

**APPENDIX D**

**POST-CLOSURE INSPECTION  
AND MAINTENANCE PLAN**

**POST-CLOSURE INSPECTION  
AND MAINTENANCE PLAN**

**PAGE-TROWBRIDGE RANCH LANDFILL  
EPA I.D. AZD980665814**

**Revised March 2012**

## **INTRODUCTION**

Regular inspections of the PTRL facility will be performed no less often than quarterly. Inspections will be conducted by UA staff members who have received training to perform work at PTRL in accordance with the Training Plan included as Appendix Q. Findings of all inspections will be recorded on the written Inspection Report form included herein as Attachment D-1. Any additional collected documentation such as photographs will be filed with the written Inspection Report. Maintenance and repair activities will be documented on the Maintenance/Repair Report form included as Attachment D-2. Completed Inspection Reports and Maintenance/Repair Reports will be kept on file with UA Risk Management Services for the duration of the Post Closure Permit period.

## **SCOPE OF INSPECTION**

Regular quarterly inspections will include all listed items on the written Inspection Report form shown in Attachment D-1, with the exception of verifying operation of groundwater monitoring wells, which are described below.

## **GROUNDWATER MONITORING WELLS**

Groundwater monitoring wells will be inspected for proper operation no less than twice annually, which will typically correspond with groundwater sample collection. In the event groundwater sample collection frequency changes, proper operation of the groundwater monitoring wells will be verified and documented no less than twice annually, approximately six months apart. Maintenance and/or repair of PTRL facility systems shall be performed, as specified in this plan, either by trained UA personnel or qualified vendors contracted for this purpose.

Preventive and corrective maintenance procedures, equipment procedures, equipment requirements, and materials needs and specifications will all be in accordance with the Project Manual for Final Cover Installation, Page-Trowbridge Ranch Landfill, Oracle Junction, Arizona, dated September 3, 1996 (prepared by SCS Engineers), and enclosed as Attachment D-3.

## **ACCESS ROADS**

UA-owned access roads leading to the facility and those inside the facility will be inspected for erosion and excessive vegetation growth. Significant road damage that may impede access to the facility for normal inspection, monitoring activities, or emergency response will be repaired prior to the next scheduled inspection.

## **PERIMETER FENCING AND SIGNS**

The facility security fence, gates, and signs will be inspected for damage, integrity of the locks, digging under the fence base, the presence and legibility of signs, and the presence of excessive vegetation around entrance gates.

Identified deficiencies or repair needs will be corrected prior to the next scheduled inspection. Reasonable measures for preventing access to the site will be implemented while awaiting fence/gate repairs. Vegetation density will be controlled by trained UA personnel or qualified vendors contracted for this purpose. Missing or unreadable signs will be replaced in kind prior to the next scheduled inspection.

## **FINAL COVER**

Final cover will be inspected for integrity, erosion, and woody vegetation growth. Final cover integrity damages will be repaired prior to the next scheduled inspection. Reseeding of the repaired areas or areas with impacted vegetation will be performed using the native vegetation specified in the closure specifications. Woody vegetation observed on the cover system during inspection will be treated to kill the plant, and marked with flagging for evaluation at the next scheduled inspection. Woody vegetation on the cover system that has not died at the time of the next scheduled inspection will be removed. Vegetation density/height on the cover system will be monitored and controlled as necessary by either trained UA personnel or a qualified contractor to facilitate visual inspection of the cover system surface. If the vegetative cover system deteriorates to a degree that it cannot prevent erosion as designed, consideration will be given to re-seeding or replenishment of vegetation as needed, consistent with the project manual for the original final cover installation.

## **DRAINAGE STRUCTURES**

Drainage structures will be inspected for excessive erosion, debris, and vegetation. The integrity of metal gates on the culverts will also be inspected. Maintenance activities shall include keeping the channels and culverts clean and free of debris, and repairing excessively damaged slopes. Only excessive vegetation will be removed or trimmed. Needed correction action or repair will be performed prior to the next scheduled inspection.

## **SURVEY MONUMENTS**

Survey monuments will be visually inspected for damage and evidence of tampering. Damaged monuments will be re-established as soon as practical by a licensed land surveyor.

## **GROUNDWATER MONITORING SYSTEM**

Groundwater monitoring well enclosures will be inspected for deterioration and/or vandalism. Department of Water Resource well identify markings will be inspected for presence and legibility. Well covers, caps, and concrete bases will be repaired or replaced as required to maintain their proper operation. Submersible well pumps will be exercised and tested for proper operation at the time of groundwater sampling, but no less than twice annually whether samples are collected or not. Pump maintenance/replacement will be performed when the pumped flow rate falls below eight gallons/minute. Television logging of wells will be performed if warranted by well conditions. Should any of the existing monitoring wells be deemed unsuitable or unable to be repaired and restored to proper function during the Post Closure Permit period, UA will consult with ADEQ about strategies for replacement or alternate monitoring options, and submit a proposal for Permit modification as applicable.

**Attachment D-1**

# INSPECTION REPORT

## PAGE-TROWBRIDGE RANCH LANDFILL

EPA I.D. 980665814

Month/Day/Year of Inspection: \_\_\_\_\_ Time: \_\_\_\_\_

Inspector's Name/Title: (print) \_\_\_\_\_

Inspector's Signature: \_\_\_\_\_

### Inspection Procedure:

To properly inspect the facility, the Inspector must walk around the perimeter, noting any specific evidence of deterioration. The Inspector must then enter and walk the length and width of the enclosed landfill area. All inspection items listed below and on the reverse of this form must be completed.

INSPECTION ITEMS	YES	NO
<b>ACCESS ROADS</b>		
1. Is the condition of UA-owned roads used to access the site and those within the facility adequate to allow access by emergency vehicles?		
2. Is there excessive vegetation on facility access roads?		
<b>PERIMETER FENCING AND SIGNS</b>		
1. Are the fences in good condition, free of fabric holes, downed fencing, bent poles, and digging under the fence base?		
2. Were all gates/locks closed upon arrival?		
2. Are all fence gates/locks operating properly?		
4. Is there excessive vegetation present around entrance gates?		
5. Are all signs legible?		
<b>FINAL COVER</b>		
1. Are there any signs of integrity problems with the Unit A and Unit B final covers?		
2. Is there any woody vegetation growth?		

3. Does vegetation density/height support inspection and maintenance activity?		
<b>DRAINAGE STRUCTURES</b>		
1. Are there any signs of drainage structure integrity problems?		
2. Are drainage structures at the site clear of any blockage from debris and/or excessive vegetation?		
3. Are metal gates intact and locked?		
<b>SURVEY MONUMENTS</b>		
1. Are survey monuments damaged?		
2. Are there any signs of survey monument tampering?		
<b>GROUNDWATER MONITORING WELLS</b>		
Are all monitoring well enclosures intact and secured?		
1. Is the concrete pad of each monitoring well intact and free of deterioration?		
3. Are groundwater samples being collected during this inspection?		
If <b>YES</b> , complete the following:		
4. Does each well pumping assembly operate properly?		
5. Are all sounding tubes clear?		

If groundwater samples are collected during this inspection, use Groundwater Sampling Log, which is included in the Groundwater Detection Monitoring Plan, to record all monitoring information.

Attachment D-2

# MAINTENANCE/REPAIR REPORT

PAGE-TROWBRIDGE RANCH LANDFILL

EPA I.D. 980665814

Name/Title: (print) \_\_\_\_\_

Signature: \_\_\_\_\_

**Instructions:**

Describe below the nature of the inspection deficiency and the action taken to correct the item. If the item represents a deficiency noted during a previous that has not been corrected, explain the reason for the corrective action delay.

DEFICIENCY	ACTION TAKEN	DATE

**Comments:**

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ATTACHMENT D-3

PAGE TROWBRIDGE RANCH LANDFILL (PTRL)  
PROJECT MANUAL FOR FINAL COVER INSTALLATION

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*DIVISION 1 NOT INCLUDED IN THIS ATTACHMENT*

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**SECTION 02110**  
**SITE CLEARING**

**PART 1 - GENERAL**

**1.01 SCOPE**

**DEMOLITION**

- A. The scope of demolition Work shall include the complete removal of all above-grade and underground interferences with new construction or facilities. Demolition includes, but is not limited to, the following:
- Existing chain link fence, as shown on the Plans, shall be removed down to the existing grade. All existing fence post foundations construction shall be removed. Existing fence fabric, top rails, brace rails, stretcher bars, post tops, and 3-strand barbed wire located on Site A shall be salvaged and neatly stored in an area designated by the Owner. Similar material on Site B are to be removed by the Contractor.
  - Existing barbed wire fence, as shown on the Plans, shall be completely removed.
  - All PVC pipe within the limits of the disposal sites shall be completely removed. The remaining borehole shall be grouted with a cement grout plug that shall extend from 2 feet below the ground surface to the bottom of the well; the remaining well shall be backfilled with processed soil above the top of the cement grout plug to the original ground surface. The cement grout shall have an admixture of 3 percent bentonite by weight. The Contractor shall submit the cement grout mix design for approval.

Galvanized steel pipe, within the limits of the disposal cells, shall be excavated to a depth of 18 inches below the existing ground surface and cut. The remaining well shall be grouted with a cement grout plug that shall extend from the new top of pipe to the bottom of the well. The hole shall then be backfilled with processed soil material. The cement grout shall have an admixture of 3 percent bentonite by weight. The Contractor shall submit the cement grout mix design for approval.

### CLEARING AND GRUBBING

- A. The protected plant species under ARS Title 3, Chapter 7 from all disturbed areas shall be transplanted in the transplantation area as shown on Plans prior to any and all clearing and grubbing operations.
- B. The Scope of Work includes satisfactory clearing and grubbing of unsuitable vegetative growth, debris, and other deleterious material from the site. The limits of Work are the construction areas defined on the Plans, which include all areas receiving fill materials, on-site borrow area, on-site stockpiled clay material, all areas to be developed for roads and drainage channels, topsoil stockpile area, and staging area.
- C. The remaining clearing and grubbing shall consist of clearing the surface of the ground of the designated areas to a minimum of 6 inches of all brush, undergrowth, hedges, heavy growth of grass or weeds, structures (if any), debris, rubbish of any nature, natural obstructions (e.g., standing water); or such material which, in the opinion of the CQA Consultant, is unsuitable for berms or other required structures. Topsoil removed during the clearing and grubbing operation should be placed in the Topsoil Stockpile area for use in revegetation of disturbed areas during the completion of the project.

## 1.02 JOB CONDITION

- A. The site clearing operation shall be conducted to insure minimum interference with roads and other adjacent occupied or in-use facilities. The Contractor shall not close or obstruct roadways, walks, or other occupied or used facilities without permission from the Owner or Engineer.
- B. Provide protection necessary to prevent damage to existing improvements.
- C. The Contractor shall protect improvements on the Owner's property.
- D. The Contractor shall restore damaged improvements to their original condition, as accepted by the Engineer.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. All materials used in conjunction with this Work shall be considered incidental to the Work.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Areas requiring clearing and grubbing shall be staked on the ground by the Contractor. The clearing and grubbing shall be done prior to the start of the placement of the Final Cover System.
- B. All useable materials, as approved by the Engineer, removed by clearing and grubbing shall be utilized or shall be stockpiled in a designated area as designated by the Engineer.

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### 3.02 EXISTING STRUCTURES AND UTILITIES

- A. Any relocation, modification, removal, etc., of existing utilities and/or public improvements required by the proposed development will be at no expense to the Owner. Abandoned structures and utilities shall be removed by the Contractor.

### 3.03 CLEARING AND GRUBBING

- A. In areas requiring clearing and grubbing, all wet and soft soils and other unsatisfactory materials shall be removed.
- B. Rocks and other projections over 6 inches in diameter shall be grubbed out to a depth of at least 18 inches below the finished grade.
- C. All trees and shrubs outside of the clearing area which will not interfere with excavation or development of the facility or cause disintegration of the improvements shall not be disturbed. In any event, the Contractor shall avoid, as far as practicable, injury to shrubbery, plants, grasses, and other vegetation growing outside of the clearing limits.
- D. The protected plant species under ARS Title 3, Chapter 7 shall be transplanted in the transplantation area. The transplantation area is shown on the Plans.
- E. All holes remaining after the grubbing operation in excavation areas shall have the sides broken down to flatten out the slopes, and shall be filled with materials acceptable to the Engineer, moistened, and properly compacted in layers to the density required in Section 02120 "General Earthwork Excavation." The same construction procedures shall be applied to all holes remaining after grubbing in the excavation areas where the depth of holes exceeds the depth of the proposed excavation.

### 3.04 DISPOSAL OF WASTE MATERIAL

- A. All materials removed in the demolition operation and deemed unsuitable for reuse by the Owner shall be removed from the site. Waste materials shall be disposed of by the Contractor. Materials deemed suitable for reuse by the Owner, shall be stored in a manner to protect the materials from damage.
- B. Contractor shall dispose of all waste materials other than soil resulting from clearing and grubbing at an approved waste disposal facility. The name, address, owner of the facility, and waste acceptance requirements shall be submitted by the Contractor and approved by the Owner prior to any waste disposal activities. Copies of all disposal records shall be submitted to the Engineer in accordance with the Submittals Section.
- C. Temporary stockpiles of excess material shall be located in top soil storage area as shown on the Plans or as directed by the Engineer.

END OF SECTION

**SECTION 02120**  
**GENERAL EARTHWORK EXCAVATION**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. This item shall consist of the excavation of the borrow area and staging of borrow soils for earthwork related to the Final Cover System, and surface drainage channels. All Work shall be performed in accordance with these Contract Documents, the Specifications, and the CQA/CQC Plan (Part IV), in conformity with the dimensions and typical sections shown on the Plans, and in conformity with the lines and grades shown on the Plans. Existing grades, depicted on the Plans, may have changed and will be verified prior to Contractor excavation activities to establish a baseline for the Work.
  
- B. All excavated materials shall remain on-site and be used (if suitable) for the installation of the final cover system.
  
- C. Selection and placement of borrow area soils into the staging area shall be the responsibility of the Contractor. The Contractor shall familiarize himself with the soil materials and performance standards required for the placement of the Final Cover System. The Engineer reserves the right to approve all materials selection and stockpiling.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Materials used in conjunction with this Work shall be furnished by the Contractor or derived from the excavations, and will be considered incidental to the Work items.

## PART 3 - EXECUTION

### 3.01 EXCAVATION

- Does not refer to Excavate for plan*
- A. Excavation in the borrow area and for the drainage channel shall be performed to obtain approximately 25,000 CY of borrow soils. No excavation shall begin until the Engineer has approved construction staking for the proposed Work. All materials excavated shall be placed in the staging area as determined by the Work Plan for the construction of the Final Cover System submitted by the Contractor. During excavation, grades shall be maintained to provide drainage of any surface water that may affect the Work. The Contractor shall not excavate any materials from the borrow area within 20 feet of the access road along the north side. The completion of the excavation shall be sloped and graded to accommodate livestock access to the entire area within the borrow area.
- B. The Contractor shall be responsible for proper drainage of stormwater and for stormwater control during construction at no additional cost to the Owner.
- C. Changes to design excavation grades proposed by the Contractor for the purpose of reducing haul will not be allowed.
- D. Tolerances for the Drainage Channel excavation shall be as follows:
1. Slopes:           Line  $\pm 0.5$  foot  
                          Grade  $\pm 0.1$  foot
  2. Base:             Line  $\pm 0.1$  foot  
                          Grade  $\pm 0.1$  foot

### 3.03 SUBGRADE RECONSTRUCTION

- A. General: The Contractor may be required to reconstruct subgrade in areas where over-excavations are determined necessary by the Engineer.

END OF SECTION

**SECTION 02210  
SOIL PROCESSING**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. The soils excavated from the borrow area will be mixed with the existing stockpiled clay material. It is estimated that the mix ratio will be about 1 part clay soil to 2 parts borrow soil. The Contractor is responsible for verifying the required mix ratio to insure that all the clay material is used in the construction and that it is uniformly dispersed in the Final Cover System.
  
- B. Mixing of the soils shall be performed in the staging area. The staging area should be located as shown on the Plans. The Contractor may adjust the size or location of the staging area with approval from Engineer.
  
- C. Unsuitable Material: Topsoil, peat, organic soils, sand, organic debris or soil with other than required physical properties as determined by the CQA Consultant.

**PART 2 - PRODUCTS**

**2.01 PROCESSED SOILS**

- A. The material shall be relatively free of organics (less than 3 percent by volume).
  
- B. Material shall be processed such that it does not contain particles greater than 2 inches in the largest dimension as required by the Engineer. The coarse fraction of the material shall be removed.

## **PART 3 - EXECUTION**

### **3.01 EQUIPMENT**

- A. The necessary equipment should be specified in the Work Plan for construction of the Final Cover System and utilized to achieve:
- A uniform and consistent mixing of borrow area soils with the existing stockpiled clay.
  - Screening of soils to remove coarser fraction larger than 2 inches.
  - Pulverization of any clay clods present in the soils.
  - Moisture addition as required to meet performance specifications for the Final Cover System.

**END OF SECTION**

## SECTION 02220

### WATERING

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION OF WORK

- A. This Work shall consist of furnishing and applying water required (a) for the compaction and preparation of grades, (b) for the alleviation or prevention of dust nuisance, and (c) for any other use which is deemed necessary by the CQA Consultant. The Contractor shall be responsible to supply water for construction activities.
- B. Water for construction shall be obtained from the local water company and transported to the site as required. The Contractor shall be responsible for obtaining all necessary permits and all costs associated with supplying water for the project.
- C. All costs shall be paid by the Contractor.
- D. Provide backflow prevention devices as required by the water supplier.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

- A. Water used in the Work shall be free of silts and other materials deleterious to the quality of the material to which it is applied or with which is mixed.

**PART 3 - EXECUTION**

**3.01 EQUIPMENT**

- A. Watering shall be by means of tank trucks or water wagons equipped with spray bars, by hose and nozzle, or by other means, any and all of which shall insure uniform and controlled application.

**END OF SECTION**

**SECTION 02300**  
**PLACEMENT OF FINAL COVER SYSTEM**

**PART 1 - GENERAL**

The PTRL was developed through construction of individual 10-foot by 10-foot by 10-foot-deep disposal cells, separated by native soils, thereby creating a "waffle-like" configuration. These cells were developed in a layered manner by placing a level of containerized waste, capping the waste with a layer of plywood sheets, cardboard, and/or 2 feet of soil, then repeating this process until approximately 6 feet of fill depth was achieved. Native soil was then placed to the current landfill grades.

The landfill facility includes an approximate 2.3-acre fenced enclosure, designated as Site B, in the southwest corner of the Page-Trowbridge Ranch, and a separate, approximately 0.9-acre fenced area, designated as Site A. Site A received hazardous in sealed 55-gallon drums (DOT 17C) which were never opened at the site. Site B was used as open neutralization pit and a burn pit prior to being used for direct burial of 1- and 5-gallon containers, as well as 55-gallon drums. Site B received some radioactive waste.

**1.01 SCOPE**

- A. The Work specified here includes preparation of subgrade and placement of soil components of the final cover system.
- B. The surface to receive compacted fill shall be processed. The processing will include, but not limited to, scarification and compaction. The Contractor shall specify all methods in the Work Plan for construction of the Final Cover System.

- C. The final cover system contains geosynthetic materials, and three (3) general soil layers (from bottom to top):
- Foundation Layer (24 inches);
  - Soil Infiltration Barrier (24 inches); and
  - Vegetative Layer (24 inches).
- D. The processed soil (i.e., borrow area soils mixed with existing stockpiled clay) shall be utilized for all the soil layers of the final cover system.
- E. The Contractor shall notify the CQA Consultant as to the source of any imported material, if required, and shall make arrangements for sampling and approval of those materials prior to the placement of the material.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. The subgrade to receive backfill materials shall be prepared as follows:
- As specified in the Work Plan for construction of the Final Cover System.
  - Moisture-conditioning.
  - Compacted to a minimum of 95 percent of the ASTM D698 density in the top 12-inches.
  - Moisture content - within  $\pm 2$  percent of its optimum moisture content.

B. The soil layers of the final cover system shall meet the following properties specified herein:

- Saturated hydraulic conductivity -  $1.0 \times 10^{-4}$  cm/sec (minimum), tested in accordance with ASTM D5084;
- Compaction - At least 95 percent of maximum dry density, tested in accordance with ASTM D698; and
- Moisture content - within  $\pm 2$  percent of its optimum moisture content.

## 2.02 SUBMITTALS

The Contractor shall submit the following:

- A. Subgrade Preparation Plan (part of the Work Plan for Construction of the Final Cover System), including provisions for a method to detect areas which could potentially cause settlement, correction of settlement, and the methods proposed for subgrade preparation to meet the specified performance standards.
- B. Means of placement of the geogrid and geonet to prevent movement during the installation process.
- C. Type of equipment and process that will be used to meet the specified performance standards for compaction and soil permeability for the Final Cover System.
- D. Method of providing bonding between the individual compacted lifts within the Final Cover System.

## **PART 3 - EXECUTION**

### **3.01 SUBGRADE PREPARATION**

- A. During subgrade preparation, visual observations will be made by the Contractor and Engineer to ensure that all soft, organic, and otherwise unsuitable materials are removed.
- B. Any soft areas or areas with cracks or voids will be recompacted to specified density.
- C. Any areas where subsidence or subsurface slump occurs, the resulting cavity will be backfilled with native material or the processed soils and recompacted to specified density and moisture. This will be measured and paid for under excess backfill.

### **3.02 FILL PLACEMENT AND COMPACTION**

- A. Place fill materials in continuous layers. The compacted thickness should not exceed 6 inches for material compacted by compaction equipment, and not more than 3 inches in compacted thickness for material compacted by hand-operated tampers.
- B. Maintain the moisture content of the backfill material within its specified optimum moisture content to aid in achieving compaction density. The fill material may have to be moistened or aerated until the material has the required moisture content to obtain the relative density.

- C. The Contractor shall compact each lift to the required percentage of maximum dry density for each area classified below:

<u>Material</u>	<u>Percent Standard Proctor Compaction</u>
Foundation Layer . . . . .	95 minimum
Infiltration Barrier Layer . . . . .	95 minimum
Vegetative Layer . . . . .	95 minimum

Compaction of fills and backfills with low expansive potentials shall be accomplished to a uniform moisture content within  $\pm 2$  percent of its optimum moisture content.

- D. Each trip of the roller shall be offset from the path of the previous trip, so that the total compaction effort shall be evenly distributed over the entire area.
- E. The Contractor shall not place fill material on surfaces that are muddy, soft, frozen, saturated, or contain ice or frost.
- F. Surplus materials shall be removed from the site as directed by the Owner.
- G. Upon completion of all the construction activities, regrade all areas disturbed by storage, hauling, and construction operations to provide drainage and prevent ponding.

**3.03 FIELD QUALITY ASSURANCE**

- A. The CQA Monitor shall perform the testing of the engineered fill to verify compliance with the Specifications. Each test report shall be sealed by the soil testing company.

- B. The in-place dry density of the compacted materials shall be determined either with a nuclear density gauge (ASTM D 2922), or with sand cone apparatus (ASTM D1556). The in-place moisture content of the compacted material shall be determined with a nuclear gauge (ASTM D 3017) in combination with oven-dried field measurement of moisture content (ASTM D 2216). If the nuclear gauge is selected for the field measurements of both the density and moisture content, the nuclear gauge shall be calibrated against a sand cone test at least once a day. The calibration sample should be obtained from the same hole or at a point directly adjacent from each other. After the gauge reading is taken, a sand cone test (including measurement for moisture) will be conducted on the same volume measured by the gauge. The average of the ratio of the sand cone test to the gauge reading for a series of tests then become the correction factor to be applied to the gauge readings.
- C. The field CQA tests for processed soil, subgrade, foundation layer, infiltration barrier, and vegetative layer shall be performed in accordance with the following frequency:

Processed Soil Properties

- Moisture
  1. 1 per 2,500 cubic yard of soil material.
  2. Using ASTM D2216 or ASTM D3017.
- Compacted soil density
  1. 1 per 5,000 cu. yd of soil material.
  2. Using ASTM D698.

- Particle size distribution
  1. 1 per 15,000 cu. yd. of soil material
  2. Using ASTM C136 and C117.

#### Subgrade

- Moisture
  1. 1 per 8,000 sq. ft.
  2. Using ASTM D2216 or ASTM D3017
- Field Density
  1. 1 per 8,000 sq. ft.
  2. Using ASTM D1556 or ASTM D 2922

#### In-Place

- Field density
  1. 1 per 10,000 sq. ft of surface area per lift.
  2. Using ASTM D2922.
- Moisture content
  1. 1 per 10,000 sq. ft of surface area per lift.
  2. Using ASTM D3017.

- Saturated hydraulic conductivity (laboratory permeability)

1. 1 per 100,000 sq. ft of surface area per lift.

2. Using ASTM D5084.

#### Calibration

- Calibrate nuclear gauge at least once a day for density and moisture using ASTM D1556 and ASTM D2216.

D. If tests indicate that the required performance standards are not achieved, the CQA Consultant shall immediately notify the Contractor. The Contractor shall prepare a Work Plan which shall be reviewed by the CQA Consultant prior to implementing the corrective action. All costs for retesting or reworking the defective area shall be the responsibility of the Contractor. Subsequent failure of retests shall require that the Contractor remove the fill and replace with suitable materials. All additional costs are the responsibility of the Contractor.

END OF SECTION

**SECTION 02400**  
**DRAINAGE CHANNELS**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. The Work specified in this Section shall include earthwork for drainage channels, installation of corrugated metal pipe arch culverts, and placement of riprap in areas shown on the Plans.

**1.02 SUBMITTALS**

- A. The Contractor shall submit data regarding gradation and quality of riprap materials and apparent specific gravity, adsorption, and durability of rock, as applicable.
- B. The Contractor shall submit manufacturer technical specification for corrugated metal arch pipe culverts in accordance with AASHTO M36 and AASHTO M213.

**PART 2 - PRODUCTS**

**2.01 DRAINAGE CHANNEL**

- A. For drainage channel bottom and sideslope surfaces:
  - 1. Quality: Free from vegetable matter and all deleterious substances; no rocks or lumps greater than 6 inches in the largest dimension.

## **2.02 CORRUGATED STEEL ARCH PIPE CULVERTS**

- A. The culverts should be manufactured with 0.064 inches thick steel and have a span of 35 inches and a rise of 24 inches.
- B. The culvert corrugations should have a pitch of 2-2/3 inches and a depth of 1/2 inches.

## **2.03 RIPRAP**

- A. Grading: As provided in Plans.
- B. Quality: The rock shall be durable and shall not contain any water or other common fluid (encountered at the service environment) nor any soluble minerals.
- C. The mean diameter of the rock shall be between 6 and 8 inches.

## **PART 3 - EXECUTION**

### **3.01 DRAINAGE CHANNEL**

- A. The Contractor shall cut the drainage channel and provide a minimum of 10 (horizontal): 1 (vertical) side slopes.
- B. The drainage channel location and other relevant details are shown on Plans.

### **3.02 CORRUGATED METAL PIPE ARCH CULVERTS**

- A. The backfill around the culverts should be compacted to a minimum of 95 percent of Standard Proctor, in accordance with the ASTM D698.

B. The culvert locations and other pertinent details are shown on the Plans.

### 3.03 RIPRAP

A. The riprap location and other pertinent details are shown on the Plans.

**END OF SECTION**

## SECTION 02610

## GEOGRID

(REV 04/14/97)

PART 1 - GENERAL

## 1.01 SCOPE

- A. All materials shall conform to the following requirements and shall be of new stock of the highest grade available, free from defects and imperfections, of recent manufacture, and unused.

## 1.02 SUBMITTALS

The following information shall be submitted by the Geosynthetics Supplier/Installer for the materials and installation of the geogrid. Reference within the Specifications to Manufacturer or independent CQA Consultant does not release the Installer from the responsibility for all materials and installation. The Owner and CQA Consultant shall not be responsible for coordinating transfer of information, scheduling, or any other activities performed by Subcontractors. Submittals to the CQA Consultant shall include:

- A. Laboratory data for the raw materials used in the manufacture of the geogrid and properties of the geogrid. This information shall be submitted before the shipping of the material.
- B. The Installer shall submit the results of laboratory analyses performed on the samples of geogrid prior to delivering to the Project site for installation. The laboratory analyses shall be performed by an accredited independent laboratory. ~~The laboratory analyses for each sample shall be as specified in the MCA's Submittal Plan in the CQA/QC Plan.~~ Sampling frequency shall be: one sample for every 10,000 square feet of geogrid delivered. If the Manufacturer of the geogrid wishes, the results of laboratory analyses performed during the manufacturing of the products

may be submitted for review, provided that the tests and sampling has been completed without bias by an independent laboratory.

- C. An Installation Plan as submitted by the geogrid supplier: The Installation Plan shall include a Construction Quality Assurance/Quality Control (CQA/CQC) Plan, lap requirements, methods and materials for securing the geogrid during placement, panel layout Plan, methodology to be employed for falling tests, copies of all forms to be used to record installation quality assurance/quality control data, résumés of key personnel, copies of the warranties to be provided at the completion of installation, and other applicable information. All installation shall be in conformance with current industry standards. The Installation Plan shall be submitted for approval at least 20 days prior to delivery of the geogrid materials to the site. The CQA Consultant reserves the right to require changes to the Installer's Installation Plan.
- D. Warranties from the Manufacturer and Installer: The Supplier/Installer shall provide warranty of the geogrid materials against physical defects for a period of 20 years. The installation warranty shall be for a period of 5 years. Warranties provided by the Manufacturer for materials and installation in no way release the Installer from responsibility for the materials and installation.
- E. Certification by the Supplier/Installer that the geogrid materials and installation is in accordance with the approved Installation Plan and other applicable Contract Documents.

**PART 2 - PRODUCTS**

**2.01 HIGH DENSITY POLYETHYLENE (HDPE) GEOGRID**

- A. The geogrid shall be comprised of HDPE material manufactured of new, first-quality products designed and manufactured. Geogrid materials shall be manufactured by TENSAR, or its approved equal.
- B. The HDPE geogrid materials and installation shall conform to the physical properties requirements shown in the table below.

PHYSICAL PROPERTY	MINIMUM TEST RESULTS	TEST METHOD
<i>deleted</i> Creep Limited Strength, at 10% Strain, lb/ft	2,900	GRI GG3-87 or ASTM D5252
<i>deleted</i> Tensile Strength, at 5% Strain, lb/ft	3,580	GRI GG1-87
Tensile Strength, at ultimate, lb/ft	6,550	GRI GG1-87
Tensile Modulus, lb/ft	<i>deleted</i>	GRI GG1-87
Junction Strength, lb/ft	5,900	GRI GG2-87
Junction Efficiency, %	90	GRI GG2-87
High Density Polyethylene, %	97	ASTM D1248
Carbon Black, %	2.0	ASTM D4218

**PART 3 - EXECUTION**

**3.01 SUBGRADE PREPARATION**

- A. Surfaces below the geogrid shall be smooth and free of all rocks, stones, sticks, roots, sharp objects, or debris of any kind. The surface shall provide a firm, unyielding foundation for the geogrid with no sudden, sharp, or abrupt changes or breaks in grade. No standing water or

excessive moisture shall be allowed. The Installer shall certify in writing that the surface on which the geogrid is to be installed is acceptable before commencing Work.

### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. Each roll shall be delivered to the site bearing markings which provide the roll and Manufacturer's lot number; thickness of the material; and the length and width of the material.
- B. Within the installation report, the CQA Consultant shall correlate the identification numbers for each roll of material to the installation panel location.

### 3.03 GEOGRID INSTALLATION

- A. The Geosynthetic Installer will provide an Installation Plan and handle all geogrids as to minimize damage to geogrids.
- B. Geogrid installation shall be in accordance with the approved Installation Plan, and in accordance with the Plans.
- C. In presence of wind, all geogrid deployed will be weighed with sandbags or the equivalent. These sandbags will be installed during placement and will remain until replaced with cover material.
- D. The Geosynthetic Installer will take all necessary precautions to prevent damage to the underlying layers during placement of the geogrid.
- E. The two layers of the geogrid shall be placed orthogonal to each other, and separated by 12 inches of Foundation Layer soil.

F. Placement of Soil Materials - The Contractor will place all soil materials on top of the geogrid in such a manner so as to minimize:

- Creep of the geogrid;
- Damage to the geogrid; and
- Excess tensile stresses in the geogrid.

G. Overlaps and Seams:

- The roll end overlap shall be 18 feet minimum and anchoring length shall be at least 18 feet; and
- The rolls shall be overlapped at least 12 inches and tied with plastic ties, if necessary.

H. Repairs - Holes or tears in the geogrid will be repaired by placing a patch extending 10 feet beyond the edges of the hole and tear. The patch will be secured to the original geogrid tying every 6 inches.

### 3.04 FIELD QUALITY CONTROL

A. All geogrid placement shall be inspected by the CCA Consultant as required, who will direct the Installer to provide geogrid samples for conformance testing in compliance with the Specifications. The sampling frequency shall consist of one sample per lot or 100,000 square feet, whichever is the greater frequency.

1. Each sample shall be tested for those parameters and physical properties as specified for field quality control samples in the COA/QC Plan.

END OF SECTION

## SECTION 02610

### GEOGRID

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. All materials shall conform to the following requirements and shall be of new stock of the highest grade available, free from defects and imperfections, of recent manufacture, and unused.

##### 1.02 SUBMITTALS

The following information shall be submitted by the Geosynthetics Supplier/Installer for the materials and installation of the geogrid. Reference within the Specifications to Manufacturer or independent CQA Consultant does not release the Installer from the responsibility for all materials and installation. The Owner and CQA Consultant shall not be responsible for coordinating transfer of information, scheduling, or any other activities performed by Subcontractors. Submittals to the CQA Consultant shall include:

- A. Laboratory data for the raw materials used in the manufacture of the geogrid and properties of the geogrid. This information shall be submitted before the shipping of the material.
- B. The Installer shall submit the results of laboratory analyses performed on the samples of geogrid prior to delivering to the Project site for installation. The laboratory analyses shall be performed by an accredited independent laboratory. Sampling frequency shall be: one sample for every 10,000 square feet of geogrid delivered. If the Manufacturer of the geogrid wishes, the results of laboratory analysis performed during the manufacturing of the products may be submitted for review, provided

that the tests and sampling has been completed without bias by an independent laboratory.

- C. An Installation Plan as submitted by the geogrid supplier: The Installation Plan shall include a Construction Quality Assurance/Quality Control (CQA/CQC) Plan, lap requirements, methods and materials for securing the geogrid during placement, panel layout Plan, methodology to be employed for failing tests, copies of all forms to be used to record installation quality assurance/quality control data, résumés of key personnel, copies of the warranties to be provided at the completion of installation, and other applicable information. All installation shall be in conformance with current industry standards. The Installation Plan shall be submitted for approval at least 20 days prior to delivery of the geogrid materials to the site. The CQA Consultant reserves the right to require changes to the Installer's Installation Plan.
- D. Warranties from the Manufacturer and Installer: The Supplier/Installer shall provide warranty of the geogrid materials against physical defects for a period of 20 years. The installation warranty shall be for a period of 5 years. Warranties provided by the Manufacturer for materials and installation in no way release the Installer from responsibility for the materials and installation.
- E. Certification by the Supplier/Installer that the geogrid materials and installation is in accordance with the approved Installation Plan and other applicable Contract Documents.

**PART 2 - PRODUCTS**

**2.01 HIGH DENSITY POLYETHYLENE (HDPE) GEOGRID**

- A. The geogrid shall be comprised of HDPE material manufactured of new, first-quality products designed and manufactured. Geogrid materials shall be manufactured by TENSAR, or its approved equal.
- B. The HDPE geogrid materials and installation shall conform to the physical properties requirements shown in the table below.

PHYSICAL PROPERTY	MINIMUM TEST RESULTS <i>(Tensar Specs)</i>	TEST METHOD
Open Area, %	68 (nominal)	COE Method <i>58-62</i>
Creep Limited Strength, at 10% Strain, lb/ft <i>13 no test</i>	2,900	GRI GG3-87 or ASTM D5262
Flexural Rigidity, mg-cm	5,100,000	ASTM D1388-84 <i>2.4-2.34</i>
Tensile Strength, at 5% Strain, lb/ft	3,580	GRI GG1-87 <i>3.1-3.10</i>
Tensile Strength, at ultimate, lb/ft	6,550	GRI GG1-87 <i>3.1-3.10</i>
Tensile Modulus, lb/ft <i>200 gsm</i>	95,000	GRI GG1-87 <i>4.1-4.10</i>
Junction Strength, lb/ft	5,900	GRI GG2-87
Junction Efficiency, %	90	GRI GG2-87
High Density Polyethylene, %	97	ASTM D1248
Carbon Black, %	2.0	ASTM D4218

*Geophysical Research Institute*

**PART 3 - EXECUTION**

**3.01 SUBGRADE PREPARATION**

- A. Surfaces below the geogrid shall be smooth and free of all rocks, stones, sticks, roots, sharp objects, or debris of any kind. The surface shall provide a firm, unyielding foundation for the geogrid with no sudden, sharp, or abrupt changes or breaks in grade. No standing water or

excessive moisture shall be allowed. The Installer shall certify in writing that the surface on which the geogrid is to be installed is acceptable before commencing Work.

### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. Each roll shall be delivered to the site bearing markings which provide the roll and Manufacturer's lot number; thickness of the material; and the length and width of the material.
- B. Within the installation report, the CQA Consultant shall correlate the identification numbers for each roll of material to the installation panel location.

### 3.03 GEOGRID INSTALLATION

- A. The Geosynthetic Installer will provide an Installation Plan and handle all geogrids as to minimize damage to geogrids.
- B. Geogrid installation shall be in accordance with the approved Installation Plan, and in accordance with the Plans.
- C. In presence of wind, all geogrid deployed will be weighed with sandbags or the equivalent. These sandbags will be installed during placement and will remain until replaced with cover material.
- D. The Geosynthetic Installer will take all necessary precautions to prevent damage to the underlying layers during placement of the geogrid.
- E. The two layers of the geogrid shall be placed orthogonal to each other, and separated by 12 inches of Foundation Layer soil.

F. Placement of Soil Materials - The Contractor will place all soil materials on top of the geogrid in such a manner so as to minimize:

- Creep of the geogrid;
- Damage to the geogrid; and
- Excess tensile stresses in the geogrid.

G. Overlaps and Seams:

- The roll end overlap shall be 18 feet minimum and anchoring length shall be at least 18 feet; and
- The rolls shall be overlapped at least 12 inches and tied with plastic ties, if necessary.

H. Repairs - Holes or tears in the geogrid will be repaired by placing a patch extending 10 feet beyond the edges of the hole and tear. The patch will be secured to the original geogrid tying every 6 inches.

### 3.04 FIELD QUALITY CONTROL

A. All geogrid placement shall be inspected by the CQA Consultant as required, who will direct the Installer to provide geogrid samples for conformance testing in compliance with the Specifications. The sampling frequency shall consist of one sample per lot or 100,000 square feet, whichever is the greater frequency.

1. Each sample shall be tested for those parameters physical properties found in Part 2.01, Subpart B.

END OF SECTION

## SECTION 02620

### GEONET

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. The Work specified here includes supplying materials, equipment, labor, and service to install geonet. The geonet will serve purposes of biotic barrier and soil reinforcing. This section is applicable to geonets made of high density polyethylene.
- B. The placement and installation of the geonet shall be in accordance with the specifications listed here and in the Project Plans.

##### 1.02 SUBMITTALS

- A. The installer shall submit Manufacturer's certifications, product data, installation procedures, and CQA sample results to the CQA Consultant prior to installation for CQA Consultant review and approval.

##### 1.03 QUALITY ASSURANCE

- A. The Installer shall notify the Owner and the CQA Consultant prior to the Work, and during the deployment and at the completion of the geonet installation. The Installer shall also allow and cooperate with the CQA Consultant to inspect the material, installation, collect samples (when necessary), and determine compliance with the Specifications.
- B. The Installer shall submit the results of laboratory analyses performed on the samples of geonet prior to delivering to the Project site for installation. The laboratory analyses shall be performed by an accredited independent laboratory. Sampling frequency shall be: one sample for

every 10,000 square feet of geonet delivered. If the Manufacturer of the geonet wishes, the results of laboratory analysis performed during the manufacturing of the products may be submitted for review, provided that the tests and sampling has been completed without bias by an independent laboratory.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. All geonet shall be a high density polyethylene (HDPE) plastic. The HDPE materials shall be manufactured from virgin, first-quality domestic polyethylene resin. Reprocessed material shall not be used. Additionally, the geonet shall comply with the physical properties provided in the Subpart B below.
  
- B. The geonet shall conform to the minimum physical properties, as determined by the indicator test methods:

PHYSICAL PROPERTY	MINIMUM TEST RESULTS	TEST METHOD
Polymer Density, g/cm <sup>3</sup>	0.937 ± 0.002 (range)	ASTM D-1505
Polymer Melt Index, g/10 min	1.0 (maximum)	ASTM D-1238
Carbon Black Content, %	2 - 3 (range)	ASTM D-1603
Nominal Thickness, inches	0.200 ± 0.022 (range)	ASTM D-1777
Tensile Strength Machine Direction, lbs/in	50 ± 10	ASTM D-1682

- C. All geonet rolls shall be furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure prior to placement. Each roll received at the Project site shall be labeled to provide identification for quality control and shall be stored in a manner which protects them from the elements.

## PART 3 - EXECUTION

### 3.01 PLACEMENT AND HANDLING

- A. Installer shall unload, store, and handle all geonet in accordance with the Manufacturer's guidelines. All damaged or torn or otherwise unusable geonet shall be removed at the responsible party's expense.
- B. The geonet shall be placed in a manner and at location shown on the Plans. The receiving surface shall be smooth, clean, and free of depressions or perturbations.
- C. The geonet rolls should be protected against dust and dirt during shipment and storage. The geonet rolls shall be delivered wrapped in plastic to protect geonet from contamination.
- D. The CQA Engineer shall examine rolls upon delivery and any deviation from the above requirements shall be reported to the Owner.
- E. During the placement of the geonet folds or wrinkles shall be avoided and fabrics shall be placed in loose conditions.
- F. On slopes, the geonet shall be secured and rolled down the slope in such a manner as to continually keep the geonet sheet in tension. If necessary, the geonet shall be positioned by hand after being unrolled to minimize wrinkles.
- G. In the presence of wind, all geonet shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during deployment and shall remain until replaced with cover material.
- H. Geonet shall only be cut using scissors or other cutting tools approved by the CQA Engineer. Care shall be taken not to leave tools in the geonet.

I. Seams and Overlap - At a minimum, the following requirements for joining the adjacent geonet shall be met:

- Adjacent rolls shall be overlapped by at least 4 inches.
- The geonet overlaps shall be tied with plastic fasteners. Tying devices shall be white or yellow for easy inspection. Metallic devices are not allowed.
- Tying shall be every 5 feet along the length at the adjacent rolls.
- In general, no horizontal seams shall be allowed on sideslopes.
- In the corners of the sideslopes of rectangular landfills, where overlaps between perpendicular geonet strips are required, an extra layer of geonet shall be unrolled along the slope, on top of the previously installed geonet, from top to bottom of the slope.

J. Defects and Repairs - If a defect is identified in the geonet, the CQA Engineer shall determine the extent and nature of the defect and following actions should be taken:

- After determining the extent and nature of the defect, the CQA Engineer shall promptly notify the Installer, Designer, Owner, and any other necessary parties to assess the problem, review alternative solutions, and implement an action plan.
- The final decision as to the appropriate repair shall be agreed upon the Owner, Installer, Designer, and CQA Engineer.
- If the hole or tear is less than 50 percent of the width of the roll, the damaged area shall be repaired as follows:

1. A patch shall be placed extending 2-foot beyond the edges of the hole or tear.

2. The patch shall be secured to the original geonet by tying every 6 inches. Tying devices shall be as indicated in Subpart I.

- If the hole or tear width across the roll is equal to or more than 50 percent of the width of the roll, the damaged area shall be repaired by cutting out the damaged portion and joining the two portions of the geonet as indicated in Subpart I.

K. The CQA Engineer shall observe any repair and report any noncompliance with the above requirements in writing to the Owner.

### 3.02 FIELD QUALITY CONTROL

A. All geonet placement shall be inspected by the CQA Consultant as required, who will direct the installer to provide geonet samples for conformance testing in compliance with the Specifications. The sampling frequency shall consist of one sample per lot or 100,000 square feet, whichever is the greater frequency.

1. Each sample shall be tested for those parameters physical properties found in Part 2.01, Subpart B.

END OF SECTION

## SECTION 02710

### SITE FENCE

#### PART 1 - GENERAL

##### 1.01 SCOPE

The Work under this Section shall consist of furnishing all labor, materials, tools, equipment, transportation and performing all operations necessary and reasonably incidental to the proper execution and completion of the installation of fence in the area as shown on the Plans. A chain link security fence shall be used for this project. A barbed wire fence shall be installed as shown on the Plans.

#### PART 2 - PRODUCTS

##### 2.01 MATERIALS

#### CHAIN LINK FENCE

- A. New fencing fabric shall consist of 6-foot, chain link fabric, complying with Federal Specifications RR-F-191D, Type I (zinc-coated). The top and bottom salvage shall be twisted and barbed. Fabric shall be No. 9 gauge with 1 3/4-inch diamond mesh size.
- B. Fence posts, gates, and accessories shall comply with Federal Specifications RR-F-183(4), and shall be hot dip galvanized in accordance with ASTM A120-69 for pipe, ASTM A123-71 for shapes, and ASTM A153-71 for hardware.
- C. Other specifications are as follows:
  - 1. Intermediate posts (line posts) shall be 2-inch (I.D.) Pipe.

2. Terminal posts - All end, corner and pull posts shall be 3-inch (I.D.) Pipe: gate posts shall be 6-inch (I.D.) Pipe.
3. Top rails shall be 1-5/8-inch (I.D.) pipe.
4. Brace rails shall be of the same size and material as top rails.
5. Stretcher bars shall be 1/4-inch by 3/4-inch bars with square edges.
6. Tension wire shall be No. 7 gauge steel wire.
7. Hog ring fasteners shall be No. 9 gauge steel wire.
8. Post tops for intermediate, end, corner, and pull posts shall be combination type with barbed wire supporting arms attached at an angle of 45 degrees; gate posts and end post adjacent to gate shall have standard post caps.
9. Barbed wire shall consist of 3-strands of 12-1/2 gauge wire, with 14 gauge 4 point barbs spaced 5 to 6 inches apart.
10. Tension rods shall be 3/8-inch galvanized steel rods.
11. Gates shall be sliding cantilever type complete with latches, stops, keepers, rollers, roller tracks, and barbed wire supports. Gate frames shall be 2-inch I.D. pipe, welded at all corners or assembled with fittings. Truss rods shall be 3/8-inch nominal diameter to prevent sag or twist. Intermediate horizontal, diagonal, and vertical braces shall be provided to assure rigid construction. Gate filler fabric shall be of the same fabric as specified for the fence and shall be attached to the gate frame at 15-inch intervals. Gate shall have no overhead obstruction.

**BARBED WIRE FENCE**

- A. Barbed wire shall be galvanized, ASTM A121, Class 2; two 12-1/2 gauge steel wires with 4 point barbs.
  
- B. Posts:
  - 1. Line Posts - Shall be studded or punched T-shaped posts with anchor plates or acceptable alternate, weighing 1.33 lb. per ft. Length shall be 8 feet minimum, and spacing shall be maximum of 8 feet on centers.
  - 2. Terminal and Corner Posts - Shall be 2 3/8-inch OD pipe, 3.65 lb. per foot, and galvanized.
  - 3. Gate Posts - Shall be 4-inch OD pipe, 9.10 lb. per foot, and galvanized.
  
- C. Ties:
  - 1. As recommended by the Manufacturer.
  
- D. Stabilizers:
  - 1. As recommended by the Manufacturer.
  - 2. Installed at mid-points between the line posts.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

#### CHAIN LINK FENCE

- A. Fence fabric shall be installed at ground level and securely fastened to the line post ties at a maximum of 24-inch intervals. Line post ties or wire fabric ties shall be of 9 gauge, galvanized steel wire. The fabric shall be tightened to provide a smooth, uniform appearance. Stretcher bars shall be provided at each gate and terminal post. Each stretcher bar shall be threaded through the fabric and anchored to the post at 15-inch intervals by positive mechanical means.
- B. Tension wire shall be attached to the bottom of the chain link fabric by means of hog-ring type of fasteners at a maximum of 24-inch intervals and secured at the terminal posts by means of brace bands.
- C. Top rails shall form a continuous brace from end to end of each stretch of fence. Top rail lengths shall be joined with expansion sleeves. Top rails shall be securely fastened to terminal posts by means of brace ends and brace bands.
- D. Brace rails (horizontal braces) shall be provided at all terminal posts midway between top rail and ground and shall extend from the terminal posts to the first adjacent line post. Braces shall be securely fastened to the line posts by brace ends and brace bands and to the terminal posts by rail ends and brace bands.
- E. Line and terminal posts shall be spaced equidistant in the fence line on a maximum of 10-foot centers. Posts shall be plumb and tops of the posts properly aligned. Line and terminal posts shall be set in concrete footings. The dimensions of the concrete footings for line posts shall be 30 inches deep, 12 inches in diameter with an embedment of 24 inches. The dimensions of the concrete footings for terminal posts shall be 36 inches deep, 12 inches in diameter with an embedment of 30 inches.

Excess concrete shall be removed and not permitted to spread over the ground adjacent to the post. Post tops shall be firmly seated on the top of posts and barbed wire stretched tightly and secured to the support arms.

- F. Gate posts shall be set in cylindrical concrete footings. The dimensions of the concrete footing shall be 42 inches deep, 24 inches in diameter, post embedment 36 inches. The top exposed surface of the footing shall be sloped to shed water. Post tops shall be firmly seated on the top of posts.
- G. To protect against lightning, all wires of the chain link fence shall be securely fastened, with galvanized wire ties, to fence grounding electrodes at intervals of 300 feet, in accordance with the United States of America Standards Institute, C5-1, Lightning Protection Code, and the National Fire Protection Association Bulletin No. 78. Electrodes for the grounding fences shall be driven into firm earth to a minimum depth of 3 feet and shall be either a standard galvanized steel post of a 3/4-inch galvanized steel pipe at intervals of 300 feet.

#### BARBED WIRE FENCE

- A. Line posts for the barbed wire fence shall be driven into firm earth to a minimum depth of 3 feet.
- B. The dimensions of the concrete footings for terminal, corner, and gate posts shall be 30 inches deep, 12 inches in diameter, with an embedment of 24 inches.
- C. The barbed wire fence shall consist of four strands of barb wire evenly spaced.

END OF SECTION

**SECTION 02720**  
**SITE RESEEDING**

**PART 1 - GENERAL**

Work under this section shall consist of furnishing all labor, materials, tools, seed equipment, transportation and performing all operations necessary and reasonably incidental to the proper execution and completion of all seeding operations. The seeding will be performed by hay mulch seeding and hydroseeding methods. The hydroseeding method shall be used on the final surfaces of the landfill (Sites A and B). The hay-mulch seeding method shall be employed for all the other disturbed areas including, staging area, Contractor's area, topsoil stockpile area, and borrow soil area.

**1.01 SCOPE**

Apply the hay-mulch seeding and hydroseeding materials to all areas noted on plans. Seeding shall be Class II and shall be performed in accordance with the requirements of these specifications.

**PART 2 - PRODUCTS**

**2.01 MATERIALS FOR HYDROSEEDING**

**SEED**

- A. The seed shall be delivered to the project site in standard, sealed, undamaged containers.
- B. Each container shall be labeled in accordance with Arizona Revised Statutes and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act. Labels shall indicate the variety of strain of seed, the percentage of germination, purity and weed content, and the

date of analysis which shall not be more than nine months prior to the delivery date.

- C. Seeds shall be 95 percent true-to-variety specified; germination to be 60 percent minimum. Seed shall be of the latest season's crop. Seed that has become wet, moldy or otherwise damaged will not be accepted.
- D. Legume seed shall be inoculated with appropriate bacteria cultures approved by the Engineer, in accordance with the culture manufacturer's inspection.
- E. The following seed mix to be applied to all disturbed areas as prescribed with overspray 10-foot into all existing native vegetation and undisturbed site areas:

Common Name	Botanical Name	Rate of Application in Pounds per Acre
Sand Dropseed	<i>Sporobolus cryptandrus</i>	3.0
Blue Grama	<i>Bouteloua gracilis</i> var. "Hatchita"	2.0
Side Oats Grama	<i>Bouteloua curtipendula</i> var. "Niner"	2.0
Cane Bluestem	<i>Bothriochlora barbinoidea</i>	1.5
Yellow Bluestem	<i>Bothriochlora ischaemum</i>	2.5

#### WOOD CELLULOSE FIBER MULCH

- A. Natural wood cellulose fiber shall have the property of dispersing readily in water and shall have no toxic effect when combined with seed or other materials.
- B. A green dye which is noninjurious to plant growth shall be used. Wood cellulose fiber shall be delivered in undamaged containers labeled and

bearing the name of the manufacturer and showing air-dry weight content.

- C. Conwed Fiber of Silva-Fiber or approved equal to be used.
- D. The wood cellulose fiber shall be manufactured so that:
  - 1. After addition and agitation in slurry tanks with fertilizers, seeds, water, and other approved additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry.
  - 2. When hydraulically sprayed on the ground, the material will form a blotter like cover impregnated uniformly with seed.
  - 3. The cover will allow the absorption of moisture and allow rainfall or applied water to percolate to the underlying soil.
- E. Weight specifications from suppliers, and for all applications, shall refer to air dry weight of the fiber, a standard equivalent of 10 percent moisture. The mulch shall be supplied in packages having a gross weight not in excess of 100 pounds, and shall be marked by the manufacturer to show the air dry weight content. Suppliers shall certify that laboratory and field testing of their product has been accomplished, and that it meets all of the foregoing requirements pertaining to wood cellulose fiber mulch.

#### HAY OR STRAW MULCH

- A. Hay or straw mulch shall be free of all contaminants. The hay or straw mulch shall also be from a source that is free of noxious weeds.
- B. The hay or straw shall be approved by the Engineer prior to application.

## WATER

- A. Water shall be free of oil, acid, salts or other substances harmful to plants.
- B. The source shall be approved by the Engineer prior to use.

## TACKING AGENT

- A. An approved tackifier should have strong adhesive characteristics, as well as imparting a high lubricity to the mixture to allow for the uniform dispersion of the hydroseeding slurry. It shall also have gelling properties to inhibit the tendency of water and fiber to move downhill as they are sprayed on steep slopes.
- B. The stabilizer should readily disperse in water without the formation of gel balls and its properties should not be changed by the addition of fertilizer to the slurry mix (AZ-TACK, AMTAX, or equal).

## CHEMICAL FERTILIZER

- A. Chemical fertilizer shall be commercially produced pelleted granular form, state-inspected to meet 16-20-0 percentages derived from inorganic sources meeting the following guaranteed analysis:
  - 1. Percentage (minimum)
  - 2. Ingredients
    - Nitrogen
    - Phosphoric acid
    - Water soluble Potash

- B. Chemical fertilizer shall be furnished in standard containers with the name, weight, and guaranteed analysis of the contents clearly marked.
- C. When a mixed fertilizer is specified, such as 16-20-0:
  - 1. The first number shall represent the minimum percent of soluble nitrogen.
  - 2. The second number shall represent the minimum percent of available phosphoric acid.
  - 3. The third number shall represent the minimum percent of water soluble potash.

## 2.02 MATERIALS FOR HAY MULCH SEEDING

### SEED

- A. Shall meet the specifications as presented in Part 2.

### HAY OR STRAW MULCH

- A. The mulch for areas to receive seeding shall include straw of oats, barley, wheat, rye or clean field hay, and shall not contain seeds of noxious weeds.
- B. Straw or hay mulch shall be dry, unweathered, and show no signs of discoloration and mold damage. Straw shall be of 2 to 6 inches in length. Old dry straw which breaks in the crimping process will not be accepted.

### WOOD CELLULOSE FIBER MULCH

- A. Wood cellulose fiber shall meet the specifications as presented in Part 2.

**WATER**

- A. Shall meet the specifications as presented in Part 2.

**CHEMICAL FERTILIZER**

- A. Fertilizer shall meet the specifications as presented in Part 2.

**PART 3 - EXECUTION**

**3.01 HYDROSEEDING**

- A. Seeding shall be of the class and variety specified, and shall be applied at the rate specified.
- B. The Contractor shall notify the Engineer at least two days prior to commencing seeding operations.
- C. Seeding shall not be performed when wind would prevent uniform application of materials or would carry seeding materials into areas not to be seeded.
- D. Preparation of the areas for seeding shall be as specified rates.
- E. Equipment and methods of distributing seeding materials shall be such as to provide an even and uniform application of the seed, mulch and/or other materials in accordance with the specified rates.
- F. Seeding operations shall not be performed on undisturbed soil outside the clearing and grubbing limits of the project or on steep rock cuts, except as specified.

**3.01.01**

**SEEDING**

- A. Seeding shall consist of furnishing and planting range grass seed, and include mulching.
- B. Where equipment can operate, the area to be seeded shall be prepared by discing, harrowing or by other approved methods of loosening the surface soils to 4 inches.
- C. On slopes too steep for equipment to operate, the area shall be prepared by hand-raking to the specified depth.
- D. On sloping areas, all discing, harrowing, and raking shall be directional along the contours of the areas involved.
- E. The surface to receive seeding shall be cleared of all trash, debris and stones larger than 1-1/2 inches in diameter, and of all roots, brush, wire, grade stakes, and other objects that would interfere with planting or maintenance operations.
- F. Rake and smooth the seed bed to even grade. All areas which are eroded shall be restored to the specified condition, grade and slope, as directed prior to seeding.
- G. On cut and fill slopes, the operation shall be conducted in such a manner as to form minor ridges thereon to assist in retarding erosion and favor germination of the seed.
- H. Due care should be taken during the seeding operations to prevent damage to existing trees and shrubs in the seeding area.
- I. Mulch material which is placed upon trees and shrubs, roadways, structures and upon any areas where mulching is not specified or is

placed in excessive depths on mulching areas shall be removed as directed. Mulch materials which are deposited in a matted condition shall be loosened and spread uniformly over the mulching areas to the specified depth.

- J. During seeding and mulching operations, care shall be exercised to prevent drift and displacement of materials. Any unevenness in materials shall be immediately corrected by the Contractor.
- K. Prior to the application of the slurry mix, protective covering shall be placed on all structures and objects where stains would be objectionable. All necessary means shall also be taken to protect the traveling public and vehicles from damage due to drifting spray.

**3.01.02 SLURRY MIX AND APPLICATION**

- A. The slurry mix of seed, fertilizer, and wood cellulose fiber mulch shall consist of or meet the following proportions:

Material	Rate
Seed	As noted in Subpart 2
Fertilizer	300 lbs/acre
Wood Fiber	1st application: 1,000 lbs/acre
Tacking Agent	1st application: 80 lbs/acre
Hay Mulch	2nd application: 2,500 lbs/acre

- B. After the first application containing seed, fertilizer, wood fiber mulch and tacking agent is applied, a second mulch layer of hay or straw broadcast with a straw blower shall be applied at the specified rate.
- C. Water shall be added to the fiber and seed mix to bring both seed and fiber to a mulch/slurry consistency. The slurry must be adequately

emulsified and mixed to allow for a consistent and uniform spread once hydraulically applied.

- D. The mixed slurry shall then be hydraulically applied, using conventionally accepted hydromulching equipment over the prepared areas. All spraying patterns shall maintain a uniform color and texture consistent with aforementioned rates.
- E. Care shall be taken during the seeding operation to prevent damage to existing trees, shrubs, and structures in the seeding area.
- F. The Contractor shall guarantee irrigated Work covered by this specification to the extent that planted seed will yield an average of at least five healthy germinated plants per square foot after 90 days.
- G. The Contractor shall protect seeded areas from damage by traffic or construction equipment. Surfaces gullied or otherwise damaged following seeding shall be repaired by regrading and reseeding.

### 3.02 HAY MULCH SEEDING

#### 3.02.01 SEEDING

- A. Seeding shall be accomplished by means of an acceptable mechanical power-drawn drill, followed by packer wheels and broadcast-type seeders. Any seeding equipment used must produce uniform distribution of the various types of seeds at the rate specified.
- B. Mechanical power-drawn drills shall have depth bands set to maintain a planting depth of at least 1/4 inch. All seed not covered in drilling process shall be "raked-in" or otherwise covered with soil to a depth of at least 1/3-inch and rolled to obtain a firm seed bed. Water shall be applied when ordered.

- C. Seed shall not be drilled or sown during windy weather or otherwise unsuitable. When a seed drill is used, it shall be set to space the rows not more than 6 inches apart. The hand method of broadcasting seeds will be permitted only on small areas not accessible to machine methods.
- D. If inspections indicate that strips wider than the specified space between the rows planted have been left, or other areas skipped, the Engineer may require immediate resowing of seed in such areas at the Contractor's expense.

### 3.02.02 MULCHING

- A. After seeding has been completed, a uniform coating of straw or hay shall be applied at the rate of 1-1/2 tons per acre, crimped in with a crimper or other acceptable equipment. The Engineer may order the employment of hand-crimping operation of such areas where excessive ground slope or confined areas would cause unsatisfactory crimping to result by mechanical methods.
- B. The seeded areas shall be mulched and crimped within 24 hours after seeding. Areas not mulched and crimped within 24 hours after seeding must be re-seeded with the specified seed mix, at the Contractor's expense, prior to mulching and crimping. Areas not properly mulched or damaged due to the Contractor's negligence shall be repaired and remulched in an acceptable manner, at the Contractor's expense. Mulch removed by wind prior to acceptance shall be reestablished immediately.
- C. Apply soil binder to all areas with 2:1 slopes or greater at the rate recommended by the Manufacturer.

END OF SECTION