. Historic portions of the structure to remain and items identified for salvage shall not be damaged while removing materials for

recycling. The following materials shall be recycled: dimension lumber, scrap wood, paper and cardboard, gypsum wallboard, asphalt, rubble, glass, metals, items of historic value.

### 3.3 DISPOSITION OF MATERIALS

Title to materials and equipment to be demolished, except Government and using service salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed.

#### 3.3.1 Material Salvaged for the Contractor

Material salvaged for the Contractor shall be temporarily stored as approved by the Contracting Officer and shall be removed from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

#### 3.3.2 Items Salvaged for the Government

Salvaged items to remain the property of the Government shall be removed in a manner to prevent damage and as directed by the Contracting Officer, shall be packed or crated to protect the items from damage. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents.

#### 3.3.3 Items Salvaged for the Using Service

Items reserved as property of the using service will be removed prior to commencement of work under this contract.

### 3.4 CLEAN-UP

Upon completion of the work, portions of structure to remain and adjacent areas and structures shall be cleaned of dust, dirt, and debris caused by salvage and demolition operations. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

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## SECTION 02300

## EARTHWORK

## PART 1 GENERAL

## 1.1 REFERENCES

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.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1140	(1997) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

## 1.2 MEASUREMENT

## 1.2.1 Excavation

The unit of measurement for excavation and borrow will be the cubic meter, yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations. The volume to be paid for will be the number of cubic meters yards of material measured in its original position and removed from the excavation and borrow areas, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. The measurements will include authorized excavation of rock, authorized excavation of unsatisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material that is scarified or plowed and reused in-place, and will not include the volume excavated without authorization or the volume of any material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow pits, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed grade.

#### 1.2.2 Topsoil Requirements

Separate excavation, hauling, and spreading or piling of topsoil and related miscellaneous operations will be considered subsidiary obligations of the Contractor, covered under the contract unit price for excavation.

#### 1.2.3 Overhaul Requirements

The unit of measurement for overhaul will be the station-meter. station-yard. The number of station-meters station-yards of overhaul to be paid for will be the product of number of cubic meters yards of overhaul material measured in the original position, multiplied by the overhaul distance measured in stations of 100 meters. feet. The overhaul distance will be the distance in stations between the center of volume of the overhaul material in its original position and the center of volume after placing, minus the free-haul distance in stations. The haul distance will be measured along the shortest route determined by the Contracting Officer as feasible and satisfactory. Unsatisfactory materials or waste will not be measured for overhaul where the length of haul for borrow is within the free-haul limits.

### 1.3 PAYMENT

Payment will constitute full compensation for all labor, equipment, tools, supplies, and incidentals necessary to complete the work.

#### 1.3.1 Classified Excavation

Classified excavation will be paid for at the contract unit prices per cubic meter yard for common or rock excavation.

#### 1.3.2 Unclassified Excavation

Unclassified excavation will be paid for at the contract unit price per cubic meter yard for unclassified excavation.

#### 1.3.3 Classified Borrow

Classified borrow will be paid for at the contract unit prices per cubic meter yard for common or rock borrow.

#### 1.3.4 Unclassified Borrow

Unclassified borrow will be paid for at the contract unit price per cubic meter yard for unclassified borrow.

#### 1.3.5 Authorized Overhaul

Authorized overhaul will be paid for at the contract unit price per station-meter station-yard for overhaul in excess of the free-haul limit as designated in paragraph DEFINITIONS.

### 1.4 DEFINITIONS

#### 1.4.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC. Satisfactory materials for grading shall be comprised of stones less than 200 mm 8 inches, except for fill material for pavements and railroads which shall be comprised of stones less than 75 mm 3 inches in any dimension.

#### 1.4.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.

#### 1.4.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

#### 1.4.4 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density.

#### 1.4.5 Topsoil

Material suitable for topsoils obtained from offsite areas will be defined in the Task Order.

### 1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The

following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Earthwork; FIO.

Procedure and location for disposal of unused satisfactory material. Blasting plan when blasting is permitted. Proposed source of borrow material.

SD-09 Reports

Testing; GA.

Within 24 hours of conclusion of physical tests, six copies of test results, including calibration curves and results of calibration tests.

SD-13 Certificates

Testing; GA.

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

SD-18 Records

Earthwork; GA.

Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

1.6 SUBSURFACE DATA

Subsurface soil boring logs are as shown in the Task Order. The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at the High Desert Area Office. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.7 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.7.1 Rock Excavation

Rock excavation shall include blasting, excavating, grading, and disposing of material classified as rock and shall include the satisfactory removal and disposal of boulders 1/2 cubic meter yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; and firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling and blasting. The removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic meter yard in volume that may be encountered in the work shall be included in this classification. If at any time during excavation, including excavation from borrow areas, the Contractor

encounters material that may be classified as rock excavation, such material shall be uncovered and the Contracting Officer notified by the Contractor. The Contractor shall not proceed with the excavation of this material until the Contracting Officer has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

#### 1.7.2 Common Excavation

Common excavation shall include the satisfactory removal and disposal of all materials not classified as rock excavation.

#### 1.8 BLASTING

Blasting will not be permitted.

#### 1.9 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

#### PART 2 PRODUCTS (Not Applicable)

#### PART 3 EXECUTION

##### 3.1 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth as required by the Task Order. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 50 mm 2 inches in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be stockpiled in locations indicated or removed from the site as required by the Task Order.

##### 3.2 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas.

During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

### 3.2.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 1 meter 4 feet from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

### 3.2.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped, or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed. Where pile foundations are to be used, the excavation of each pit shall be stopped at an elevation 300 mm 1 foot above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, loose and displaced material shall be removed and excavation completed, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

### 3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas shown or from other approved sources, either private or within the limits of the project site, selected by the Contractor. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay

royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

#### 3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

The Contractor shall notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

#### 3.5 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

#### 3.6 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section and the Task Order. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

#### 3.7 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

##### 3.7.1 General Requirements

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up to a depth of 15 mm 6 inches or as required by the Task Order; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just

prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

### 3.7.2 Frozen Material

Embankment shall not be placed on a foundation which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Contracting Officer and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompacted to the specified criteria before additional material is placed. The Contracting Officer will determine when placement of fill shall cease due to cold weather. The Contracting Officer may elect to use average daily air temperatures, and/or physical observation of the soils for his determination. Embankment material shall not contain frozen clumps of soil, snow, or ice.

## 3.8 EMBANKMENTS

### 3.8.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75 mm. 3 inches. The material shall be placed in successive horizontal layers of loose material not more than 152 millimeters 6 inches in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

## 3.9 SUBGRADE PREPARATION

### 3.9.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 150 mm 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified.

### 3.9.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, each layer of the embankment shall be compacted to at least 95 percent of laboratory maximum density. Compaction shall be performed on materials that are within two percent of optimum water content.

#### 3.9.2.1 Subgrade for Railroads

Subgrade for railroads shall be compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be performed on materials that are within two percent of optimum water content.

#### 3.9.2.2 Subgrade for Pavements

Subgrade for pavements shall be compacted to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, the top 152 mm 6 inches of subgrade shall be scarified, windrowed, thoroughly blended, reshaped, and compacted. Compaction shall be performed on materials that are within two percent of optimum water content.

#### 3.9.2.3 Subgrade for Shoulders

Subgrade for shoulders shall be compacted to at least 95 percentage laboratory maximum density for the full depth of the shoulder. Compaction shall be performed on materials that are within two percent of optimum water content.

### 3.10 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

### 3.11 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 30 mm 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a

manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

### 3.12 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 50 mm 2 inch depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 152 mm 6 inches and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from offsite areas.

### 3.13 TESTING

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Field in-place density shall be determined in accordance with ASTM D 1556. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements. Tests on recompacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

#### 3.13.1 Fill and Backfill Material Gradation

#### 3.13.2 In-Place Densities

a. Two tests per lift for each increment or fraction thereof of 1672 square meters 2000 square yards, placed during each 8 hour shift for areas compacted by other than hand-operated machines. Water content shall be determined by the test method outlined in ASTM D 2216.

b. One random test at each location, of each lift or backfill areas compacted by other than hand-operated machines.

c. One test per each lift of embankment or backfill for roads, airfields.

d. One test per each lift of embankment or backfill for railroads.

#### 3.13.3 Gradation with Atterberg Limits

One test for every in-place density tests. From compacted material, the gradation of fill and backfill material shall be determined in accordance with ASTM C 136 and ASTM D 1140, as applicable. Atterberg limits shall be determined in accordance with the test method outlined in ASTM D 4318.

### 3.14 3. Moisture-Density Relationships with Gradation, Atterberg Limits, Specific Gravity, and Classification.

One test for for every five field density tests, with not less than one test for each type of material.

### 3.13.5 Subgrade Testing

#### 3.13.5.1 Field Density with Moisture Content

a. Two tests per lift for each in-trementor fraction thereof of 836 square meters 1000 square yards placed during each 8 hour shift for areas compacted by other than hand-operated machines.

b. One random test at each location, of each lift of fill or backfill areas compacted by hand-operated machines.

#### 3.13.5.2 Gradation with Atterberg Limits.

Two teats for every five in-place density tests. From compacted material, the gradation of fill and bacvkfill material shall be determined in accordance with ASTM C 136 and ASTM D 1140, as applicable. atterberg limits shall be determined in accordance with the test method outlined in ASTM D 4318.

#### 3.13.5.3 Moisture-Density Relationships with Gradation, Atteberg Limits, Specific Gravity, and Classification

One test for every five field density tests, with not less than one for each type of material.

#### 3.13.5.4 Tolerance Tests for Subgrades

Checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made at the edges and centerlines of subgrade areas, inboth the longitudinal and transverse directions, at 15.24 meters 50 foot intervals during construction of the subgrade.

### 3.14 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

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## SECTION 02315

## EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

## PART 1 GENERAL

## 1.1 REFERENCES

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.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil, and Rock
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1995a) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

## 1.2 DEGREE OF COMPACTION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, abbreviated as percent laboratory maximum density.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation;

submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-09 Reports

Testing; FIO.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC.

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75 mm 3 inches. The Contracting Officer shall be notified of any contaminated materials.

#### 2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM shall be identified as cohesionless only when the fines are nonplastic.

#### 2.1.4 Nonfrost Susceptible (NFS) Material

Nonfrost susceptible material shall be a uniformly graded washed sand with a maximum particle size such that less than 5 percent passing the 0.075 mm No. 200 size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

### 2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 37.5 mm 1-1/2 inches and no more than 2 percent by weight shall pass the 4.75 mm No. 4 size sieve.

## PART 3 EXECUTION

### 3.1 CLEARING AND GRUBBING

The areas within lines 1.5 m 5 feet outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines,

structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING AND BACKFILLING. Materials removed shall be disposed of outside the limits of Government-controlled property at the Contractor's responsibility.

### 3.2 TOPSOIL

Topsoil shall be stripped to a depth as required by the Task Order within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

### 3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified, and shall include trenching for utility and foundation drainage systems to a point 1.5 m 5 feet beyond the building line of each building and structure, excavation for outside grease interceptors, underground fuel tanks, and all work incidental thereof. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed and replaced with satisfactory material as required by the Task Order; and payment will be made in conformance with the Task Order. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced, at no additional cost to the Government, with satisfactory materials to the indicated excavation grade; except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

### 3.4 DRAINAGE AND DEWATERING

#### 3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

#### 3.4.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 900 mm 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions

for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 meters 6 feet below the working level.

### 3.5 SHORING

Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

### 3.6 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

### 3.7 BLASTING

Blasting will not be permitted.

### 3.8 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 150 mm 6 inches below the bottom of the pipe, and the overdepth shall be backfilled with satisfactory material placed and compacted in conformance with paragraph FILLING AND BACKFILLING.

### 3.9 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained as specified in Section 02300 EARTHWORK.

### 3.10 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02300 EARTHWORK.

### 3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. For pile foundations, the excavation shall be stopped at an elevation of from 150 to 300 mm 6 to 12 inches above the bottom of the footing before driving piles. After pile driving has been completed, the remainder of the excavation shall be completed to the elevations shown. Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps

or benches to provide a satisfactory bond. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

### 3.12 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 150 mm 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm, 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

### 3.13 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 200 mm 8 inches in loose thickness, or 150 mm 6 inches when hand-operated compactors are used. After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade and shall include backfill for outside grease interceptors and underground fuel tanks. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm 2 feet above sewer lines and 300 mm 1 foot above other utility lines shall be free from stones larger than 25 mm 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 100 mm 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

	Percent Laboratory maximum density	
	Cohesive material	Cohesionless material
<u>Fill, embankment, and backfill</u>		
Under structures, building slabs, steps, paved areas, around footings, and in trenches	90	95
Under sidewalks and grassed areas	85	90
Nonfrost susceptible materials		95
<u>Subgrade</u>		
Under building slabs, steps, and paved areas, top 300 mm	90	95
Under sidewalks, top 150 mm	85	90

	Percent Laboratory maximum density	
	Cohesive material	Cohesionless material
<u>Fill, embankment, and backfill</u>		
Under structures, building slabs, steps, paved areas, around footings, and in trenches	90	95
Under sidewalks and grassed areas	85	90
Nonfrost susceptible materials		95
<u>Subgrade</u>		
Under building slabs, steps, and paved areas, top 12 inches	90	95
Under sidewalks, top 6 inches	85	90

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recomaction over underground utilities and heating lines shall

be by hand tamping.

### 3.14 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556.

#### 3.14.1 In-Place Densities

In-place density and moisture content test results shall be included with the Contractor's daily construction quality control reports.

##### 3.14.1.1 In-Place Density of Subgrades

One test per 1672 square meters 2000 square foot or fraction thereof.

##### 3.14.1.2 In-Place Density of Fills and Backfills

One test per of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area lift.

#### 3.14.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

#### 3.14.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material, including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 5 density tests, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

### 3.15 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

### 3.16 GRADING

Areas within 1.5 m 5 feet outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

### 3.17 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall

be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 50 mm 2 inches by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 1.46 kN/m to 2.34 kN/m 100 to 160 pounds per linear foot of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

### 3.18 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades reestablished to the required elevations and slopes.

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## SECTION 02811

## UNDERGROUND SPRINKLER SYSTEMS

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1997) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B 32	(1996) Solder Metal
ASTM B 43	(1996) Seamless Red Brass Pipe, Standard Sizes
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM D 1785	(1996a) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1996a) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2287	(1996) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D 2464	(1996a) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1996a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2774	(1994) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3261	(1996) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM F 441 (1995) Chlorinated Poly(Vinyl Chloride)  
(CPVC) Plastic Pipe, Schedules 40 and 80

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.2 (1983; R 1991; Errata May 1992) Gages and  
Gaging for Unified Inch Screw Threads

ASME B16.3 (1992) Malleable Iron Threaded Fittings

ASME B16.15 (1985; R 1994) Cast Bronze Threaded  
Fittings Classes 125 and 250

ASME B16.18 (1984; R 1994) Cast Copper Alloy Solder  
Joint Pressure Fittings

ASME B16.22 (1995) Wrought Copper and Copper Alloy  
Solder Joint Pressure Fittings

ASME B40.1 (1991) Gauges - Pressure Indicating Dial  
Type - Elastic Element

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE ANSI/ASSE 1012 (1995) Backflow Preventers with  
Intermediate Atmospheric Vent

ASSE 1013 (1993) Reduced Pressure Principle Backflow  
Preventers

ASSE 1020 (1974; Rev thru Feb 1989) Pressure Vacuum  
Breaker Assembly (Recommended for Outdoor  
Usage)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C509 (1994) Resilient-Seated Gate Valves for  
Water Supply Service

AWWA C901 (1996) Polyethylene (PE) Pressure Pipe and  
Tubing, 1/2 In. Through 3 In., for Water  
Service

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-51145 (Rev C) Flux, Soldering, Non-Electronic,  
Paste & Liquid

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH  
(FCCCHR)

FCCCHR-01 (1993) Manual of Cross-Connection Control

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-80 (1997) Bronze Gate, Globe, Angle and Check

Valves

MSS SP-85 (1994) Cast Iron Globe & Angle Valves  
Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (1993) Industrial Control and Systems,  
Controllers, Contactors, and Overload  
Relays Rated Not More Than 2,000 Volts AC  
or 750 Volts DC

NEMA ICS 6 (1993) Industrial Control and Systems,  
Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 (1992) Water Hammer Arresters

1.2 PERFORMANCE REQUIREMENTS

System shall operate with a minimum water pressure of at the point of connection as required by the Task Order.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Framed Instructions; FIO.

Labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation.

Field Training ; ga.

Information describing training to be provided, training aids to be used, samples of training materials to be provided, and schedules and notification of training.

Design Analysis and Calculations; GA. Spare Parts; fio.

Design analyses and pressure calculations verifying that system will provide the irrigation requirements. Spare parts data for each different item of material and equipment specified, after approval of the related submittals and not later than the start of the field tests. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

SD-04 Drawings

Sprinkler System; ga.

Detail drawings for valves, sprinkler heads, backflow preventers, automatic controllers, emitter heads, and water hammer arresters. Drawings shall include a complete list of equipment and materials, and manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed system layout, type and number of heads and emitters, zone valves, drain pockets, backflow devices, controllers, and mounting details of controllers. As-built Drawings which provide current factual information showing locations of mains, heads, valves, and controllers including deviations from and amendments to the drawings and changes in the work shall be included.

#### SD-06 Instructions

Sprinkler System; ga.

Detailed procedures defining the Contractor's provisions for accident prevention, health protection, and other safety precautions for the work to be done.

#### SD-09 Reports

Field Tests; fio.

Performance test reports, in booklet form, showing all field tests performed to adjust each component; and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of control valves.

#### SD-13 Certificates

Sprinkler System; fio.

The material supplier's or equipment manufacturer's statement that the supplied material or equipment meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of material supplier or product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply.

#### SD-19 Operation and Maintenance Manuals

Sprinkler System; ga.

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set prior to field testing and the remainder upon acceptance. Manuals shall be approved prior to the field training course. Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

#### 1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from the weather; excessive humidity and temperature variation; direct sunlight (in the case of plastic or rubber materials); and dirt, dust, or other contaminants.

#### 1.5 FIELD MEASUREMENTS

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT REQUIREMENTS

##### 2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer who has produced similar systems which have performed well for a minimum period of 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

##### 2.1.2 Nameplates

Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

##### 2.1.3 Extra Stock

The following extra stock shall be provided: Two sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

#### 2.2 PIPING MATERIALS

##### 2.2.1 Copper Tubing and Associated Fittings

Tubing shall conform to requirements of ASTM B 88, Type K. Fittings shall conform to ASME B16.22 and ASME B16.18, solder joint. Solder shall conform to ASTM B 32 95-5 tin-antimony. Flux shall conform to CID A-A-51145, Type I.

##### 2.2.2 Red Brass Pipe and Associated Fittings

Pipe shall conform to requirements of ASTM B 43, regular. Fittings shall be Class 250, cast bronze threaded conforming to the requirements of ASME B16.15.

##### 2.2.3 Galvanized Steel Pipe and Associated Fittings

Pipe shall conform to requirements of ASTM A 53, Schedule 40. Fittings shall be Class 150 conforming to requirements of ASME B16.3.

##### 2.2.4 Polyvinyl Chloride (PVC) Pipe, Fittings and Solvent Cement

#### 2.2.4.1 PVC Pipe

Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40 or 80; or ASTM D 2241, PVC 1120 SDR 21, Class 200.

#### 2.2.4.2 PVC Fittings

Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

#### 2.2.4.3 Solvent Cement

Solvent cement shall conform to the requirements of ASTM D 2564.

#### 2.2.5 Polyethylene (PE) Plastic Piping

Pipe shall conform to AWWA C901, outside diameter base with dimension ratio (DR) of 9.3 to provide 1034 kPa (150 psi) 150 psi minimum pressure rating. Fittings shall conform to ASTM D 3261, DR of 9.3.

#### 2.2.6 Dielectric Fittings

Dielectric fittings shall conform to ASTM F 441, Schedule 80, CPVC threaded pipe nipples, 100 mm (4 inch) 4 inch minimum length.

#### 2.2.7 Emitter Hose and Distribution Tubing

Emitter hose and distribution tubing shall conform to ASTM D 2287, maximum inside diameter of 13 mm (1/2 inch), 1/2 inch, minimum wall thickness of 2.286 mm (90 mils), 90 mils, vinyl plastic extruded from non-rigid chloride, integrally algae-resistant, homogeneous throughout, smooth inside and outside, free from foreign materials, cracks, serrations, blisters and other effects. Slip fittings shall be provided.

### 2.3 SPRINKLER AND EMITTER HEADS

#### 2.3.1 Pop-Up Spray Heads

##### 2.3.1.1 General Requirements

Pop-up spray heads lay flush with housing, then pop up when water pressure 138 kPa 20 psi is activated in system. The rising member supporting the nozzle shall be identical on full, half, third or quarter pattern sprinklers so that nozzles will be interchangeable. The sprinkler head shall be designed to be adjustable for coverage and flow. The nozzle shall be removable so head does not have to be removed for flushing or cleaning. Nozzle rises a minimum of 100 mm (4 inches) 4 inches above the body. The body shall be constructed with a 13 mm 1/2 inch female thread for installation in a fixed underground pipe system.

##### 2.3.1.2 Shrubbery Sprinkler Heads

Sprinkler heads shall be conical spray with adjustable or non-adjustable coverage and designed for permanent aboveground mounting on riser or pop-ups at a height compatible with ground covers. Provide brass nozzles.

##### 2.3.2 Rotary Pop-Up Sprinklers

Sprinklers shall be capable the area, volumn and pressure as required by the Task Order. Construction shall be high impact molded plastic with filter screen, reducible watering radius, and choice of nozzles and have adjustable radius capabilities.

#### 2.3.3 Bubbler Sprinkler Heads

Heads shall be multiple-spray bubbler with adjustable flow and designed for permanent aboveground mounting on risers.

#### 2.3.4 Surface Connected Lawn Sprinkler Heads

Heads shall be an impulse type with or without sled, ring, or wheel base; multiple T Type; a rotary type with sled, spike or wheel base; or oscillating type with wheel or sled base.

#### 2.3.5 Emitter Heads

Emitter heads shall be self-cleaning, pressure compensating diaphragm with one or six self-piercing barbed outlets; each capable of emitting from 1 to 8 L/hour (1/4 to 2 gallons per hour) 1/4 to 2 gallons per hour flow. Emitter body shall be ultraviolet stabilized, algae, and heat resistant plastic construction.

### 2.4 VALVES

#### 2.4.1 Gate Valves, Less than 80 mm (3 Inches) 3 Inches

Gate valves shall conform to the requirements of MSS SP-80, Type 1, Class 150, threaded or soldered ends as required by the Task Order.

#### 2.4.2 Gate Valves, 80 mm (3 Inches) 3 Inches and Larger

Gate valves shall conform to the requirements of AWWA C509 and have encapsulated resilient wedge, parallel seats, non-rising stems, and open by counterclockwise turning. End connections shall be flanged. Interior construction of valves shall be bronze including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

#### 2.4.3 Angle Valves, Less Than 65 mm (2-1/2 Inches) 2-1/2 Inches

Angle valves shall conform to the requirements of MSS SP-80, Type 3, Class 150 threaded or soldered ends as required by the Task Order.

#### 2.4.4 Angle Valves, 65 mm (2-1/2 Inches) 2-1/2 Inches and Larger

Angle valves shall conform to the requirements of MSS SP-85, Type II, Class 250 threaded or flanged ends as required by the Task Order.

#### 2.4.5 Quick Coupling Valves

Quick coupling valves shall have brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main. Lids shall be lockable vinyl with spring for positive closure on key removal.

#### 2.4.6 Remote Control Valves, Electrical

Remote control valves shall be solenoid actuated globe valves of 20 to 80 mm (3/4 to 3 inch) 3/4 to 3 inch size, suitable for 24 volts, 60 cycle, and designed to provide for shut-off in event of power failure. Valve shall be cast bronze or brass or plastic housing suitable for service at 1034 kPa (150 psi) 150 psi operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

#### 2.4.7 Drain Valves

##### 2.4.7.1 Manual Valves

Manual valves shall conform to requirements of MSS SP-80, Type 3, Class 150 threaded or soldered ends, as required by the Task Order, for sizes less than 65 mm (2-1/2 inches) 2-1/2 inches and MSS SP-85, Type II, Class 250 threaded or flanged ends, as required by the Task Order, for sizes 65 mm (2-1/2 inches) 2-1/2 inches and larger.

##### 2.4.7.2 Automatic Valves

Automatic valves shall be brass or plastic, spring loaded ball drip type, Class 150 150 pounds and threaded ends, designed to close at 18 kPa (6 foot) 6 foot pressure head with positive seal at 21 kPa (3 psi) 3 psi pressure or greater and be open to drain at less than 21 kPa (3 psi) 3 psi pressure.

#### 2.4.8 Pressure Regulating Master Valve

Pressure regulating master valve shall be automatic mechanical self-cleaning, self-purging control system having an adjustable pressure setting operated by a solenoid on alternating current with 0.70 amperes at 24 volts. Valve shall close slowly and be free of chatter in each diaphragm position, have manual flow stem to adjust closing speed and internal flushing, and one or two inlet tappings capable of being installed as a straight pattern valve. Body shall be cast bronze or brass with removable brass seat serviceable from top without removing valve body from system. Valve shall operate at 1034 kPa (150 psi) 150 psi working pressure and pilot range from 70 to 875 kPa (10 to 125 psi). 10 to 125 psi.

#### 2.4.9 Backflow Preventers

Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR-01. Backflow preventers with intermediate atmospheric vent shall be in accordance with ASSE ANSI/ASSE 1012. Reduced pressure principle backflow preventers shall be in accordance with ASSE 1013.

##### 2.4.9.1 Pressure Type Vacuum Breaker

Vacuum breaker shall conform to the requirements of ASSE 1020 and shall be bronze or brass construction, as required by the Task Order, with one or two check valves, vacuum relief, inlet and discharge shut-offs valves, field test cocks, and vacuum relief opening of greater diameter than unit.

##### 2.4.9.2 Reduced Pressure Type Backflow Preventers

Backflow preventers shall be Class 150 150 pound flanged cast iron, bronze or brass, as required by the Task Order, mounted gate valve and strainer, 304 stainless steel or bronze, internal parts. Total pressure drop through complete assembly shall be a maximum of 70 kPa (10 psi) 10 psi at rated flow. Piping shall be red brass pipe and fittings or galvanized steel pipe and fittings as required by the Task Order. Strainers shall be bronze or brass construction with gasket caps. Units shall have 200-mesh stainless steel screen elements.

## 2.5 ACCESSORIES AND APPURTENANCES

### 2.5.1 Valve Keys for Manually Operated Valves

Valve keys shall be 15 mm (1/2 inch) 1/2 inch diameter by 1000 mm 3 feet long, tee handles and keyed to fit valves.

### 2.5.2 Valve Boxes and Concrete Pads

#### 2.5.2.1 Valve Boxes

Valve boxes shall be cast iron, plastic lockable, or precast concrete for each gate valve, manual control valve and remote control valve. Box sizes shall be adjustable for valve used. Word "IRRIGATION" shall be cast on cover. Shaft diameter of box shall be minimum 130 mm (5-1/4 inches).5-1/4 inches. Cast iron box shall have bituminous coating.

#### 2.5.2.2 Concrete Pads

Concrete pads shall be precast or cast-in-place reinforced concrete construction for reduced pressure type backflow preventers.

### 2.5.3 Pressure Gauges

Pressure gauges shall conform to requirements of ASME B40.1, single style pressure gauge for water with 115 mm (4-1/2 inch) 4-1/2 inchdial brass or aluminum case, bronze tube, gauge cock, pressure snubber, and siphon. Scale range shall be suitable for irrigation sprinkler systems.

### 2.5.4 Service Clamps

Service clamps shall be bronze flat, double strap, with neoprene gasket or "O"-ring seal.

### 2.5.5 Water Hammer Arresters

Water hammer arrester shall conform to the requirements of PDI WH 201; stainless steel construction with an encased and sealed bellows compression chamber.

### 2.5.6 Emitter Head Accessories

#### 2.5.6.1 Strainer

Strainer shall be provided at inlet to each drip line. Strainer shall have stainless steel screen having equivalent of 140-mesh filtration capacity and incorporate flush valves within strainer to clean screen without disassembling unit.

#### 2.5.6.2 Pressure Regulator

Pressure regulator shall be provided at each drip system if supply pressure exceeds 350 kPa (50 psi). 50 psi.

#### 2.5.6.3 Riser Adapters

Riser adapters shall be provided with a rigid piping system.

#### 2.5.6.4 Tubing Stakes

Tubing stakes shall be plastic coated steel, or other non-corrosive strong material to secure tubing.

#### 2.5.6.5 Emitter Outlet Check Valve (Bug Cap)

Check valves shall be provided at end of each emitter outlet distribution line. Valves shall permit free flow of water with minimum restriction; prevent back siphoning, entry of insects, and contamination into outlet ports.

#### 2.5.6.6 Access Sleeve

Access sleeve shall be provided at buried emitters placed in covered boxes.

Lids of access sleeve shall be secured with removable lugs. Drip hose in both vertical and horizontal axis shall be secured.

#### 2.5.6.7 Closure Caps

Closure caps shall be in accordance with manufacturer's recommendations.

### 2.6 AUTOMATIC CONTROLLERS, ELECTRICAL

Controller shall conform to the requirements of NEMA ICS 2 with 120-volt single phase service, operating with indicated stations, and grounded chassis. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover, pedestal-mounted or wall-mounted as required by the Task Order. Controller shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch for each day of week for one, two or three schedules, allowing each station to be scheduled individually as to days of watering; a minute switch for each station with a positive increment range of 3 to 60 minutes or 0 to 3 hours, as required by the Task Order, set time within one percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each operation to be scheduled throughout a 24-hour day; a circuit breaker for surge protection; and circuit for a 9-volt rechargeable NiCad battery.

### 2.7 ELECTRICAL WORK

Wiring and rigid conduit for electrical power shall be in accordance with NFPA 70.

### 2.8 CONCRETE MATERIALS

Concrete shall have a compressive strength of 17 MPa 2500 psi at 28 days as specified in Section 03307, CONCRETE FOR MINOR STRUCTURES.

### 2.9 WATER SUPPLY MAIN MATERIALS

Tapping sleeves, service cut off valves, and connections to water supply mains shall be as required by the Task Order.

## 2.10 INSULATING JOINTS

Insulating joints and dielectric fittings shall be as required by the Task Order.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Sprinkler system shall be installed after site grading has been completed. Excavation, trenching, and backfilling for sprinkler system shall be in accordance with the applicable provisions of Section 02315, EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS, except as modified herein.

#### 3.1.1 Trenching

Trench around roots shall be hand excavated to pipe grade when roots of 50 mm 2 inches diameter or greater are encountered. Trench width shall be 100 mm 4 inches minimum or 1-1/2 times diameter of pipe, whichever is wider. Backfill shall be hand tamped over excavation. When rock is encountered, trench shall be excavated 100 mm 4 inches deeper and backfilled with silty sand (SM) or well-graded sand (SW) to pipe grade. Trenches shall be kept free of obstructions and debris that would damage pipe. Subsoil shall not be mixed with topsoil. Existing concrete walks, drives and other obstacles shall be bored at a depth conforming to bottom of adjacent trenches. Pipe sleeves for bored pipe shall be two pipe diameters larger than sprinkler pipe.

#### 3.1.2 Piping System

##### 3.1.2.1 Cover

Underground piping shall be installed to meet the minimum depth of backfill cover specified.

##### 3.1.2.2 Clearances

Minimum horizontal clearances between lines shall be 100 mm 4 inches for pipe 50 mm (2 inches) 2 inches and less; 300 mm 12 inches for 65 mm (2-1/2 inches) 2-1/2 inches and larger. Minimum vertical clearances between lines shall be 25 mm. 1 inch.

##### 3.1.2.3 Minimum Slope

Minimum slope shall be 50 mm per 10 m 6 inches per 100 feet in direction of drain valves.

#### 3.1.3 Piping Installation

##### 3.1.3.1 Polyvinyl Chloride (PVC) Pipe

a. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.

b. Threaded joints shall be full cut with a maximum of three threads

remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

c. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions. Pipe shall be installed in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 5 degrees C. 40 degrees F.

#### 3.1.3.2 Soldered Copper Tubing

Pipe shall be reamed and burrs removed. Contact surfaces of joint shall be cleaned and polished. Flux shall be applied to male and female ends. End of tube shall be inserted into fittings full depth of socket. After soldering, a solder bead shall show continuously around entire joint circumference. Excess acid flux shall be removed from tubings and fittings.

#### 3.1.3.3 Threaded Brass or Galvanized Steel Pipe

Prior to installation, pipe shall be reamed. Threads shall be cut in conformance with ASME B1.2. Pipe joint compound shall be applied to male end only.

#### 3.1.3.4 Insulating Joints

Insulating and dielectric fittings shall be provided where pipes of dissimilar metal are joined and at connections to water supply mains as shown. Installation shall be as required by the Task Order.

#### 3.1.4 Installation of Valves

##### 3.1.4.1 Manual Valves

Valves shall be installed in a valve box extending from grade to below valve body, with a minimum of 100 mm 4 inches cover measured from finish grade to top of valve stem.

##### 3.1.4.2 Automatic Valves

Valve shall be set plumb in a valve box extending from grade to below valve body, with minimum of 100 mm 4 inch cover measured from grade to top of valve. Automatic valves shall be installed beside sprinkler heads with a valve box.

##### 3.1.4.3 Drain Valves

Entire system shall be manually or automatically drainable. Low points of system shall be equipped with drain valve draining into an excavation containing 0.03 cubic meter 1 cubic foot gravel. Gravel shall be covered with building paper then backfilled with excavated material and 150 mm 6 inches of topsoil.

#### 3.1.5 Sprinklers and Quick Coupling Valves

Sprinklers and valves shall be installed plumb and level with terrain.

#### 3.1.6 Installation of Drip Irrigation System

#### 3.1.6.1 Emitter Hose

Emitter laterals shall be buried 150 mm 6 inches deep. Connections shall be solvent welded in accordance with manufacturer's recommendation to standard weight Schedule 40 PVC fittings and bushings. Hose shall be installed in a serpentine manner. When cutting hose, shearing tool such as a pipe cutter, knife, or shears shall be used. Manufacturer's recommended tool and procedures when punching hose for emitters shall be followed.

#### 3.1.6.2 Emitter Heads

Emitters shall be installed in a plastic emitter box. Emitter on a rigid PVC nipple shall be connected to PVC drip lateral with a tee or elbow. Tubing shall be attached to barbed fitting and daylight distribution tubing at root ball secured with stake, with bug cap at end of secured distribution tubing. After installing emitters and before operating system, end of drip lateral shall be opened and flushed clean. The number of emitters on a line shall not exceed manufacturer's recommendations for that hose or distribution tubing size and length.

#### 3.1.6.3 Tubing Stakes

Main irrigation line shall be secured with stakes where line is aboveground. Stakes shall be spaced to ensure that hose does not shift location in presence of foot traffic, operations, gravity on slope installations, or environmental effects. Discharge of the emitter distribution tubing shall be staked to ensure that discharge point of emitter will be maintained at specified position in relation to plant material to be irrigated.

#### 3.1.7 Backflow Preventers

Backflow preventer shall be installed in new connection to existing water distribution system, between connection and control valves. Backflow preventer shall be installed with concrete pads.

##### 3.1.7.1 Pressure Type Vacuum Breaker

Pressure type vacuum breaker shall be installed 300 mm 12 inches above highest head.

##### 3.1.7.2 Reduced Pressure Type

Pipe lines shall be flushed prior to installing reduced pressure device; device shall be protected by a strainer located upstream. Device shall not be installed in pits or where any part of device could become submerged in standing water.

#### 3.1.8 Control Wire and Conduit

##### 3.1.8.1 Wires

Low voltage wires may be buried beside pipe in same trench. Rigid conduit shall be provided where wires run under paving. Wires shall be number tagged at key locations along main to facilitate service. One control circuit shall be provided for each zone and a circuit to control sprinkler system.

##### 3.1.8.2 Loops

A 300 mm 12 inch loop of wire shall be provided at each valve where controls are connected.

#### 3.1.8.3 Expansion and Contraction

Multiple tubes or wires shall be bundled and taped together at 3 m 10 foot intervals with 300 mm 12 inch loop for expansion and contraction.

#### 3.1.8.4 Splices

Electrical splices shall be waterproof.

#### 3.1.9 Automatic Controller

Exact field location of controllers shall be determined before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

#### 3.1.10 Thrust Blocks

Concrete shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set. Thrust blocks shall be as specified in Section 02510 WATER DISTRIBUTION SYSTEM.

#### 3.1.11 Backfill

##### 3.1.11.1 Minimum Cover

Depth of cover shall be 600 mm 24 inches for 32 mm (1-1/4 inch) 1-1/4 inch pipe or smaller; 600 mm 24 inches for 40 to 50 mm (1-1/2 to 2 inch) 1-1/2 to 2 inch pipe; 600 mm 24 inches for 65 mm (2-1/2 inch) 2-1/2 inch pipe or larger; 1000 mm 36 inches for pipes under traffic loads, farm operations, and freezing temperatures; and 450 mm 18 inches for low-voltage wires. Remainder of trench or pipe cover shall be filled to within 80 mm 3 inches of top with excavated soil, and compact soil with plate hand-held compactors to same density as undisturbed adjacent soil.

##### 3.1.11.2 Restoration

Top 80 mm 3 inches shall be filled with topsoil and compacted with same density as surrounding soil. Lawns and plants shall be restored in accordance with Sections 02921 SEEDING, 02922 SODDING, 02923 SPRIGGING, and Section 02930 EXTERIOR PLANTING. Pavements shall be restored in accordance with Section 3307 CONCRETE FOR MINOR STRUCTURES.

#### 3.1.12 Adjustment

After grading, seeding, and rolling of planted areas, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by providing new nipples of proper length or by use of heads having an approved device, integral with head, which will permit adjustment in height of head without changing piping.

#### 3.1.13 Disinfection

Sprinkler system fed from a potable water system shall be disinfected upstream of backflow preventer in be as required by the Task Order.

### 3.1.14 Cleaning of Piping

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

## 3.2 FIELD TESTS

All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

### 3.2.1 Hydrostatic Pressure Test

Piping shall be tested hydrostatically before backfilling and proved tight at a hydrostatic pressure of 1034 kPa (150 psi) 150 psi without pumping for a period of one hour with an allowable pressure drop of 35 kPa (5 psi). 5 psi. If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer.

### 3.2.2 Leakage Tests

Leakage tests for service main shall be as required by the Task Order.

### 3.2.3 Operation Test

At conclusion of pressure test, sprinkler heads or emitter heads, quick coupling assemblies, and hose valves shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

## 3.3 FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system. After as-built drawings are approved by Contracting Officer, controller charts and programming schedule shall be prepared. One chart for each controller shall be supplied. Chart shall be a reduced drawing of actual as-built system that will fit the maximum dimensions inside controller housing. Black line print for chart and a different pastel or transparent color shall indicate each station area of coverage. After chart is completed and approved for final acceptance, chart shall be sealed between two 0.505 mm (20 mil) 20 mil pieces of clear plastic.

## 3.4 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance

manuals.

3.5 CLEANUP

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

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## SECTION 02921

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## SECTION 02921

## SEEDING

## PART 1 GENERAL

## 1.1 REFERENCES

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.

## AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01 (Aug 95) Federal Seed Act Regulations Part 201

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 977 (1991) Emulsified Asphalt

ASTM D 2028 (1976; R 1992) Cutback Asphalt (Rapid-Curing Type)

ASTM D 4972 (1995a) pH of Soils

ASTM D 5268 (1992; R 1996) Topsoil Used for Landscaping Purposes

ASTM D 5883 (1996) Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-01 Data

Equipment; GA. Surface Erosion Control Material; GA. Chemical Treatment Material; GA.

Manufacturer's literature including physical characteristics, application and installation instructions for equipment, surface erosion control material and chemical treatment material.

## SD-07 Schedules

Equipment; FIO.

A listing of equipment to be used for the seeding operation.

SD-08 Statements

Delivery; FIO.

Delivery schedule.

Finished Grade and Topsoil; GA.

Finished grade status.

Topsoil; GA.

Availability of topsoil from the stripping and stock piling operation.

SD-09 Reports

Equipment Calibration; FIO.

Certification of calibration tests conducted on the equipment used in the seeding operation.

Soil Test; FIO.

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-13 Certificates

Seed; GA. Topsoil; GA. pH Adjuster; GA. Fertilizer; GA. Organic Material ; GA. Soil Conditioner; GA. Mulch; FIO. Asphalt Adhesive; GA. Pesticide ; GA.

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

- a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.
- b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
- c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.
- d. Fertilizer. Chemical analysis and composition percent.
- e. Organic Material: Composition and source.
- f. Soil Conditioner: Composition and source.
- g. Mulch: Composition and source.

h. Asphalt Adhesive: Composition.

i. Pesticide. EPA registration number and registered uses.

SD-14 Samples

Delivered Topsoil; FIO.

Samples taken from several locations at the source.

Soil Amendments; FIO.

A 4.5 kilogram 10 pound sample.

Mulch; FIO.

A 4.5 kilogram 10 pound sample.

SD-18 Records

Quantity Check; GA.

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Seed Establishment Period; FIO.

Calendar time period for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described.

Maintenance Record; GA.

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide; GA.

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

1.4.1.1 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site.

#### 1.4.1.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

#### 1.4.1.3 Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

#### 1.4.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm 1-1/2 inch diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site.

#### 1.4.3 Storage

Materials shall be stored in designated areas. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with seeding operation materials.

#### 1.4.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

#### 1.4.5 Time Limitation

Hydroseeding time limitation for holding seed in the slurry shall be a maximum 24 hours.

### PART 2 PRODUCTS

#### 2.1 SEED

##### 2.1.1 Seed Classification

State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS-01 and applicable state seed laws.

##### 2.1.2 Permanent Seed Species and Mixtures

Permanent seed species and mixtures shall be proportioned by weight as follows:

Botanical Name	Common Name	Mixture Percent by Weight	Percent Pure Live Seed
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LAWN SEED

(as required by the Task Order)

FIELD SEED

(as required by the Task Order)

2.1.3 Temporary Seed Species

Temporary seed species for surface erosion control or overseeding shall be as follows:

Botanical Name	Common Name	Percent Pure Live Seed
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(as required by the Task Order)

2.1.4 Quality

Weed seed shall be a maximum 1 percent by weight of the total mixture.

2.1.5 Seed Mixing

The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed.

2.1.6 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the seed specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite shall not be used.

### 2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, sulfur, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

#### 2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 55 percent shall pass through a 0.250 mm No. 60 sieve. To raise soil pH, ground limestone shall be used.

#### 2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 97 percent shall pass through a 0.250 mm No. 60 sieve.

#### 2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 35 percent shall pass through a 0.250 mm No. 60 sieve.

### 2.3.2 Fertilizer

It shall be as recommended by the soil test. Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

### 2.3.3 Nitrogen Carrier Fertilizer

It shall be as recommended by the soil test. Nitrogen carrier fertilizer shall be commercial grade, free flowing, and uniform in composition. The fertilizer may be a liquid nitrogen solution.

### 2.3.4 Organic Material

Organic material shall consist of either bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

#### 2.3.4.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

#### 2.3.4.2 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones,

sticks, and soil.

#### 2.3.4.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen.

#### 2.3.4.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm 3/8 inch screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm 2 inches in length.

#### 2.3.4.5 Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

#### 2.3.5 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for use singly or in combination to meet the requirements of the soil test.

##### 2.3.5.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm No. 10 sieve and a minimum 10 percent by weight shall pass a 1.18 mm No. 16 sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

##### 2.3.5.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized and applied according to the manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide, with an absorption capacity of 250-400 times its weight. Polymers shall also be added to the seed and be a starch grafted polyacrylonitrile, with graphite added as a tacky sticker. It shall have an absorption capacity of 100 plus times its weight.

##### 2.3.5.3 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to a minimum temperature of 650 degrees C. 1200 degrees F. Gradation: A minimum 90 percent shall pass a 2.36 mm No. 8 sieve; a minimum 99 percent shall be retained on a 0.250 mm No. 60 sieve; and a maximum 2 percent shall pass a 0.150 mm No. 100 sieve. Bulk density: A maximum 640 kilogram per cubic meter 40 pounds per cubic foot.

#### 2.3.5.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

#### 2.3.5.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

### 2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region.

#### 2.4.1 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice, furnished in air-dry condition and with a consistency for placing with commercial mulch-blowing equipment.

#### 2.4.2 Hay

Hay shall be native hay, sudan-grass hay, broomsedge hay, or other herbaceous mowings, furnished in an air-dry condition suitable for placing with commercial mulch-blowing equipment.

#### 2.4.3 Wood Cellulose Fiber

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

#### 2.4.4 Paper Fiber

Paper fiber mulch shall be recycled news print that is shredded for the purpose of mulching seed.

### 2.5 ASPHALT ADHESIVE

Asphalt adhesive shall conform to the following: Emulsified asphalt, conforming to ASTM D 977, Grade SS-1; and cutback asphalt, conforming to ASTM D 2028, Designation RC-70.

### 2.6 WATER

Water shall be the responsibility of the Contractor, unless otherwise noted. Water shall not contain elements toxic to plant life.

### 2.7 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

### 2.8 SURFACE EROSION CONTROL MATERIAL

Surface erosion control material shall conform to the following:

#### 2.8.1 Surface Erosion Control Blanket

Blanket shall be machine produced mat of wood excelsior formed from a web of interlocking wood fibers; covered on one side with either knitted straw blanket-like mat construction; covered with biodegradable plastic mesh; or interwoven biodegradable thread, plastic netting, or twisted kraft paper cord netting.

#### 2.8.2 Surface Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 19 to 25 mm 3/4 to 1 inch square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

#### 2.8.3 Surface Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 605 grams per meter 1.22 pounds per linear yard and 1200 mm 4 feet wide with mesh openings of approximately 25 mm 1 inch square.

#### 2.8.4 Surface Erosion Control Chemicals

Chemicals shall be high-polymer synthetic resin or cold-water emulsion of selected petroleum resins.

#### 2.8.5 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids shall resist mold growth.

#### 2.8.6 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

### PART 3 EXECUTION

#### 3.1 INSTALLING SEED TIME AND CONDITIONS

##### 3.1.1 Seeding Time

Seed shall be installed as required by the Task Order.

##### 3.1.2 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed.

When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for approval.

##### 3.1.3 Equipment Calibration

Immediately prior to the commencement of seeding operations, calibration tests shall be conducted on the equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's

specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. The calibration test results shall be provided within 1 week of testing.

#### 3.1.4 Soil Test

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection on site shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the seed species specified.

### 3.2 SITE PREPARATION

#### 3.2.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the seeding operation.

#### 3.2.2 Application of Soil Amendments

##### 3.2.2.1 Applying pH Adjuster

The pH adjuster shall be applied as recommended by the soil test. The pH adjuster shall be incorporated into the soil to a maximum 100 mm 4 inch depth or may be incorporated as part of the tillage operation.

##### 3.2.2.2 Applying Fertilizer

The fertilizer shall be applied as recommended by the soil test. Fertilizer shall be incorporated into the soil to a maximum 100 mm 4 inch depth or may be incorporated as part of the tillage or hydroseeding operation.

##### 3.2.2.3 Applying Soil Conditioner

The soil conditioner shall be as recommended by the soil test. The soil conditioner shall be spread uniformly over the soil a minimum 25 mm 1 inch depth and thoroughly incorporated by tillage into the soil to a maximum 100 mm 4 inch depth.

##### 3.2.2.4 Applying Super Absorbent Polymers

Polymers shall be spread uniformly over the soil as recommended by the manufacturer and thoroughly incorporated by tillage into the soil to a maximum 100 mm 4 inch depth.

#### 3.2.3 Tillage

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum 100 mm 4 inch depth. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall

be tilled to a minimum 50 mm 2 inch depth by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer, and soil conditioner may be applied during this procedure.

### 3.2.4 Prepared Surface

#### 3.2.4.1 Preparation

The prepared surface shall be a maximum 25 mm 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris.

#### 3.2.4.2 Lawn Area Debris

Debris and stones over a minimum 16 mm 5/8 inch in any dimension shall be removed from the surface.

#### 3.2.4.3 Field Area Debris

Debris and stones over a minimum 75 mm 3 inch in any dimension shall be removed from the surface.

#### 3.2.4.4 Protection

Areas with the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

### 3.3 INSTALLATION

Prior to installing seed, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

#### 3.3.1 Installing Seed

Seeding method shall be Broadcast Seeding, Drill Seeding or Hydroseeding as required by the Task Order. Seeding procedure shall ensure even coverage. Gravity feed applicators, which drop seed directly from a hopper onto the prepared soil, shall not be used because of the difficulty in achieving even coverage, unless otherwise approved. Absorbent polymer powder shall be mixed with the dry seed at the rate recommended by the manufacturer.

##### 3.3.1.1 Broadcast Seeding

Seed shall be uniformly broadcast at the rate specified by the Task Order using broadcast seeders. Half the total rate of seed application shall be broadcast in 1 direction, with the remainder of the seed rate broadcast at 90 degrees from the first direction. Seed shall be covered a maximum 6 mm 1/4 inch depth by disk harrow, steel mat drag, cultipacker, or other approved device.

### 3.3.1.2 Drill Seeding

Seed shall be uniformly drilled to a maximum 13 mm 1/2 inch depth and at the rate specified by the Task Order, using equipment having drills a maximum 175 mm 7 inches distance apart. Row markers shall be used with the drill seeder. Half the total rate of seed application shall be drilled in 1 direction, with the remainder of the seed rate drilled at 90 degrees from the first direction. The drilling equipment shall be maintained with half full seed boxes during the seeding operations.

### 3.3.1.3 Rolling

The entire area shall be firmed with a roller not exceeding 130 kilograms per meter 90 pounds per foot roller width. Slopes over a maximum 3-horizontal-to-1 vertical shall not be rolled. Areas seeded with seed drills equipped with rollers shall not be rolled.

### 3.3.2 Hydroseeding

Seed shall be mixed to ensure broadcast at the rate specified by the Task Order. Seed and fertilizer shall be added to water and thoroughly mixed to meet the rates specified. The time period for the seed to be held in the slurry shall be a maximum 24 hours. Wood cellulose fiber mulch and tackifier shall be added at the rates recommended by the manufacturer after the seed, fertilizer, and water have been thoroughly mixed to produce a homogeneous slurry. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

### 3.3.3 Mulching

#### 3.3.3.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 0.75 metric tons per hectare 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

#### 3.3.3.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

#### 3.3.3.3 Asphalt Adhesive Tackifier

Asphalt adhesive tackifier shall be sprayed at a rate between 666 to 866 liters per hectare 10 to 13 gallons per 1000 square feet. Sunlight shall not be completely excluded from penetrating to the ground surface.

#### 3.3.3.4 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

### 3.3.3.5 Asphalt Adhesive Coated Mulch

Hay or straw mulch may be spread simultaneously with asphalt adhesive applied at a rate between 666 to 866 liters per hectare 10 to 13 gallons per 1000 square feet, using power mulch equipment which shall be equipped with suitable asphalt pump and nozzle. The adhesive-coated mulch shall be applied evenly over the surface. Sunlight shall not be completely excluded from penetrating to the ground surface.

### 3.3.3.6 Wood Cellulose Fiber, Paper Fiber, and Recycled Paper

Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. The mulch shall be mixed and applied in accordance with the manufacturer's recommendations.

### 3.3.4 Watering Seed

Watering shall be started immediately after completing the seeding of an area. Water shall be applied to supplement rainfall at a rate sufficient to ensure moist soil conditions to a minimum 25 mm 1 inch depth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas, unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

## 3.4 SURFACE EROSION CONTROL

### 3.4.1 Surface Erosion Control Material

Where indicated or as directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade.

### 3.4.2 Temporary Seeding

The application rate shall be as specified by the Task Order. When directed during contract delays affecting the seeding operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded in accordance with temporary seed species listed under Paragraph SEED.

#### 3.4.2.1 Soil Amendments

When soil amendments have not been applied to the area, the quantity of 1/2 of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. The area shall be watered in accordance with paragraph Watering Seed.

#### 3.4.2.2 Remaining Soil Amendments

The remaining soil amendments shall be applied in accordance with the paragraph Tillage when the surface is prepared for installing seed.

## 3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount

of material used shall be compared with the total area covered to determine the rate of application used. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

### 3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

#### 3.6.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

#### 3.6.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A pesticide plan shall be submitted.

### 3.7 RESTORATION AND CLEAN UP

#### 3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the seeding operation shall be restored to original condition at Contractor's expense.

#### 3.7.2 Clean Up

Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

### 3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the seeding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

### 3.9 SEED ESTABLISHMENT PERIOD

#### 3.9.1 Commencement

The seed establishment period to obtain a healthy stand of grass plants shall begin on the first day of work under this contract and shall end 3 months after the last day of the seeding operation. Written calendar time period shall be furnished for the seed establishment period. When there is more than 1 seed establishment period, the boundaries of the seeded area

covered for each period shall be described. The seed establishment period shall be coordinated with Sections 02922 SODDING, 02923 SPRIGGING, and 02930 EXTERIOR PLANTING. The seed establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas.

### 3.9.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for species and health when the grass plants are a minimum 25 mm 1 inch high.

#### 3.9.2.1 Lawn Area

A satisfactory stand of grass plants from the seeding operation for a lawn area shall be a minimum 200 grass plants per square meter 20 grass plants per square foot. Bare spots shall be a maximum 150 mm 6 inches square. The total bare spots shall be a maximum 2 percent of the total seeded area.

#### 3.9.2.2 Field Area

A satisfactory stand of grass plants from the seeding operation for a field area shall be a minimum 100 grass plants per square meter 10 grass plants per square foot. The total bare spots shall not exceed 2 percent of the total seeded area.

### 3.9.3 Maintenance During Establishment Period

Maintenance of the seeded areas shall include eradicating weeds, insects and diseases; protecting embankments and ditches from surface erosion; maintaining erosion control materials and mulch; protecting installed areas from traffic; mowing; watering; and post-fertilization.

#### 3.9.3.1 Mowing

- a. Lawn Areas: Lawn areas shall be mowed to a minimum 75 mm 3 inch height when the turf is a maximum 100 mm 4 inches high. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.
- b. Field Areas: Field areas shall be mowed once during the season to a minimum 75 mm 3 inch height. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

#### 3.9.3.2 Post-Fertilization

The fertilizer shall be applied as recommended by the soil test. A maximum 4 kilograms per hectare 1/2 pound per 1000 square feet of actual available nitrogen shall be provided to the grass plants. The application shall be timed prior to the advent of winter dormancy and shall be made without burning the installed grass plants.

#### 3.9.3.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

#### 3.9.3.4 Repair or Reinstall

Unsatisfactory stand of grass plants and mulch shall be repaired or

reinstalled, and eroded areas shall be repaired in accordance with paragraph SITE PREPARATION.

3.9.3.5 Maintenance Record

A record of each site visit shall be furnished, describing the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

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## SECTION 02922

## SODDING

## PART 1 GENERAL

## 1.1 REFERENCES

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602	(1995a) Agricultural Liming Materials
ASTM D 4972	(1995a) pH of Soils
ASTM D 5268	(1992; R 1996) Topsoil Used for Landscaping Purposes
ASTM D 5883	(1996) Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-01 Data

Equipment; GA. Chemical Treatment Material; GA.

Manufacturer's literature including physical characteristics, application and installation instructions for equipment and chemical treatment material.

## SD-07 Schedules

Equipment; FIO.

A listing of equipment to be used for the sodding operation.

## SD-08 Statements

Delivery; FIO.

Delivery schedule.

Finished Grade and Topsoil; GA.

Finished grade status.

Topsoil; GA.

Availability of topsoil from the stripping and stock piling operation.

SD-09 Reports

Equipment Calibration; FIO.

Certification of calibration tests conducted on the equipment used in the sodding operation.

Soil Test; GA.

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-13 Certificates

Sod; GA. Topsoil; GA. pH Adjuster; GA. Fertilizer; GA. Organic Material ; FIO. Soil Conditioner; GA. Pesticide; GA.

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

- a. Sod. Classification, botanical name, common name, mixture percentage of species, percent purity, quality grade, field location and state certification.
- b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
- c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.
- d. Fertilizer. Chemical analysis and composition percent.
- e. Organic Material: Composition and source.
- f. Soil Conditioner: Composition and source.
- g. Pesticide. EPA registration number and registered uses.

SD-14 Samples

Delivered Topsoil; FIO.

Samples taken from several locations at the source.

Soil Amendments; FIO.

A 4.5 kilogram 10 pound sample.

Temporary Seeding; GA.

Sample of annual seed species and application rate.

SD-18 Records

Quantity Check; GA.

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed. The quantity of sod used shall be compared against the total area installed.

Sod Establishment Period; GA.

Calendar time period for the sod establishment period. When there is more than one sod establishment period, the boundaries of the sodded area covered for each period shall be described.

Maintenance Record; FIO.

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide; GA.

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

### 1.3 SOURCE INSPECTION

The sources of sod material and delivered topsoil shall be subject to inspection.

### 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

#### 1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

##### 1.4.1.1 Sod

Sod shall be protected during delivery to prevent desiccation, internal heat buildup, or contamination.

##### 1.4.1.2 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site.

##### 1.4.1.3 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

##### 1.4.1.4 Pesticides

Pesticide material shall be delivered to the site in the original, unopened

containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

#### 1.4.2 Inspection

Sod shall be inspected upon arrival at the job site for conformity to species. Sod shall be checked for visible broadleaf weeds, and a visible consistency with no obvious patches of foreign grasses that exceed 2 percent of the canopy. Sod that is heating up, dry, moldy, yellow, irregularly shaped, torn, or of uneven thickness shall be rejected. Other materials shall be inspected for compliance with specified requirements. Open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm 1-1/2 inch diameter; and topsoil that contains viable plants and plant parts, shall be rejected. Unacceptable materials shall be removed from the job site.

#### 1.4.3 Storage

##### 1.4.3.1 Sod

Sod shall be stored in designated areas and kept in a moist condition by watering with a fine mist, and covered with moist burlap, straw, or other covering. Covering shall allow air to circulate, preventing internal heat from building up. Sod shall be protected from exposure to wind and direct sunlight until installed.

##### 1.4.3.2 Other Material Storage

Materials shall be stored in designated areas. Lime and fertilizer shall be stored in cool, dry locations, away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with sod operation materials.

#### 1.4.4 Handling

Sod shall not be damaged during handling. Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

#### 1.4.5 Time Limitation

Time limitation between harvesting and installing sod shall be a maximum 36 hours.

## PART 2 PRODUCTS

### 2.1 SOD

#### 2.1.1 Sod Classification

State-certified, Nursery-grown sod shall be provided as classified by applicable state laws. Sod section shall be sized to permit rolling and lifting without breaking.

#### 2.1.2 Grass Species

Grass species shall be proportioned as follows:

Botanical Name	Common Name	Mixture Percent
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(as specified by the Task Order)

### 2.1.3 Quality

Sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 25 mm 1 inch in diameter, woody plant roots, and other materials detrimental to a healthy stand of grass plants. Broadleaf weeds and patches of foreign grasses shall be a maximum 2 percent of the sod section.

### 2.1.4 Thickness

Sod shall be machine cut to a minimum 35 mm 1-3/8 inch thickness. Measurement for thickness shall exclude top growth and thatch.

### 2.1.5 Anchors

Sod anchors shall be as recommended by the sod supplier.

### 2.1.6 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

## 2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the sod species specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash, or other material over a maximum 40 mm 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

## 2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material, and soil conditioners meeting the following requirements. Vermiculite shall not be used.

### 2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

#### 2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 55 percent shall pass through a 0.250 mm No. 60 sieve. To raise soil pH, ground limestone shall be used.

#### 2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 97 percent shall pass through a 0.250 mm No. 60 sieve.

#### 2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 35 percent shall pass through a 0.250 mm No. 60 sieve.

#### 2.3.2 Fertilizer

It shall be as recommended by the soil test. Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

#### 2.3.3 Nitrogen Carrier Fertilizer

It shall be as recommended by the soil test. Nitrogen carrier fertilizer shall be commercial grade, free flowing, and uniform in composition. The fertilizer may be a liquid nitrogen solution.

#### 2.3.4 Organic Material

Organic material shall consist of either bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

##### 2.3.4.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

##### 2.3.4.2 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume straw, sawdust, or other bedding materials. Manure shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

##### 2.3.4.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material free of stones, sticks, soil, and toxic substances harmful to plants, fully composted or stabilized with nitrogen.

##### 2.3.4.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it

was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm 3/8 inch screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent or less by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm 2 inches in length.

#### 2.3.4.5 Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

#### 2.3.5 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for use singly or in combination to meet the requirements for topsoil.

##### 2.3.5.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm No. 10 sieve and a minimum 10 percent by weight shall pass a 1.18 mm No. 16 sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

##### 2.3.5.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized and applied according to the manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide with an absorption capacity of 250-400 times its weight.

##### 2.3.5.3 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to minimum temperature of 650 degrees C. 1200 degrees F. Gradation: A minimum 90 percent passing 2.36 mm No. 8 sieve; a minimum 99 percent shall be retained on a 0.250 mm No. 60 sieve; and a maximum 2 percent shall pass a 0.150 mm No. 100 sieve. Bulk density: A maximum 640 kilogram per cubic meter 40 pounds per cubic foot.

##### 2.3.5.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

##### 2.3.5.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

#### 2.4 WATER

Water shall be the responsibility of the Contractor unless otherwise noted. Water shall not contain elements toxic to plant life.

#### 2.5 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil

fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

### PART 3 EXECUTION

#### 3.1 INSTALLING SOD TIME AND CONDITIONS

##### 3.1.1 Sodding Time

Sod shall be installed as required by the Task Order.

##### 3.1.2 Sodding Conditions

Sodding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture or other unsatisfactory conditions prevail, the work shall be stopped when directed.

When special conditions warrant a variance to the sodding operations, proposed alternate times shall be submitted for approval.

##### 3.1.3 Equipment Calibration

Immediately prior to the commencement of sodding operations, calibration tests shall be conducted on the equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. Provide calibration test results within one week of testing.

##### 3.1.4 Soil Test

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection on site shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the sod species specified.

#### 3.2 SITE PREPARATION

##### 3.2.1 Finished Grade and Topsoil

Prior to the commencement of the sodding operation, the Contractor shall verify that finished grades are as indicated on drawings; the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 02300 EARTHWORK.

##### 3.2.2 Application of Soil Amendments

###### 3.2.2.1 Applying pH Adjuster

The pH adjuster shall be applied at the rate recommended by the soil test. The pH adjuster shall be incorporated into the soil to a maximum 100 mm 4 inch depth or may be incorporated as part of the tillage operation.

###### 3.2.2.2 Applying Fertilizer

The fertilizer shall be applied at the rate recommended by the soil test. Fertilizer shall be incorporated into the soil to a maximum 100 mm 4 inch depth or may be incorporated as part of the tillage or hydroseeding operation.

#### 3.2.2.3 Applying Soil Conditioner

The soil conditioner shall be as recommended by the soil test. The soil conditioner shall be spread uniformly over the soil a minimum 25 mm 1 inch depth and thoroughly incorporated by tillage into the soil to a maximum 100 mm 4 inches depth.

#### 3.2.2.4 Applying Super Absorbent Polymers

Polymers shall be spread uniformly over the soil as recommended by the manufacturer and thoroughly incorporated by tillage into the soil to a maximum 50 mm 2 inches deep prior to placement of sod.

#### 3.2.3 Tillage

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum 100 mm 4 inches deep. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum 50 mm 2 inches deep by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer, and soil conditioner may be applied during this procedure.

#### 3.2.4 Prepared Surface

##### 3.2.4.1 Preparation

The prepared surface shall be a maximum 25 mm 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be rolled and completed with a light raking to remove from the surface debris and stones over a minimum 16 mm 5/8 inch in any dimension.

##### 3.2.4.2 Protection

Areas within the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

#### 3.3 INSTALLATION

Prior to installing sod, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Areas shall be sodded as indicated. Adequate soil moisture shall be ensured prior to sodding by spraying water on the area to be sodded and wetting the soil to a maximum 25 mm 1 inch depth.

##### 3.3.1 Installing Sod

Rows of sod sections shall be placed parallel to and tightly against each other. Joints shall be staggered laterally. The sod sections shall not be stretched or overlapped. All joints shall be butted tight. Voids and air drying of roots shall be prevented. Sod sections shall be laid across the slope on long slopes. Sod sections shall be laid at right angles to the flow of water in ditches. Sod sections shall be anchored on slopes steeper than 3-horizontal-to-1-vertical. Anchoring may be required when surface weight or pressure upon placed sod sections is anticipated to cause lateral movement. Sod anchors shall be placed a minimum 600 mm 2 feet on center with a minimum 2 anchors per sod section.

### 3.3.2 Finishing

Displacement of the sod shall be prevented by tamping or rolling the sod in place and knitting the sod to the soil. Air pockets shall be eliminated and a true and even surface shall be provided. Frayed edges shall be trimmed, and holes or missing corners shall be patched with sod.

### 3.3.3 Rolling

The entire area shall be firmed with a roller not exceeding 130 kilograms per meter 90 pounds per foot roller width. Slopes over a maximum 3-horizontal-to-1 vertical shall not be rolled.

### 3.3.4 Watering Sod

Watering shall be started immediately after completing each day of installing sod. Water shall be applied at least 3 times per week to supplement rainfall, at a rate sufficient to ensure moist soil conditions to a minimum depth of 25 mm 1 inch. Run-off, puddling, and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or plant material shall be prevented.

## 3.4 TEMPORARY SEEDING

The application rate shall be as required by the Task Order. When directed during contract delays affecting the sodding operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded with annual seed in accordance with Section 02921 SEEDING. When there is no Section 02921 SEEDING provided in the project, an annual seed species and application rate shall be submitted for approval.

### 3.4.1 Soil Amendments, Tillage and Watering

When soil amendments have not been applied to the area, the quantity of 1/2 of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. The area shall be watered in accordance with paragraph Watering Sod as required.

### 3.4.2 Remaining Soil Amendments

The remaining soil amendments shall be applied in accordance with the paragraph Tillage when the surface is prepared for installing sod.

## 3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight

certificates shall be retained as a record of the amount used. The amount of the material used shall be compared with the total area covered to determine the rate of application. The quantity of sod used shall be compared against the total area established with sod. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

### 3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

#### 3.6.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

#### 3.6.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

### 3.7 RESTORATION AND CLEAN UP

#### 3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the sodding operation shall be restored to original condition at Contractor's expense.

#### 3.7.2 Clean Up

Excess and waste material shall be removed from the sodded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

### 3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the sodding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed. Signage shall be in accordance with the Task Order.

### 3.9 SOD ESTABLISHMENT PERIOD

#### 3.9.1 Commencement

The sod establishment period to obtain a healthy stand of grass plants shall begin on the first day of work under this contract and shall end 3

months after the last day of sodding operation. Written calendar time period shall be furnished for the sod establishment period. When there is more than 1 sod establishment period, the boundaries of the sodded area covered for each period shall be described. The sod establishment period should be coordinated with Sections 02921 SEEDING, 02923 SPRIGGING, and 02930 EXTERIOR PLANTING. The sod establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas.

### 3.9.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for species and health. A satisfactory stand of grass plants from the sodding operation shall be living sod uniform in color and leaf texture. Bare spots shall be a maximum 50 mm 2 inch square. Joints between sod pieces shall be tight and free from weeds and other undesirable growth.

### 3.9.3 Maintenance During Establishment Period

Maintenance of the sodded areas shall include eradicating weeds, insects and diseases; protecting embankments and ditches from surface erosion; maintaining erosion control materials and mulch; protecting installed areas from traffic; mowing; watering; and post-fertilization.

#### 3.9.3.1 Mowing

Sodded areas shall be mowed to a minimum 75 mm 3 inch height when the turf is a maximum 100 mm 4 inch height. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

#### 3.9.3.2 Post-Fertilization

The fertilizer shall be applied as recommended by the soil test. A maximum 4 kilograms per hectare 1/2 pound per 1000 square feet of actual available nitrogen shall be provided to the grass plants. The application shall be timed prior to the advent of winter dormancy and shall be made without burning the installed grass plants.

#### 3.9.3.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

#### 3.9.3.4 Repair

Unsatisfactory stand of grass plants shall be repaired or reinstalled, and eroded areas shall be repaired in accordance with paragraph SITE PREPARATION.

#### 3.9.3.5 Maintenance Record

A record of each site visit shall be furnished which describes the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

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## SECTION 02923

## SPRIGGING

## PART 1 GENERAL

## 1.1 REFERENCES

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.

## AGRICULTURAL MARKETING SERVICE (AMS)

AMS-01 (Aug 95) Federal Seed Act Regulations Part 201

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 4972 (1995a) pH of Soils

ASTM D 5268 (1992; R 1996) Topsoil Used for Landscaping Purposes

ASTM D 5883 (1996) Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-01 Data

Equipment; GA. Chemical Treatment Material; GA.

Manufacturer's literature, including physical characteristics, application and installation instructions for equipment and chemical treatment material.

## SD-07 Schedules

Equipment; FIO.

A listing of equipment to be used for the sprigging operation.

## SD-08 Statements

Delivery; FIO.

Delivery schedule.

Finished Grade and Topsoil; FIO.

Finished grade status.

Topsoil; GA.

Availability of topsoil from the stripping and stock piling operation.

#### SD-09 Reports

Equipment Calibration; FIO.

Certification of calibration tests conducted on the equipment used in the sprigging operation.

Soil Test; GA.

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

#### SD-13 Certificates

Sprigs; GA. Seed; GA. Topsoil; GA. pH Adjuster; GA. Fertilizer; GA. Organic Material; GA. Soil Conditioner; GA. Pesticide; GA.

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

- a. Sprigs. Cultivar name, genetic purity and field location.
- b. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.
- c. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
- d. pH Adjuster. Calcium carbonate equivalent and sieve analysis.
- e. Fertilizer. Chemical analysis and composition percent.
- f. Organic Material: Composition and source.
- g. Soil Conditioner: Composition and source.
- h. Pesticide. EPA registration number and registered uses.

#### SD-14 Samples

Delivered Topsoil; GA.

Samples taken from several locations at the source.

Soil Amendments; GA.

A 4.5 kilogram 10 pound sample.

Temporary Seeding; GA.

Sample of annual seed species and application rate.

#### SD-18 Records

Quantity Check; GA.

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed. The quantity of sprigs used shall be compared against the total area installed.

Sprig Establishment Period; GA.

Calendar time period for the sprig establishment period. When there is more than 1 sprig establishment period, the boundaries of the sprigged area covered for each period shall be described.

Maintenance Record; GA.

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide; GA.

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

### 1.3 SOURCE INSPECTION

The sources of sprig material and delivered topsoil shall be subject to inspection.

### 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

#### 1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

##### 1.4.1.1 Sprigs

Sprigs shall be protected during delivery to prevent desiccation, internal heat buildup, or contamination.

##### 1.4.1.2 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site.

#### 1.4.1.3 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

#### 1.4.1.4 Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers, bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

#### 1.4.2 Inspection

Sprigs shall be inspected upon arrival at the jobsite for conformity to cultivar and genetic purity. Sprigs shall have attached roots with 2 to 3 nodes and shall be 100 to 150 mm 4 to 6 inches in length, with no adhering soil, weed stems, or roots. Sprigs that have been exposed to heat or excessive drying shall be rejected. Seed shall be inspected upon arrival at the job site for conformity to cultivar and quality. Seed that is wet, moldy, or bears a test date 5 months or older, shall be rejected. Other materials shall be inspected for compliance. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm 1-1/2 inch diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site.

#### 1.4.3 Storage

##### 1.4.3.1 Sprigs

Sprigs shall be stored in designated areas and covered with moist burlap, straw, or other covering. Covering shall allow air to circulate preventing internal heat from building up. Sprigs shall be protected from exposure to wind, and direct sunlight until installed.

##### 1.4.3.2 Other Material Storage

Materials shall be stored in designated areas. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with plant material or other materials.

#### 1.4.4 Handling

Sprigs shall not be damaged during handling. Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

#### 1.4.5 Time Limitation

Time limitation between harvesting and installing sprigs shall be a maximum 24 hours. Hydroseeding time limitation for holding seed in the slurry shall be a maximum 24 hours.

## PART 2 PRODUCTS

2.1 SPRIGS

2.1.1 Sprig Cultivar

The cultivar shall be healthy living stems, stolons, or rhizomes. They shall have attached roots from 100 to 150 mm 4 to 6 inches long that include 2 to 3 nodes.

2.1.2 Quality

Sprigs shall be grown under climatic conditions similar to those in the locality of the project. Sprigs shall have no adhering soil, weed stems, or roots. Sprigs shall be obtained from heavy and dense sod, and shall be free from material detrimental to a healthy stand of grass plants. Sprigs that have been exposed to heat or excessive drying shall be rejected.

2.2 SEED

2.2.1 Seed Classification

State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS-01 and applicable state seed laws.

2.2.2 Temporary Seed Species

Botanical Name	Common Name	Percent Pure Live Seed
_____	_____	_____

(as required by the Task Order)

Weed seed shall be a maximum 1 percent by weight of the total mixture.

2.3 SUBSTITUTIONS

Substitutions will not be allowed without written request and approval from the Contracting Officer.

2.4 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil, stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the sprig plants specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

2.5 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material, and soil conditioners meeting the following requirements. Vermiculite shall not be used.

### 2.5.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

#### 2.5.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 55 percent shall pass through a 0.250 mm No. 60 sieve. To raise soil pH, ground limestone shall be used.

#### 2.5.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 97 percent shall pass through a 0.250 mm No. 60 sieve.

#### 2.5.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 35 percent shall pass through a 0.250 mm No. 60 sieve.

### 2.5.2 Fertilizer

It shall be as recommended by the soil test. Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

#### 2.5.3 Nitrogen Carrier Fertilizer

It shall be as recommended by the soil test. Nitrogen carrier fertilizer shall be commercial grade, free flowing, and uniform in composition. The fertilizer may be a liquid nitrogen solution.

#### 2.5.4 Organic Material

Organic material shall consist of either bonemeal, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

##### 2.5.4.1 Bonemeal

Bonemeal shall be finely ground, steamed bone product, containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

##### 2.5.4.2 Rotted Manure

Rotted manure shall be unleached horse, chicken, or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

#### 2.5.4.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material free of stones, sticks, soil, and toxic substances harmful to plants, fully composted, or stabilized with nitrogen.

#### 2.5.4.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. It shall be derived from food, agricultural, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm 3/8 inch screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent or less by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm 2 inches in length.

#### 2.5.4.5 Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

#### 2.5.5 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for use singly or in combination to meet the requirements for topsoil.

##### 2.5.5.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm No. 10 sieve and a minimum 10 percent by weight shall pass a 1.18 mm No. 16 sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

##### 2.5.5.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized and applied according to the manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide with an absorption capacity of 250-400 times its weight. Polymers shall also be added to the seed, and be a starch grafted polyacrylonitrile with graphite added as a tacky sticker. Polymers shall have an absorption capacity of 100 plus times its weight.

##### 2.5.5.3 Calcined Clay

Calcined clay shall be granular particles produced from montmorillonite clay calcined to minimum temperature of 650 degrees C. 1200 degrees F. Gradation: A minimum 90 percent passing 2.36 mm No. 8 sieve; a minimum 99 percent shall be retained on a 0.250 mm No. 60 sieve; and a maximum 2 percent shall pass a 0.150 mm No. 100 sieve. Bulk density: A maximum 640 kilogram per cubic meter 40 pounds per cubic foot.

##### 2.5.5.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

#### 2.5.5.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

### 2.6 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region.

#### 2.6.1 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice furnished in air-dry condition, and with a consistency for placing with commercial mulch-blowing equipment.

#### 2.6.2 Hay

Hay shall be native hay, sudan-grass hay, broomsedge hay, or other herbaceous mowings furnished in an air-dry condition, suitable for placing with commercial mulch-blowing equipment.

#### 2.6.3 Wood Cellulose Fiber

Wood cellulose fiber shall not contain any growth or germination-inhibiting factors, and shall be dyed an appropriate color to facilitate placement during application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 4.5 to 6.0.

#### 2.6.4 Paper Fiber

Paper fiber mulch shall be recycled news print that is shredded for the purpose of mulching seed.

### 2.7 WATER

Unless otherwise noted, water shall be the responsibility of the Contractor. Water shall not contain elements toxic to plant life.

### 2.8 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

## PART 3 EXECUTION

### 3.1 INSTALLING SPRIGS TIME AND CONDITIONS

#### 3.1.1 Sprigging Time

Sprigs shall be installed as required by the Task Order.

#### 3.1.2 Sprigging Conditions

Sprigging operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed.

When special conditions warrant a variance to the sprigging operations, proposed alternate times shall be submitted for approval.

### 3.1.3 Equipment Calibration

Immediately prior to the commencement of sprigging operations, calibration tests shall be conducted on the equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. Provide the calibration test results within 1 week of testing.

### 3.1.4 Soil Test

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection onsite shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the sprig cultivar specified.

## 3.2 SITE PREPARATION

### 3.2.1 Finished Grade and Topsoil

Prior to the commencement of sprigging operation, the Contractor shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 02300 EARTHWORK.

### 3.2.2 Application of Soil Amendments

#### 3.2.2.1 Applying pH Adjuster

The pH adjuster shall be applied at the rate recommended by the soil test. The pH adjuster shall be incorporated into the soil to a maximum 100 mm 4 inch depth or may be incorporated as part of the tillage operation.

#### 3.2.2.2 Applying Fertilizer

The fertilizer shall be applied at the rate recommended by the soil test. Fertilizer shall be incorporated into the soil to a maximum 100 mm 4 inch depth or may be incorporated as part of the tillage or hydroseeding operation.

#### 3.2.2.3 Applying Soil Conditioner

The soil conditioner shall be as recommended by the soil test. The soil conditioner shall be spread uniformly over the soil a minimum 25 mm 1 inch depth and thoroughly incorporated by tillage into the soil to a maximum 100 mm 4 inches depth.

#### 3.2.2.4 Applying Super Absorbent Polymers

Polymers shall be applied at the rate recommended by the manufacturer and incorporated into the soil to a maximum 100 mm 4 inch depth as part of the tillage operation.

#### 3.2.3 Tillage

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum depth of 100 mm. 4 inches. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum depth of 50 mm 2 inches by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer and soil conditioner may be applied during this procedure.

#### 3.2.4 Prepared Surface

##### 3.2.4.1 Preparation

The prepared surface shall be a maximum 25 mm 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be rolled and completed with a light raking to remove debris.

##### 3.2.4.2 Lawn Area Debris

Debris and stones over a minimum 16 mm 5/8 inch in any dimension shall be removed from the surface.

##### 3.2.4.3 Field Area Debris

Debris and stones over a minimum 75 mm 3 inches in any dimension shall be removed from the surface.

##### 3.2.4.4 Protection

Areas with the prepared surface shall be protected from compaction and damage by vehicular or pedestrian traffic and surface erosion.

#### 3.3 INSTALLATION

Prior to installing sprigs, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Areas shall be sprigged as indicated.

##### 3.3.1 Installing Sprigs

The sprigging method shall be Broadcast Sprigging, Hydroplanting, Row Sprigging or applying seed-over-sprigs as required by the Task Order. Sprigging procedure shall ensure even coverage.

##### 3.3.1.1 Broadcast Sprigging

Sprigs shall be broadcast uniformly by hand, with mechanical equipment, or other approved method. Sprigs shall be planted to provide a minimum number of 30 viable sprigs per square meter 25 viable sprigs per square yard. The distance between individual sprigs shall be a maximum 300 mm 12 inch space.

Sprigs shall be forced into the soil to a minimum 25 mm 1 inch depth by disk-rolling, pressing with steel matting, or other approved method.

#### 3.3.1.2 Hydroplanting

Sprigs shall be mixed with water and uniformly applied under pressure over the entire area. Sprigs shall be covered by distributing a topdressing uniformly and evenly to a minimum 25 mm 1 inch depth. Topdressing shall conform to the paragraph TOPSOIL.

#### 3.3.1.3 Row Sprigging

Sprigs shall be planted in rows spaced a maximum of 300 mm 12 inches apart and to a minimum 25 mm 1 inch depth, with mechanical sprig planter or other methods. Sprigs shall be placed in the rows a maximum 150 mm 6 inch distance apart.

#### 3.3.2 Mulching

##### 3.3.2.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 0.75 metric tons per hectare 2 tons per acre. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

##### 3.3.2.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

##### 3.3.2.3 Wood Cellulose Fiber, Paper Fiber and Recycled Paper

Wood cellulose fiber, paper fiber, or recycled paper shall be applied as part of the hydroseeding operation. The mulch shall be mixed and applied in accordance with the manufacturer's recommendations.

#### 3.3.3 Applying Seed Over Sprigs

Seed shall be applied using either broadcast or hydroseeding equipment and methods. Seeding procedure shall ensure even coverage. Gravity feed applicators, which drop seed directly from a hopper onto the prepared soil, shall not be used.

##### 3.3.3.1 Broadcast Seeding

Seed shall be uniformly broadcast at the rate as required by the Task Order using broadcast seeders. Half the total rate of seed application shall be broadcast in 1 direction, with the remainder of the seed rate broadcast at

90 degrees from the first direction. Seed shall be covered to a minimum 6 mm 1/4 inch depth by disk harrow, steel mat drag, cultipacker, or other approved device. Seed shall be broadcast and covered prior to sprigging operation.

#### 3.3.3.2 Hydroseeding

Seed shall be mixed to ensure broadcast at the rate as required by the Task Order. Seed and fertilizer shall be added to water and thoroughly mixed at the rates specified. The maximum time period for the seed to be held in the slurry shall be 24 hours. Wood cellulose fiber mulch and tackifier shall be added at the rates recommended by the manufacturer after the seed, fertilizer, and water have been thoroughly mixed to produce a homogeneous slurry. Slurry shall be uniformly applied under pressure over the entire area. The hydroseeded area shall not be rolled.

#### 3.3.4 Rolling

The entire area shall be firmed with a roller not exceeding 130 kilograms per meter 90 pounds per foot roller width. Slopes over a maximum 3-horizontal-to-1 vertical shall not be rolled.

#### 3.3.5 Finishing

A minimum 25 percent of the installed sprigs shall extend above the ground surface upon completion of the sprigging operation.

#### 3.3.6 Watering Sprigs

Watering shall be started immediately after completing each day of sprigging. Water shall be applied at a rate sufficient to ensure moist soil conditions to a minimum 25 mm 1 inch depth. Run-off, puddling, and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or plant material shall be prevented.

### 3.4 TEMPORARY SEEDING

The application rate shall be as required by the Task Order. When directed during contract delays affecting the sprigging operation or when a quick cover is required to prevent surface erosion, the areas designated shall be seeded in accordance with temporary seed species listed under paragraph SEED.

#### 3.4.1 Soil Amendments

When no soil amendments have been applied to the area, the quantity of 1/2 of the required soil amendments shall be applied and the area tilled in accordance with paragraph SITE PREPARATION. The area shall be watered in accordance with paragraph Watering Sprigs as required.

#### 3.4.2 Remaining Soil Amendments

The remaining soil amendments shall be applied in accordance with the paragraph Tillage when the surface is prepared for installing sprigs.

### 3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for

recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount of the material used shall be compared with the total area covered to determine the rate of application used. The quantity of sprigs used shall be compared against the total area established with sprigs. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

### 3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

#### 3.6.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

#### 3.6.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

### 3.7 RESTORATION AND CLEAN UP

#### 3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the sprigging operation shall be restored to original condition at Contractor's expense.

#### 3.7.2 Clean Up

Excess and waste material shall be removed from the sprigged areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

### 3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the sprigging operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed. Signage shall be in accordance with Section 10430 EXTERIOR SIGNAGE.

### 3.9 SPRIG ESTABLISHMENT PERIOD

#### 3.9.1 Commencement

The sprig establishment period to obtain a healthy stand of grass plants

shall begin on the first day of work under this contract and shall end 3 months after the last day of sprigging operations. Written calendar time period shall be furnished for the sprig establishment period. When there is more than 1 sprig establishment period, the boundaries of the sprigged area covered for each period shall be described. The sprig establishment period shall be coordinated with Sections 02921 SEEDING, 02922 SODDING, and 02930 EXTERIOR PLANTS. The sprig establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas.

### 3.9.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for cultivar and health when grass plants are a minimum 25 mm 1 inch high. A satisfactory stand of grass plants from the sprigging operation shall be a minimum 60 grass plants per square meter 6 grass plants per square foot. When annual seed is applied over the sprigs, the annual grass plants shall not be counted. Bare spots shall be a maximum 230 mm 9 inch square. The total bare spots shall be a maximum 2 percent of the total sprigged area.

### 3.9.3 Maintenance During Establishment Period

Maintenance of the sprigged areas shall include eradicating weeds, insects, and diseases; protecting embankments and ditches from surface erosion; maintaining erosion control materials and mulch; protecting installed areas from traffic; mowing; watering; and post-fertilization.

#### 3.9.3.1 Mowing

a. Lawn Areas: Lawn areas shall be mowed to a minimum 75 mm 3 inch height when the sprigs are a maximum 100 mm 4 inches high. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

b. Field Areas: Field areas shall be mowed once during the season to a minimum 75 mm 3 inch height. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

#### 3.9.3.2 Post-Fertilization

The fertilizer shall be applied as recommended by the soil test. A maximum 4 kilograms per hectare 1/2 pound per 1000 square feet of actual available nitrogen shall be provided to the grass plants. The application shall be timed prior to the advent of winter dormancy and shall be made without burning the installed grass plants.

#### 3.9.3.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

#### 3.9.3.4 Repair

Unsatisfactory stand of grass plants shall be repaired or reinstalled, and eroded areas shall be repaired in accordance with paragraph SITE PREPARATION.

#### 3.9.3.5 Maintenance Record

A record of each site visit shall be furnished describing the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

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## SECTION 02930

## EXTERIOR PLANTING

## PART 1 GENERAL

## 1.1 REFERENCES

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.

## AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA ANSI/ANLA Z60.1 (1996) Nursery Stock

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300 (1995) Tree Care Operations - Trees, Shrubs and other Woody Plant Maintenance

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 4972 (1995a) pH of Soils

ASTM D 5034 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM D 5035 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM D 5268 (1992; R1996) Topsoil Used for Landscaping Purposes

ASTM D 5883 (1996) Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Geotextile; GA. Chemical Treatment Material; GA.

Manufacturer's literature including physical characteristics, application

and installation instructions for geotextile and chemical treatment material.

SD-04 Drawings

Shop Drawings; GA.

Scale drawings defining areas to receive plant materials.

SD-07 Schedules

Equipment; FIO.

A listing of equipment to be used for the planting operation.

SD-08 Statements

Delivery; FIO.

Delivery schedule.

Finished Grade, Topsoil and Underground Utilities; GA.

Finished grade status; location of underground utilities and facilities; and availability of topsoil from the stripping and stock piling operation.

SD-09 Reports

Soil Test; FIO. Percolation Test; FIO.

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-13 Certificates

Plant Material; GA. Topsoil; FIO. pH Adjuster; GA. Fertilizer; FIO. Organic Material; FIO. Soil Conditioner; FIO. Organic Mulch; FIO. Mycorrhizal Fungi Inoculum; GA. Pesticide; GA.

Prior to delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following.

- a. Plant Material: Classification, botanical name, common name, size, quantity by species, and location where grown.
- b. Topsoil: Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
- c. pH Adjuster: Sieve analysis and calcium carbonate equivalent.
- d. Fertilizer: Chemical analysis and composition percent.
- e. Organic Material: Composition and source.
- f. Soil Conditioner: Composition and source.

- g. Organic Mulch: Composition, source, and treatment against fungi growth.
- h. Mycorrhizal Fungi Inoculum: Plant material treated.
- i. Pesticide. EPA registration number and registered uses.

SD-14 Samples

Delivered Topsoil; FIO.

Samples taken from several locations at the source.

Soil Amendments; FIO.

A 4.5 kilogram 10 pound sample.

Mulch; FIO.

A 4.5 kilogram 10 pound sample.

Geotextile; FIO.

A 150 mm 6 inch square sample.

SD-18 Records

Plant Establishment Period; GA.

Calendar time period for the plant establishment period. When there is more than one establishment period, the boundaries of the planted areas covered for each period shall be described.

Maintenance Record; GA.

Maintenance work performed, quantity of plant losses, and replacements; and diagnosis of unhealthy plant material.

Application of Pesticide; GA.

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-19 Operation and Maintenance Manuals

Maintenance Instructions; GA.

Instruction for year-round care of installed plant material.

1.3 SOURCE INSPECTIONS

The nursery or source of plant material and the source of delivered topsoil shall be subject to inspection.

1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

#### 1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

##### 1.4.1.1 Plant Material Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the correct botanical plant name and size.

##### 1.4.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

##### 1.4.1.3 Delivered Topsoil

Prior to the delivery of any topsoil, the availability of topsoil shall be verified in paragraph TOPSOIL. A soil test shall be provided for delivered topsoil.

##### 1.4.1.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

##### 1.4.1.5 Pesticide Material

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

#### 1.4.2 Inspection

Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion. Plant material shall be checked for unauthorized substitution and to establish nursery grown status. Plant material showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution shall be rejected. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container. Plant material with broken or cracked balls; or broken containers shall be rejected. Bare-root plant material that is not dormant or is showing roots were pulled from the ground shall be rejected. Other materials shall be inspected for compliance with paragraph PRODUCTS. Open soil amendment containers or wet soil amendments shall be rejected. Topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than 40 mm 1-1/2 inch diameter shall be rejected. Topsoil that contains viable plant material and plant parts shall be rejected.

Unacceptable material shall be removed from the job site.

#### 1.4.3 Storage

##### 1.4.3.1 Plant Material Storage

Plant material not installed on the day of arrival at the site shall be stored and protected in designated areas. Plant material shall not be stored longer than 30 days. Plant material shall be protected from direct exposure to wind and sun. Bare-root plant material shall be heeled-in. All plant material shall be kept in a moist condition by watering with a fine mist spray until installed.

##### 1.4.3.2 Other Material Storage

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with planting operation material.

#### 1.4.4 Handling

Plant material shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped plant material shall be avoided. Plant material shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles.

#### 1.4.5 Time Limitation

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum 24 hours.

### 1.5 WARRANTY

Furnished plant material shall have a warranty for plant growth to be in a vigorous growing condition for a minimum 12 month period. A minimum 12 month calendar time period for the warranty of plant growth shall be provided regardless of the contract time period. When plant material is determined to be unhealthy in accordance with paragraph PLANT ESTABLISHMENT PERIOD, it shall be replaced once under this warranty.

## PART 2 PRODUCTS

### 2.1 PLANT MATERIAL

#### 2.1.1 Plant Material Classification

The plant material shall be nursery grown stock conforming to ANLA ANSI/ANLA Z60.1 and shall be the species specified.

#### 2.1.2 Plant Schedule

The plant schedule shall provide botanical names as included in one or more of the publications listed under "Nomenclature" in ANLA ANSI/ANLA Z60.1.

#### 2.1.3 Substitutions

Substitutions will not be permitted without written request and approval from the Contracting Officer.

#### 2.1.4 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA ANSI/ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment, method of shipment, or shipment. Plant quality is determined by the growing conditions; method of shipment to maintain health of the root system; and growth of the trunk and crown as follows.

#### 2.1.5 Growing Conditions

Plant material shall be native to or well-suited to the growing conditions of the project site. Plant material shall be grown under climatic conditions similar to those at the project site.

#### 2.1.6 Method of Shipment to Maintain Health of Root System

##### 2.1.6.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine.

##### 2.1.6.2 Balled and Potted (Pot) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be done by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. Container shall be used to retain the ball unbroken. Container shall be rigid to hold ball shape and protect root mass during shipping.

##### 2.1.6.3 Balled and Platform (BP) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. Plants shall be prepared as balled and burlapped plant material and securely fastened to wood platform for shipping.

##### 2.1.6.4 Bare-Root (BR) Plant Material

Minimum root spread shall be in accordance with ANLA ANSI/ANLA Z60.1. A well branched root system characteristic of the species specified shall be provided. Roots shall not be pulled from the ground. Bare-root plant material shall be inoculated with mycorrhizal fungi during germination in

the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. Bare-root plant material shall be dormant. The root system shall be protected from drying out.

#### 2.1.6.5 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA ANSI/ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

#### 2.1.7 Growth of Trunk and Crown

##### 2.1.7.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA ANSI/ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 150 mm 6 inches from ground level.
- c. Specimen: The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

##### 2.1.7.2 Palms

Palms shall have the specified height as measured from the base of the trunk to the base of the fronds or foliage in accordance with ANLA ANSI/ANLA Z60.1. The palm shall have straight trunk and healthy fronds or foliage as typical for the variety grown in the region of the project. Palms trimmed or pruned for delivery shall retain a minimum of 150 mm 6 inches of foliage at the crown as a means of determining plant health.

##### 2.1.7.3 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANLA ANSI/ANLA Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

##### 2.1.7.4 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANLA ANSI/ANLA Z60.1. The coniferous evergreen trees shall not be "poled" or the leader removed. Acceptable plant material shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and

tightly knit plant. The form of growth desired shall be as indicated.

#### 2.1.7.5 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material shall have the height-to-spread ratio recommended by ANLA ANSI/ANLA Z60.1. Acceptable plant material shall be well shaped and recognized by the trade as typical for the variety grown in the region of the project.

#### 2.1.7.6 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall have the minimum number of runners and length of runner recommended by ANLA ANSI/ANLA Z60.1. Plant material shall have heavy, well developed and balanced crown with vigorous, well developed root system and shall be furnished in containers.

#### 2.1.8 Plant Material Size

Plant material shall be furnished in sizes indicated. Plant material larger in size than specified may be provided at no additional cost to the Government.

#### 2.1.9 Plant Material Measurement

Plant material measurements shall be in accordance with ANLA ANSI/ANLA Z60.1.

### 2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the plant material specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

### 2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite is not recommended.

#### 2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

##### 2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 55 percent shall pass through a 0.25 mm No. 60 sieve. To raise soil pH, ground limestone shall be used.

##### 2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 97 percent shall pass through a 0.25 mm No. 60 sieve.

#### 2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm No. 8 sieve and a minimum 35 percent shall pass through a 0.25 mm No. 60 sieve.

#### 2.3.2 Fertilizer

It shall be as recommended by the soil test. Fertilizer shall be controlled release commercial grade; free flowing, pellet or tablet form; uniform in composition; and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

#### 2.3.3 Organic Material

Organic material shall consist of either bonemeal, peat, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

##### 2.3.3.1 Bonemeal

Bonemeal shall be a finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

##### 2.3.3.2 Rotted Manure

Rotted manure shall be unleached horse, chicken, or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. Manure shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and shall be free of stones, sticks, and soil.

##### 2.3.3.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, or other wood waste material free of stones, sticks, and toxic substances harmful to plants, and stabilized with nitrogen.

##### 2.3.3.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. It shall be derived from food, agricultural, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm 3/8 inch screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent or less by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm 2 inches in length.

#### 2.3.3.5 Worm Castings

Worm castings shall be screened from worms and food source and shall be commercially packaged.

#### 2.3.4 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for single use or in combination to meet topsoil requirements for the plant material specified.

##### 2.3.4.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm No. 10 sieve and a minimum 10 percent by weight shall pass a 1.18 mm No. 16 sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

##### 2.3.4.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized according to manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide with an absorption capacity of 250-400 times its weight.

##### 2.3.4.3 Calcined Clay

Granular particles shall be produced from montmorillonite clay calcined to minimum temperature of 650 degrees C. 1200 degrees F. Gradation: A minimum 90 percent passing 2.36 mm No. 8 sieve; a minimum 99 percent shall be retained on 0.25 mm No. 60 sieve; and a maximum 2 percent shall pass a 0.15 mm No. 100 sieve. Bulk density: A maximum 640 kilogram per cubic meter 40 pounds per cubic foot.

##### 2.3.4.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

##### 2.3.4.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

#### 2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure is not recommended to be used as a mulch because it would encourage surface rooting of the plant material and weeds.

##### 2.4.1 Inorganic Mulch

When inorganic mulch is required for decorative purposes, it shall be provided in areas designated, and consist of materials as required by the Task Order.

##### 2.4.2 Organic Mulch

Organic mulch materials shall be native to the project site and consist of recycled mulch, shredded bark, wood chips, or ground bark.

#### 2.4.2.1 Recycled Mulch

Recycled mulch may include compost, tree trimmings, or pine needles with a gradation that passes through a 65 x 65 mm 2-1/2 x 2-1/2 inch screen. It shall be cleaned of all sticks a minimum 25 mm 1 inch in diameter and plastic materials a minimum 75 mm 3 inch length. The material shall be treated to retard the growth of mold and fungi. Other recycled mulch may include peanut shells, pecan shells or coco bean shells.

#### 2.4.2.2 Shredded Bark

Locally shredded material shall be treated to retard the growth of mold and fungi.

#### 2.4.2.3 Wood Chips and Ground Bark

Locally chipped or ground material shall be treated to retard the growth of mold and fungi. Gradation: A maximum 50 mm 2 inch wide by 100 mm 4 inch long.

### 2.5 GEOTEXTILE

Geotextile shall be woven or nonwoven; polypropylene, polyester, or fiberglass, mat in accordance with ASTM D 5034 or ASTM D 5035. It shall be made specifically for use as a fabric around plant material. Nominal weight shall be a minimum 120 grams per square meter 4 ounces per square yard. Permeability rate shall be a minimum 1 mm 0.04 inch per second.

### 2.6 WOOD STAKING MATERIAL

Wood stakes shall be hardwood or fir; rough sawn; free from knots, rot, cross grain, or other defects that would impair their strength.

#### 2.6.1 Bracing Stake

Wood bracing stakes shall be a minimum 50 x 50 mm 2 x 2 inch square and a minimum 2400 mm 8 feet long with a point at one end. Stake shall be set without damaging rootball.

#### 2.6.2 Wood Ground Stakes

Wood ground stakes shall be a minimum of 50 x 50 mm 2 x 2 inch square and a minimum 900 mm 3 feet long with a point at one end.

#### 2.6.3 Deadmen

Wood deadmen shall be a minimum 100 x 100 x 900 mm 4 x 4 x 36 inches long.

### 2.7 METAL STAKING AND GUYING MATERIAL

Metal shall be aluminum or steel consisting of recycled content made for holding plant material in place.

#### 2.7.1 Bracing Stakes

Metal bracing stakes shall be a minimum 25 mm 1 inch diameter and a minimum

2400 mm 8 feet long. Stake shall be set without damaging rootball.

#### 2.7.2 Metal Ground Stakes

Metal ground stakes shall be a minimum 13 mm 1/2 inch diameter and a minimum 900 mm 3 feet long.

#### 2.7.3 Earth Anchor

Metal earth anchors shall be a minimum 13 mm 1/2 inch diameter and a minimum 600 mm 2 feet long.

#### 2.7.4 Guying Material

Metal guying material shall be a minimum 12 gauge wire. Multi-strand cable shall be woven wire. Guying material tensile strength shall conform to the size of tree to be held firmly in place.

#### 2.7.5 Turnbuckle

Metal turnbuckles shall be galvanized or cadmium-plated steel, and shall be a minimum 75 mm 3 inches long with closed screw eyes on each end. Screw thread tensile strength shall conform to the size of tree to be held firmly in place.

### 2.8 PLASTIC STAKING AND GUYING MATERIAL

Plastic shall consist of recycled plastic product made for holding plant material firmly in place. Plastic shall not be used for deadmen.

#### 2.8.1 Plastic Bracing Stake

Plastic bracing stakes shall be a minimum 50 mm 2 inch diameter and a minimum 2400 mm 8 feet long. Stake shall be set without damaging rootball.

#### 2.8.2 Plastic Ground Stakes

Plastic ground stakes shall be a minimum 50 mm 1 inch diameter and a minimum 900 mm 3 feet long.

#### 2.8.3 Plastic Guying Material

Plastic guying material shall be designed specifically for the purpose of firmly holding plant material in high wind velocities.

#### 2.8.4 Chafing Guard

Plastic chafing guards shall be used to protect tree trunks and branches when metal is used as guying material. The material shall be the same color throughout the project site. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

### 2.9 RUBBER GUYING MATERIAL

Rubber chafing guards, consisting of recycled material, shall be used to protect tree trunks and branches when metal guying material is applied. The material shall be the same color throughout the project. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

## 2.10 FLAG

Plastic flag material shall be used on guying material. It shall be a minimum 150 mm 6 inches long. Tape color shall be consistent and visually complimentary to the entire project area. The tape color shall meet pedestrian visual safety requirements for day and night.

## 2.11 TREE ROOT BARRIERS

Tree root barriers shall be metal or plastic consisting of recycled content. Barriers shall utilize vertical stabilizing members to encourage downward tree root growth. Barriers shall limit, by a minimum 90 percent, the occurrence of surface roots. Tree root barriers which are designed to be used as plant pit liners will be rejected.

## 2.12 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

## 2.13 WATER

Unless otherwise directed, water shall be the responsibility of the Contractor. Water shall not contain elements toxic to plant life.

## 2.14 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

# PART 3 EXECUTION

## 3.1 INSTALLING PLANT MATERIAL TIME AND CONDITIONS

### 3.1.1 Deciduous Plant Material Time

Deciduous plant material shall be installed as required by the Task Order.

### 3.1.2 Evergreen Plant Material Time

Evergreen plant material shall be installed as required by the Task Order.

### 3.1.3 Plant Material Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, frozen ground or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted for approval.

### 3.1.4 Tests

#### 3.1.4.1 Percolation Test

Test for percolation shall be done to determine positive drainage of plant pits and beds. A positive percolation shall consist of a minimum 25 mm 1 inch per 3 hours; when a negative percolation test occurs, a shop drawing

shall be submitted indicating the corrective measures.

#### 3.1.4.2 Soil Test

Delivered topsoil, excavated plant pit soil, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection onsite shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the plant material specified.

### 3.2 SITE PREPARATION

#### 3.2.1 Finished Grade, Topsoil and Underground Utilities

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the planting operation. The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

#### 3.2.2 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted to meet field conditions.

#### 3.2.3 Protecting Existing Vegetation

When there are established lawns in the planting area, the turf shall be covered and/or protected during planting operations. Existing trees, shrubs, and plant beds that are to be preserved shall be barricaded along the dripline to protect them during planting operations.

### 3.3 EXCAVATION

#### 3.3.1 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments to plant material location, type of plant and planting method shall be submitted for approval.

#### 3.3.2 Turf Removal

Where the planting operation occurs in an existing lawn area, the turf shall be removed from the excavation area to a depth that will ensure the removal of the entire root system.

#### 3.3.3 Plant Pits

Plant pits for ball and burlapped or container plant material shall be dug to a depth equal to the height of the root ball as measured from the base of the ball to the base of the plant trunk. Plant pits for bare-root plant

material shall be dug to a depth equal to the height of the root system. Plant pits shall be dug a minimum 50 percent wider than the ball or root system to allow for root expansion. The pit shall be constructed with sides sloping towards the base as a cone, to encourage well aerated soil to be available to the root system for favorable root growth. Cylindrical pits with vertical sides shall not be used.

### 3.4 INSTALLATION

#### 3.4.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. In relation to the surrounding grade, the plant material shall be set even with the grade at which it was grown.

##### 3.4.1.1 Bare-Root Plant Material

Bare-root plant material shall be placed in water a minimum 30 minutes prior to setting.

##### 3.4.2 Tree Root Barrier

Tree root barriers shall be installed as recommended by the manufacturer. Tree root barriers shall be used for trees located up to a maximum 1800 mm 6 feet from paved surfaces or structures.

##### 3.4.3 Backfill Soil Mixture

The backfill soil mixture may be a mix of topsoil and soil amendments suitable for the plant material specified. When practical, the excavated soil from the plant pit that is not amended provides the best backfill and shall be used.

##### 3.4.4 Adding Mycorrhizal Fungi Inoculum

Mycorrhizal fungi inoculum shall be added as recommended by the manufacturer for the plant material specified.

##### 3.4.5 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Additional requirements are as follows.

###### 3.4.5.1 Balled and Burlapped, and Balled and Platformed Plant Material

Biodegradable burlap and tying material shall be carefully opened and folded back from the top a minimum 1/3 depth from the top of the root ball. Backfill mixture shall be added to the plant pit in 150 mm 6 inch layers with each layer tamped.

###### 3.4.5.2 Bare-Root Plant Material

The root system shall be spread out and arranged in its natural position. Damaged roots shall be removed with a clean cut. The backfill soil mixture shall be carefully worked in amongst the roots and watered to form a soupy mixture. Air pockets shall be removed from around the root system, and

root to soil contact shall be provided.

#### 3.4.5.3 Container-Grown and Balled and Potted Plant Material

The plant material shall be carefully removed from containers that are not biodegradable. Prior to setting the plant in the pit, a maximum 1/4 depth of the root mass, measured from the bottom, shall be spread apart to promote new root growth. For plant material in biodegradable containers the container shall be split prior to setting the plant with container. Backfill mixture shall be added to the plant pit in 150 mm 6 inch layers with each layer tamped.

#### 3.4.5.4 Earth Berm

An earth berm, consisting of backfill soil mixture, shall be formed with a minimum 100 mm 4 inch height around the edge of the plant pit to aid in water retention and to provide soil for settling adjustments.

#### 3.4.6 Plant Bed

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas. Earth berms shall be provided. Polymers shall be spread uniformly over the plant bed and in the planting pit as recommended by the manufacturer and thoroughly incorporated into the soil to a maximum 100 mm 4 inch depth.

#### 3.4.7 Watering

Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated.

#### 3.4.8 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity.

##### 3.4.8.1 One Bracing Stake

Trees 1200 to 1800 mm 4 to 6 feet high shall be firmly anchored in place with one bracing stake. The bracing stake shall be placed on the side of the tree facing the prevailing wind. The bracing stake shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly to the stake with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. A chafing guard shall be used when metal is the guying material.

##### 3.4.8.2 Two Bracing Stakes

Trees from 1800 to 2400 m 6 to 8 feet height shall be firmly anchored in place with 2 bracing stakes placed on opposite sides. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly between the stakes with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Chafing guards shall be used when metal is the guying material.

#### 3.4.8.3 Three Ground Stakes

Trees over a minimum 2400 mm 8 feet height and less than a maximum 150 mm 6 inch caliper shall be held firmly in place with 3 bracing or ground stakes spaced equidistantly around the tree. Ground stakes shall be avoided in areas to be mowed. Stakes shall be driven into firm ground outside the earth berm. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. For trees over maximum 75 mm 3 inch diameter at breast height, turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used when metal is the guying material.

#### 3.4.9 Deadmen or Earth Anchors

Trees over a minimum 150 mm 6 inch caliper shall be held firmly in place with wood deadmen buried a minimum 900 mm 3 feet in the ground or metal earth anchors. Multi-strand cable guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used.

#### 3.4.10 Flags

A flag shall be securely fastened to each guy line equidistant between the tree and the stake, deadmen, or earth anchor. The flag shall be visible to pedestrians.

### 3.5 FINISHING

#### 3.5.1 Plant Material

Prior to placing mulch, the installed area shall be uniformly edged to provide a clear division line between the planted area and the adjacent turf area, shaped as indicated. The installed area shall be raked and smoothed while maintaining the earth berms.

#### 3.5.2 Placing Geotextile

Prior to placing mulch, geotextile shall be placed as indicated in accordance with the manufacturer's recommendations.

#### 3.5.3 Placing Mulch

The placement of mulch shall occur a maximum 48 hours after planting. Mulch, used to reduce soil water loss, regulate soil temperature and prevent weed growth, shall be spread to cover the installed area with a minimum 100 mm 4 inch uniform thickness. Mulch shall be kept out of the crowns of shrubs, ground cover, and vines and shall be kept off buildings, sidewalks and other facilities.

#### 3.5.4 Pruning

Pruning shall be accomplished by trained and experienced personnel. The pruning of trees and palms shall be in accordance with ANSI A300. Only dead or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Clean cuts

shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

### 3.6 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. Installed areas shall be kept free of weeds, grass, and other undesired vegetation. The maintenance includes maintaining the mulch, watering, and adjusting settling.

### 3.7 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

#### 3.7.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

#### 3.7.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

### 3.8 RESTORATION AND CLEAN UP

#### 3.8.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

#### 3.8.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared.

### 3.9 PLANT ESTABLISHMENT PERIOD

#### 3.9.1 Commencement

Upon completion of the last day of the planting operation, the plant establishment period for maintaining installed plant material in a healthy

growing condition shall commence and shall be in effect for the remaining contract time period, not to exceed 12 months. Written calendar time period shall be furnished for the plant establishment period. When there is more than one plant establishment period, the boundaries of the planted area covered for each period shall be described. The plant establishment period shall be coordinated with Sections 02921 SEEDING; 02922 SODDING; and 02923 SPRIGGING. The plant establishment period shall be modified for inclement weather shut down periods, or for separate completion dates for areas.

### 3.9.2 Maintenance During Establishment Period

Maintenance of plant material shall include straightening plant material, straightening stakes; tightening guying material; correcting girdling; supplementing mulch; pruning dead or broken branch tips; maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; and removing and replacing unhealthy plants.

#### 3.9.2.1 Watering Plant Material

The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of 25 mm 1 inch absorbed water per week, delivered in the form of rain or augmented by watering. Run-off, puddling and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or existing plant material shall be prevented.

#### 3.9.2.2 Weeding

Grass and weeds in the installed areas shall not be allowed to reach a maximum 75 mm 3 inches height before being completely removed, including the root system.

#### 3.9.2.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

#### 3.9.2.4 Post-Fertilization

The plant material shall be topdressed at least once during the period of establishment with controlled release fertilizer, reference paragraph SOIL AMENDMENTS. Apply at the rate of 1 kilogram per 10 square meters 2 pounds per 100 square feet of plant pit or bed area. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

#### 3.9.2.5 Plant Pit Settling

When settling occurs to the backfill soil mixture, additional backfill soil shall be added to the plant pit or plant bed until the backfill level is equal to the surrounding grade. Serious settling that affects the setting of the plant in relation to the maximum depth at which it was grown requires replanting in accordance with paragraph INSTALLATION. The earth berm shall be maintained.

#### 3.9.2.6 Maintenance Record

A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, and the quantity of replacements made on each site visit.

### 3.9.3 Unhealthy Plant Material

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 2 mm 1/16 inch square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement.

Unhealthy or dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

### 3.9.4 Replacement Plant Material

Unless otherwise directed, plant material shall be provided for replacement in accordance with paragraph PLANT MATERIAL. Replacement plant material shall be installed in accordance with paragraph INSTALLATION, and recommendations in paragraph PLANT ESTABLISHMENT PERIOD. Plant material shall be replaced in accordance with paragraph WARRANTY. An extended plant establishment period shall not be required for replacement plant material.

### 3.9.5 Maintenance Instructions

Written instructions shall be furnished containing drawings and other necessary information for year-round care of the installed plant material; including, when and where maintenance should occur, and the procedures for plant material replacement,.

-- End of Section --